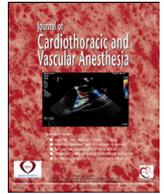




Contents lists available at ScienceDirect

Journal of Cardiothoracic and Vascular Anesthesia

journal homepage: www.jcvaonline.com

Review Article

Contemporary Challenges for Fellowship Training in Adult Cardiothoracic Anesthesiology: Perspectives From Program Directors Around the United States

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The fellowship in adult cardiothoracic anesthesiology has matured as an accredited program. This special article addresses current challenges in this educational milieu. The first challenge relates to serving as a program director in the contemporary era. The second challenge deals with the accreditation process, including the site visit. The third challenge discusses the integration of structural heart disease and interventional echocardiography into daily practice. The fourth challenge deals with the issues that face fellowship education in the near future. Taken together, these perspectives provide a review of the contemporary challenges facing fellowship education in adult cardiothoracic anesthesiology.

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Key Words: accreditation; site visit; interventional echocardiography; structural heart disease; Cleveland Clinic; Cooper Medical Center; Wake Forest University; University of Pennsylvania

THE CURRENT fellowship in adult cardiothoracic anesthesiology has undergone a steady evolution that has included formal accreditation. This special article tackles current challenges in this educational milieu. The first theme concerns the challenges with becoming and being a program director of a busy fellowship in the specialty. The second theme describes the challenges for the stakeholders in a fellowship during the initial accreditation process, including a site visit. The third theme discusses the challenges surrounding the integration of structural heart disease and

interventional echocardiography into the daily practice of the specialty. The fourth theme outlines the challenges that face fellowship education in the near future. Taken together, these perspectives from program directors from the United States provide a review of the contemporary challenges facing fellowship education in adult cardiothoracic anesthesiology.

The Road to Success as a Program Director

Background

Despite its long history as a subspecialty, adult cardiothoracic anesthesiology in the United States earned its status as a

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fully accredited fellowship in 2006.¹ Since that time, a steady increase in the number of fellowship programs and positions offered across the United States has occurred. With this growth comes the need for highly dedicated and qualified program directors to oversee these programs while maintaining compliance with the Accreditation Council of Graduate Medical Education's rigid mandates and timetables.^{1,2}

The roles of the program director traditionally have been underestimated by many academic cardiothoracic anesthesiologists, particularly in a busy departmental environment where clinical and academic productivity typically are dominant forces.^{3,4} First and foremost, the fellowship program director is an administrator who is passionate about the education and professional development of fellows.³⁻⁵ This important role has evolved from that of an educator who provided an impactful clinical and didactic experience, along with the completion of associated administrative tasks, to a leader with expertise in adult learning theory, evaluation and assessment, and scholarly productivity and who is a champion of patient safety.³⁻⁵

Program Director

A successful program director has developed the capacity to motivate and extract from fellows more than he or she imagined.^{2,3} Over and above the administrative and educational responsibilities, the successful program director is a leader whose roles extend beyond daily interactions with trainees, faculty, and department leadership.^{5,6} The duties of a contemporary program director now encompass the realm of quality and patient safety, risk management, personal well-being, and a team-based approach to the delivery of quality health care.¹⁻⁶ With an effectively run program that shows no traces of difficulty, the administrative burden of the program director can go unnoticed until there is some disruption in the routine day-to-day activities.

The road to becoming a successful program director has been a source of inquiry for many educators who aspire to follow a career path centered around pedagogy and education.^{7,8} Individual

experiences leading to the position of program director have been quite variable. Early in the accreditation process, program directors from the previously established (then unaccredited) fellowships in adult cardiothoracic anesthesiology maintained their positions, taking on the responsibility of completing the requisite paperwork, following the framework in the common program requirements for a fellowship from the Accreditation Council of Graduate Medical Education, and ensuring that their programs remained in full compliance.⁹ This adaptive response from seasoned program directors is evidenced by the small number of new program directors relative to the growing number of new programs early on in the accreditation process (Table 1). Currently there are 70 fellowship programs in adult cardiothoracic anesthesiology in the United States that are spread across 31 states with 228 active fellows.¹⁰

Leadership

The rapid growth of fellowship programs in cardiothoracic anesthesiology has created the need for dedicated and enduring leadership, with an unwavering commitment to education and quality.^{11,12} Although formal accreditation of these fellowships occurred just more than a decade ago, many fellowship programs across the United States have been in existence for decades longer.¹³ It was the pioneering efforts of leaders from the Society of Cardiovascular Anesthesiologists that ultimately resulted in the recognition of adult cardiothoracic anesthesiology as a specialty worthy of accreditation in the United States.^{13,14} Since the time that accreditation began, the fellowship in adult cardiothoracic anesthesiology has become very competitive, as reflected by the increase in applicants from 267 in 2013 to 355 in 2019 for 168 and 224 positions, respectively.¹⁵ This applicant surge of 32% over 6 years supports the priority to ensure that fellowship programs in adult cardiothoracic anesthesiology are directed by high-quality and effective leaders.

Table 1
Trends in Growth and Attrition of Program Directors in Adult Cardiothoracic Anesthesiology Since Accreditation

Period	Programs	Total New PD	Percent New PD	Active Fellows	New Programs	Total Attrition	Percent Attrition
2019–20	70	12	17.14%	228	1	–11	15.7%
2018–19	69	13	18.84%	215	3	–10	14.5%
2017–18	66	7	10.61%	207	0	–7	10.6%
2016–17	66	16	24.24%	193	4	–12	18.2%
2015–16	62	7	11.29%	183	1	–6	9.7%
2014–15	61	11	16.39%	177	1	–10	16.4%
2013–14	60	6	10.00%	167	2	–4	6.7%
2012–13	58	7	12.07%	165	2	–5	8.6%
2011–12	56	3	5.36%	153	4	0	0
2010–11	52	8	15.38%	144	5	–3	5.8%
2009–10	47	6	12.77%	119	3	–3	6.4%
2008–09	44	5	11.36%	109	13	0	0
2007–08	33	2	6.06%	80	27	0	0
2006–07	4	0	0	15	4	0	0

NOTE. Data from Accreditation Council for Graduate Medical Education (www.acgme.org/adspublic/reports). The presence of more new program directors than new programs likely represents preexisting program directors in newly accredited programs. Abbreviation: PD, program director.

Commitment

Program directors should be committed to keeping pace with the constantly evolving administrative requirements to master the expanding technological advances in cardiothoracic surgery and imaging and to creating a fellowship environment rich in educational opportunities and scholarly pursuits.^{16,17} So what road leads to becoming a superb program director? Unfortunately, the answer to this question is highly variable and dependent on a number of factors. Early on in the accreditation process, few program directors had any prior formalized training in graduate medical education but maintained their leadership roles, learning by trial and error how to navigate the intricacies of the accreditation system.^{18,19}

As more programs joined the ranks of fully accredited fellowships in adult cardiothoracic anesthesiology, institutions were charged with identifying and developing educational leaders willing to take an active role in tackling the administrative responsibilities that come with starting a new program and/or bringing an existing program up to speed.^{20,21} Because some of the more common program citations are related to problems with satisfactory performance of program director responsibilities, it remains a core priority to vet these individuals thoroughly, whose approval eventually rests with the respective designated institutional official and ultimately the national adult cardiothoracic anesthesiology review committee.^{4,8,22}

For many individuals, the desire to become a program director stems from a longstanding interest in all aspects of graduate medical education, often coupled with a love for teaching.¹⁻⁵ However, historically others who coincidentally met the minimal requirements were unexpectedly called upon out of necessity, generally after the unanticipated departure of an existing program director.²³ The interest of taking on the role of program director may occur at any point in a physician's career—as early as residency or into the more senior years of academic practice. The common denominator for all aspiring program directors is a willingness to lead and take ownership for all aspects of a program and the ability to maintain a balance with the many responsibilities shared by all clinicians and academicians.^{20,23}

Challenges and Resources

For programs that were accredited before the introduction of the Next Accreditation System by the Accreditation Council for Graduate Medical Education, this restructuring of the accreditation process resulted in a burdensome transition to the new system for most program directors.^{18,19} For programs established after this change, however, this new accreditation system eliminated a significant amount of administrative paperwork and preparation for site visits while also reducing the number of program citations.^{18,19}

Despite the complexities associated with overseeing a training program, numerous resources are available to both acting and aspiring program directors to achieve excellence in graduate medical education. Many of these resources were discussed thoroughly in a recently published special article about the art of mentoring in this educational domain.⁵ In brief, such resources range from national educational meetings to webinars, institutional-sponsored

lectures, workshops, retreats, and other miscellaneous courses. A number of institutions have their own medical school sponsor faculty development programs and medical education fellowships, and others have established their own programs to develop educators.²⁴⁻²⁷ Such programs include Stanford's anesthesia teaching scholars program at Stanford University and the teaching scholars program for educators in the health sciences at McGill University.²⁵⁻²⁷ Although program content can vary from institution to institution, the coursework typically will address topics such as improving teaching skills to more in-depth faculty development, curriculum design, and education-based leadership skills.²⁵⁻²⁹ For example, one institution described how an annual retreat for program directors used different models to identify how individuals handle conflict situations and to determine preferred leadership styles.²⁷ The investigators found that among 17 participants, 47% preferred compromise as a means of handling conflict, whereas 18% preferred avoidance or an accommodating mode; with regard to leadership styles, a majority preferred a coaching style.²⁷

The *Journal of Graduate Medical Education*, an official publication of the Accreditation Council for Graduate Medical Education, offers a series of quick reading topics geared at enhancing faculty development in medical education. These are short communications on important topics of interest to medical educators that summarize important regulatory changes and discuss practical tips for program improvement.²² The *Journal of Cardiothoracic and Vascular Anesthesia* also has fostered an educational focus for fellowship education that can assist both fellows and faculty.¹⁻⁸ As will be discussed later in this article, there also are advanced degrees in medical education for those who are able to incorporate such training into their busy schedules.²⁸⁻³³

Despite the availability of programs such as those previously outlined in this article, determining the quality of these programs has been difficult because metrics generally are limited to survey-based satisfaction outcomes and self-reported behavioral changes, without addressing organizational effect.²⁸⁻³³ One study addressed the limited assessment methods of faculty development programs and found that program assessment could be enhanced by examining the influence its graduates had on their peers and other groups, and it offered a model for advancing broader program assessments and outcomes beyond satisfaction queries.²⁸ A systematic review that included 52 articles (1991–2015, with 34 published in the latter 5 y) on the subject of training in graduate medical education found that in general, leadership curricula had limited effectiveness, with higher-quality studies (11/52) adopting more classroom and small group teaching, project-based learning, and mentoring and coaching approaches.²⁹ Common themes included teamwork and leadership models. These investigators found that longitudinal or serial training sessions were superior to single events and suggested that fellowship training is an ideal setting for the establishment of longitudinal curricula.²⁹

Advanced Training in Medical Education

There has been a growing interest in medical education research and the establishment of pathways leading to specialization in education, including formal training programs.²⁸⁻³³ Whether an advanced degree is necessary is debatable, as

some individuals stand to benefit more than others, and certain skills alternatively can be obtained using other means.³⁰ Not all participants in these programs share the same personal goals. Cited benefits have included career advancement, development of additional skill sets, mentorship, and networking.³⁰ Constraints include protected time, working around busy clinical schedules, and obtaining funding.³⁰

For many program directors, advanced degrees in education can offer a strong foundation in educational theory and practice. One such degree is a master's in education degree that is focused on medical education.^{31–33} Some might even argue that obtaining such a degree should be given strong consideration.³¹ An entirely online 2-year part-time program was launched nationally in 2002 through the University of Cincinnati Colleges of Medicine and Education as a flexible alternative for those unable to take adequate time from their busy clinical and administrative schedules.^{32,33} Graduates from this program have been academically productive as evidenced by numerous publications, promotions, awards, and extramural funding for educational projects.^{32,33}

It has been noted that there is a lack of publications dedicated to cardiovascular education despite substantial published material on the science of medical education.^{34,35} This specialty gap was seen as an opportunity to grow this aspect of cardiovascular medicine for fellows-in-training and early career cardiologists and to implement an education scholar pathway.^{34,35} The same principles can be applied to adult cardiothoracic anesthesiology. As mentioned, the *Journal of Cardiothoracic and Vascular Anesthesia* already has contributed to such an endeavor with the regular appearance of fellowship and education-themed special articles.^{1–8} This growth of “medical education science” into a recognized entity will provide endless opportunities for individuals dedicated to a structured approach to such a pathway and no doubt will have a positive effect on how trainees are taught. For more senior faculty who trained in a different era, educational methods have changed from the traditional lecture format to more innovative methods that include simulation (now a program requirement for trainees), a dependence on social media (dissemination and search strategies), advanced modes of communication, and numerous interactive formats including group projects and problem-based learning methods.^{36,37} Program directors are responsible for the implementation of a curriculum and must be aware of changing educational needs and styles. Education science ties in nicely with these goals.^{36–38}

There is increasing advocacy for preparation before assuming the role as a leader in medical education.^{36–38} It has been recommended that medical education fellowships offered by a number of institutions be implemented during training to prepare future teaching faculty for their academic appointments.^{36,37} Recently graduated faculty who enter academic practice often are inadequately prepared for their new role unless they were exposed to some type of formal or informal training. Longitudinal faculty development programs can create multidisciplinary communities of educators who can share ideas and create new initiatives.^{36–38} The need for leadership development training has been recommended as an added goal of residency training. Blumenthal et al., in a call to action, described the importance of leadership and management in the

delivery of maximally effective patient care and advocate that program directors address the barriers to producing leaders in health care.³⁸ This goal is in alignment with program requirements and can be adapted easily to the competencies. Such skills lend themselves equally well to the education arena. Not all trainees have natural leadership and management skills, and early training under an evidence-based program framework design could help bridge this gap and address obstacles to leadership development.^{36–38}

For aspiring program directors in adult cardiothoracic anesthesiology, early exposure to these many resources as “preemptive” preparation can make for a smooth and seamless transition into this future role.^{5–8,11,12,22} As with medicine in general, an education-centered career also is a life-long learning process and continuing education remains an important part of maintaining competence. Mentoring of “future prospects” by including them in the numerous fellowship-related activities and committees (eg, clinical competency committee, education committee, program evaluation committee, fellowship candidate interviews) creates a pool of potential future leaders in education who ultimately might aspire to become program directors or at the very least become valuable members of the team of medical educators.^{1–6} Along parallel lines, program directors also should have a future succession plan to maintain stability within the program and to make room for new ideas and innovations.²³ Program director turnover is a serious concern and can be a major deterrent to attracting quality applicants. According to 2018–2019 data from the Accreditation Council for Graduate Medical Education, 12.7% of specialty programs (n = 664) and 11.8% of subspecialty programs (n = 759) experienced at least 1 change in program director.³⁹ There was more than 1 change in program director in fewer than 1% of programs. What is lacking, however, is the number of years of service before program directors stepped down from their role. The average tenure for most program directors is approximately 7 years.³⁹ This predictable turnover highlights the importance of a succession plan characterized by adequate preparation and strong departmental and institution support.²³

The Cleveland Clinic Experience

Since its establishment in 1974, the adult cardiothoracic anesthesiology fellowship at the Cleveland Clinic has had 5 program directors, the latter 2 (Drs Capdeville and Hargrave) having served from January 2008 to the present (accreditation was obtained in 2007). The experience of Capdeville, having never previously served in an educational leadership role, was vastly different from that of her successor, Hargrave. For Capdeville, there was the overwhelming task of navigating the complex accreditation system and seeking out resources to give this new experience some sense of direction. There also was the stress of completing annual program information forms, preparing for both upcoming internal and external site visits, gauging fellow satisfaction, dealing with unanticipated conflicts, and initiating change where deficits existed. These challenges were compounded by the transition to the new

accreditation system, which created a new set of guidelines to learn and enforce.^{18,19} Despite everything, the existence of a vast network of resources within the institution, a supportive department chairman, a designated institutional officer who was readily available despite a busy schedule, and an excellent department of graduate medical education led to what potentially could have been a catastrophic beginning for a novice to a new career direction that was both rewarding and a source of ongoing collaboration with numerous educators within the institution. For Hargrave, the transition was less chaotic because she had been identified early on as a future leader with a drive to maintain the program's quality, all while keeping pace with the fellows' educational needs. As a well-respected educator and role model, and after serving on several of the program's committees, she eventually became the associate program director, from which it was a natural progression to becoming the next program director, resulting in a flawless transition. She participated in numerous faculty development activities and education-related committees before taking the helm and continues to develop and enhance the program. Presently, more junior faculty with talent as educators are being identified as possible future leaders for when the time comes to pass the baton. As an example, the previous associate program director for adult cardiothoracic anesthesiology participated in the many faculty development opportunities offered within the institution, obtained a master's degree in medical education, and is currently the new program director for the core anesthesiology residency. The value of a well-thought out succession plan cannot be overstated because it is instrumental in maintaining and advancing program quality.²⁰

The Accreditation Process for an Adult Cardiothoracic Anesthesiology Fellowship

Background

The pathway to accreditation by the Accreditation Council for Graduate Medical Education for an adult cardiothoracic anesthesiology fellowship can be complex and laborious, requiring both funding and institutional support.¹⁻⁵ However, institutions that sponsor this fellowship program can benefit from the added cardiothoracic educational infrastructure, increased scholarly activity, and increased faculty academic productivity within the cardiothoracic division.^{40,41} The fellowship program also may serve as a recruiting tool for future cardiothoracic anesthesiology faculty for a sponsoring institution.⁴¹ The application process for a new program requires detailed information regarding the sponsoring institution, participating sites, and core anesthesiology residency program.⁴ Program-specific information, including the proposed educational curriculum and the blueprint for trainee evaluation, also are embedded in the full application for subsequent careful review.⁴

This initial application is thoroughly reviewed by the Accreditation Council for Graduate Medical Education, and an initial 2-year accreditation may be granted without a site visit to the institution if the sponsoring institution already hosts a functional core anesthesiology residency program.⁴² The full

accreditation site visit then is scheduled at the end of the initial 2-year accreditation period. Even if a new fellowship program in adult cardiothoracic anesthesiology implements a comprehensive and robust educational plan and addresses effectively the issues arising in the initial 2 years of the fellowship, the program director and faculty of a new program still may be uncertain of their program's performance until this full accreditation visit has taken place.⁴⁻⁶ As such, this pending site visit can be a source of great anxiety for the program director and sponsoring institution of a new fellowship in the specialty.

The Cooper Experience

The following discussion explores the course leading to the site visit by the Accreditation Council for Graduate Medical Education at the end of the initial 2-year accreditation period for the fellowship program in adult cardiothoracic anesthesiology at Cooper Medical Center, a tertiary care, 635-bed hospital in southern New Jersey. The current fellowship has 1 position and initially was accredited in 2017. The basic tenets and timeline of a full site visit for initial accreditation are outlined in detail. Thereafter, the commentary covers the institutional pre-visit preparation and submission of documentation, the subsequent internal preparation for the face-to-face visit, and the events of the actual site visit. This systematic approach allows the program leadership to prepare thoroughly for this accreditation process.

The Site Visit and the Accreditation Council for Graduate Medical Education

The present day Accreditation Council in Graduate Medical Education began in 1981 with the mission to improve health care and population health by assessing and advancing the quality of education for physicians-in-training through a high-quality accreditation process.⁴³ The official accreditation of adult cardiothoracic anesthesiology as a distinct subspecialty was completed in 2006, with the national anesthesiology review committee overseeing and managing program requirements.^{1,8,11-13,22} This review committee meets 3 times a year and is responsible for overseeing and monitoring the accreditation process for adult cardiothoracic anesthesiology fellowships across the United States.⁴⁴

The on-site visit by the Accreditation Council for Graduate Medical Education is used to assess whether a newly accredited fellowship is appropriately compliant with the program requirements for adult cardiothoracic anesthesiology. An appointed field representative visits the sponsoring institution for the fellowship in question and meets with the faculty and fellows, aiming to ascertain the presence of institutional support, a vigorous clinical and educational environment, and as well as sufficient departmental engagement and expertise within the program.⁴² After the visit, the field representative crafts a report that is added to the agenda for review at the next meeting of the national anesthesiology review committee. Based on this site visit report and designated information uploaded by the program into the Accreditation Data System administered by the Accreditation Council for Graduate Medical Education, the review committee makes a

final decision on the program's accreditation status.⁴² This decision is communicated electronically to the program and subsequently is published on the Accreditation Data System website within 5 days of the decision, followed by an uploaded detailed letter within 90 days of the decision.⁴⁵

Once a fellowship in adult cardiothoracic anesthesiology is accredited through this rigorous process, it has achieved a state of continued accreditation that is monitored along with the core anesthesiology residency. The fellowship program then continues to report updates and any major changes to the Accreditation Council for Graduate Medical Education on an annual basis as part of the work covered by the fellowship program evaluation committee.^{1,2} The fellowship program also must then complete a comprehensive self-study 2 years in advance of the scheduled 10-year site visit.^{1,2}

The Document Update Before the Initial Site Visit

Preparation for the initial site visit begins by revisiting the documents submitted with the initial application to the Accreditation Council for Graduate Medical Education.⁴ The fellowship programs must update the program-specific application before the visit to confirm that the document describes the current status of the program and to update the common program information on the Accreditation Data System website.⁴⁶ This is perhaps the most arduous component of the pre-visit preparation because it requires the program coordinator and program director to critically review every detail of the initial application for fellowship accreditation.⁴ Because a newly accredited fellowship program may not have an existing, unaccredited fellowship program to serve as a template before the initial application for accreditation, much of the program application has to be filled with detailed plans on how the educational program will be administered.

In the 2 years after initial accreditation, the expectation is that the program concept has been translated into reality, but not always exactly as outlined by the initial application. The challenge for the program administrators is to confirm that their update of the detailed application before the site visit is an accurate reflection of the current state of the program.⁴⁶ The program application must reflect what actually is taking place in the program instead of what was planned for the program because it is likely that changes may have taken place during the launch of the fellowship.

It is imperative that both the program director and coordinator are very familiar with the details of all program requirements for adult cardiothoracic anesthesiology as outlined by the Accreditation Council for Graduate Medical Education.²⁻⁶ This familiarity will allow the program leadership to confirm that all these requirements currently are being met by the fellowship program in question. Although not required, a program may appoint an associate fellowship director, possibly a motivated junior faculty member, to assist the fellowship director with management and oversight of the program, including the requirements of the accreditation process.^{4,5,12}

Additional documents that require updating before the site visit include program policies, competency goals and objectives, program-specific evaluation tools, and the fellowship schedule.

The faculty information for the fellowship should be updated to reflect the current status, including board certifications in anesthesiology and echocardiography.⁴⁶

Program Preparation Before the Initial Site Visit

Currently, there are 70 accredited programs in adult cardiothoracic anesthesiology across the United States; 9 have received accreditation in the last 5 years and 4 are still in their "initial accreditation" window of 2 years. Because 83% (57/70) of the accredited programs have self-reported a new program director in the last 5 years, it follows that most current program directors have not experienced this process of shepherding their fellowship through a site visit by the Accreditation Council for Graduate Medical Education.⁴⁷ Soliciting support from the institution's graduate medical education office, including the designated institutional official, is very helpful for institutional guidance through the accreditation process and initial site visit.¹⁻⁶ This engagement of all stakeholders within the department and the institution typically will result in a smooth accreditation process and site visit.

The office of graduate medical education at the sponsoring institution should be very familiar with the Accreditation Council for Graduate Medical Education and its processes. As a result of this expertise, this central office can help conduct an internal review of the fellowship program in adult cardiothoracic anesthesiology before the initial site visit.^{43,45} The office of graduate medical education at Cooper was instrumental in preparing the fellowship program for this full accreditation site visit.

Cooper's program application for fellowship accreditation was updated and then sent for detailed review by the designated institutional official. The resulting feedback was incorporated into the update before its dispatch to the Accreditation Council for Graduate Medical Education. Furthermore, the graduate medical education office at Cooper also conducted a "mock visit" with the fellowship administrators, faculty, and fellows to familiarize all the stakeholders with the processes of the site visit and to reduce the anxiety about this evaluation through a simulation process. Critical feedback was delivered in a structured and systematic fashion to the program leadership after the "mock visit" for formulation of an action plan to address the identified deficiencies before the official site visit.¹⁻³

The Accreditation Council for Graduate Medical Education notifies the institution of the date of the site visit approximately 60 days before the scheduled date.⁴⁵ At Cooper, the "mock visit" was run by a senior educational leader who had experience with accreditation visits for other residency and fellowship programs at the institution. As part of the simulation, a packet containing program information that typically is required by the Accreditation Council was delivered to the "mock visitor" 2 months before the scheduled mock visit. The fellowship leadership at Cooper found that the pre-visit "dry run" was part of the vital preparation for the actual visit because it helped the stakeholder group understand the process of the visit and answer questions on program administration with confidence. As a group, the authors highly recommend that any new program undergo a similar process before its initial full accreditation visit because of all the benefits

that accrue from this simulation. For example, Cooper's cardiac anesthesiology faculty became significantly more aware and understanding of hospital and departmental policies related to the fellowship. The faculty also familiarized themselves with the program policies related to fellow assessment of faculty performance; at Cooper, fellow feedback is batched with resident feedback to help de-identify the evaluations, given that there is currently one fellow.

Departmental support is as valuable as institutional support for preparation of the pending site visit. The Accreditation Council for Graduate Medical Education is in the process of reviewing and revising the expectation of protected administrative time for program directors; the revisions currently are pending board approval. If approved, a small program (<5 fellows) will be required to provide 4 hours per week of protected administrative time for the management of the fellowship program. As fellow complement increases above 5, the amount of expected protected time rises to 8 hours per week.⁴⁸ Additional dedicated administrative time for the program director ahead of the accreditation visit to ensure that the program's detailed application, program evaluation tools, and educational program are in order likely will contribute to a successful site visit. The pending site visit also will test the organizational skills of the program coordinator, and a binder containing all program application documents, including the educational program, block schedule, and evaluation tools should be prepared for easy reference on the day of the site visit.²⁻⁴ A separate binder should be prepared with trainee content that contains, among other items, written evaluations by multiple evaluators and the clinical competency committee.²⁻⁶

Day of Site Visit

The program is expected to make key personnel available to meet with the field representative on the date of the site visit that is communicated 60 days ahead of time by the Accreditation Council Graduate Medical Education, although rescheduling might be possible under very extraordinary circumstances.²⁻⁴ Soon after the program receives official notice of the visit date, communication from the field representative should outline the anticipated schedule for the site visit day. The leadership of the fellowship in adult cardiothoracic anesthesiology at Cooper was sent clear and detailed instructions on the selection of an appropriate venue for the meetings with the field representative. The field representative also asked that 1 faculty member take the lead to survey the rest of the fellowship faculty with respect to the perceived strengths and weaknesses of the program and then communicate the responses back to the representative before the site visit. The request for fellow feedback from the appointed field representative was provided by the fellow at Cooper so that the field representative was fully informed before the scheduled visit.

The site visit proceeded smoothly. The field representative departed approximately 3.5 hours after arrival, and during the visit held focused meetings with the following stakeholders: program director and coordinator, the designated institutional official, core faculty members (without the program director), the fellow, the program director of the core residency, and the

department chairperson. Finally, the field representative held a concluding "clarification" meeting with the program director to provide feedback about the collated impressions of the program.

Faculty of the Cooper program found the final meeting with the field representative to be extremely helpful because it provided a roadmap to further enhance Cooper's fellowship I adult cardiothoracic anesthesiology program. Faculty received feedback that small, but important, improvements were required for its fellow evaluation processes. The semi-annual evaluations required revision to include a summary of individual feedback from multisource evaluations and a summary of the fellow's case logs. The field representative also encouraged the program to improve on the timeliness of evaluations by faculty members. This early feedback allowed faculty to start developing and implementing their action plan immediately; the final letter of assessment from the Accreditation Council Graduate Medical Education regarding Cooper's "continued accreditation" status was received only 10 months after the visit.

Concluding Comments

Programs in adult cardiothoracic anesthesiology should not view the scrutiny of the initial site visit as an anxiety-provoking test of program development and administration. Rather, the program, the institution, and the trainees would be better served by viewing the initial accreditation site visit as an opportunity for an intensive self-review of the program. Being open and up-front with the field representative will demonstrate the program's willingness to make changes for the better. Any deficiencies that are brought to light can be resolved and the program can be improved for future trainees. Viewing the initial site visit through this lens can help a new fellowship program in adult cardiothoracic anesthesiology gain the firm footing to anchor future success. As the field representative from the Accreditation Council for Graduate Medical Education stated to Cooper faculty before his departure, "The Accreditation Council is not in the business of shutting down new programs. It is in the business of helping them to improve."

Fellowship Education in Echocardiography for Structural Heart Disease

Background

Even though cardiac anesthesiology fellowship programs have been in existence since the 1970s, the addition of transesophageal echocardiography was a particularly important milestone for the specialty.^{16,17} As of the academic year 2019–2020, there were 70 Accreditation Council for Graduate Medical Education–accredited adult cardiothoracic anesthesiology fellowships with 228 spots, as outlined earlier. The fellowship requirements for advanced training in adult cardiothoracic anesthesiology set by the Accreditation Council for Graduate Medical Education include a minimum length of 12 months with training in management of patients undergoing cardiac procedures with and without cardiopulmonary bypass.¹⁻⁶ At present, the special certification examination in perioperative echocardiography that is completed after fellowship is administered by the National Board of

Echocardiography. This examination requires documented review of at least 300 examinations in transesophageal echocardiography, of which at least 150 have been performed by the trainee.⁴⁹

In the content outline for this examination of special competence in perioperative transesophageal echocardiography, interventional techniques are mentioned but without great specifics.⁴⁹ The need for specialized training in echocardiography is becoming increasingly clearer as advances are made, particularly with interventional cardiology.^{1,2} As transcatheter interventions continue to expand and develop, it is likely that the demand for expert imaging from specialists such as cardiac anesthesiologists will only continue to grow.^{12-14,16,17} Although this represents a valuable opportunity, it also raises the question of how to best integrate the additional echocardiographic training into the fellowship.

The Structural Heart Field

In order to address this important question, one must first understand the transcatheter landscape. The list of echocardiography-guided transcatheter interventions includes valve replacement, valve repair, paravalvular leak resolution, atrial and ventricular septal defect closure, and left atrial appendage occlusion devices.⁵⁰ The common valve replacement procedures are transcatheter aortic and mitral valve replacements, including valve-in-valve procedures.⁵¹ Transcatheter valve repair includes edge-to-edge repair and annuloplasty for mitral and tricuspid valves.⁵¹⁻⁵³ The role of echocardiography may include intraprocedural guidance for trans-septal puncture, device positioning and deployment, and assessment of the procedural result after device deployment.^{54,55} Often, multiple devices are available for each of the interventions listed, which further adds to the expertise needed. In addition to procedural guidance, the perioperative echocardiographer must be aware of potential complications of these interventions, including pericardial tamponade, early device malfunction or malposition, and coronary artery occlusion.^{56,57} Currently, the interventional echocardiographer is typically either a cardiologist or cardiac anesthesiologist. There is likely some provider variability in this staffing model across institutions around the United States, with some high-volume groups using a mix of both providers. The ability for cardiac anesthesiologists to provide imaging for these procedures certainly would increase their armamentarium. However, it necessitates proper training to do so.

Looking at the cardiology training guidelines offers opportunities to model the ideal training for anesthesiologists in interventional echocardiography.⁵⁴⁻⁵⁶ Unfortunately, the cardiology guidelines and recommendations in this area are limited. Imaging aside, the interventional cardiologists seeking to train in structural heart disease were faced with challenges such as variability in volumes of procedures performed, limited availability of some devices to patients enrolled in clinical trials, and senior providers having limited experience.⁵⁵ Collectively, this meant that only a fraction of centers were experienced enough to offer adequate training. The same challenges would similarly apply to cardiac anesthesiology fellowship programs. Ultimately, the ability to provide adequate training would

depend on case volumes to allow for proper exposure. A training guideline from 1994 highlighted the importance of case mix in advanced cardiology training, including echocardiography, and suggested that competence in echocardiography depends not only on case volume but also on case variety.⁵⁸ A more recent guideline from 2015 updated the approach to specific training in transesophageal echocardiography for cardiologists. The guideline highlights the importance of specific instruction in intraoperative echocardiography with a focus on guiding management of structural heart disease for cardiologists seeking expert certification in echocardiography.⁵⁹ Although there are no specific guidelines for training in interventional echocardiography, this recent expert consensus has suggested that such training should occur at high-volume centers.⁵⁹ Although the guidelines from the National Board of Echocardiography for special competence in adult echocardiography include the roles of this imaging modality in interventional procedures as part of the content outline, it does not delve into specifics on training.⁴⁹ It is likely that these details will be developed, given the explosion of new transcatheter procedures for heart disease.⁵¹⁻⁵⁹

The American Society for Echocardiography and European Association for Echocardiography have provided recommendations for intraprocedural imaging for these novel transcatheter interventions.⁶⁰ These guidelines discuss specifics for transcatheter aortic and mitral valve procedures.⁶⁰ This expert consensus noted that in the presence of procedural complications the functions of anesthesiologist and echocardiographer should be separated so that each provider can focus on the emergent priorities that must synergize for clinical rescue.⁶⁰ This statement highlights the point that administering anesthesia for these procedures is a distinct skill set from performing the echocardiography for such procedures.⁶⁰ In many institutions, transcatheter aortic valve replacement now is performed without general anesthesia, making transthoracic evaluation of these valves, typically by sonographers, more relevant.⁶¹

Based on the minimum requirements for procedures in perioperative echocardiography, appropriate minimum numbers for interventional echocardiography could be extrapolated. As previously stated, fellows in adult cardiothoracic anesthesiology typically prepare for the examination of special competence in advanced perioperative echocardiography that typically requires 300 examinations in transesophageal echocardiography, of which at least 150 must be performed by the trainee.^{62,63} In contrast, the minimum number of examinations in transesophageal echocardiography for the examination of special competence in basic perioperative echocardiography is 150, of which at least 50 must be performed by the trainee.^{63,64} These standards could be combined to suggest a reasonable guideline for the number of examinations required to attain special competence in procedural echocardiography. A reasonable proposal could be that a trainee in advanced interventional echocardiography review at least 150 interventional examinations in transesophageal echocardiography, of which at least 50 should be performed in person by the trainee. Although this proposal may be consistent with existing standards, an official standard has yet to be formulated.

If the proposed procedural standard is considered as a minimum, the additional training for specialization in interventional echocardiography might not be achievable in all fellowship programs in adult cardiothoracic anesthesiology. Given the proposed breadth of this additional training, it may not be feasible to add this additional educational goal to a 1-year fellowship that already is very busy. Furthermore, current fellowship programs in adult cardiothoracic anesthesiology may not have the capacity to provide this specialized training. In this setting, it may be reasonable that a separate fellowship dedicated to structural heart imaging after completion of a 1-year fellowship in adult cardiothoracic anesthesiology would be more appropriate and could be offered by high-volume centers with the appropriate resources. The adult structural heart fellowship program at Beth Israel Deaconess Medical Center is one example of such a program that has been launched to address this perceived gap in advanced training.⁶⁵ This fellowship is not accredited by the Accreditation Council for Graduate Medical Education and is currently 6 to 12 months in duration. The outlined curriculum has been designed to foster competence and expertise in the anesthetic and echocardiographic management of structural heart disease.

A major advantage of this approach is that it allows the trainee to devote full attention to master the intended curriculum during the fellowship. An alternative approach for cardiologists has been to develop adequate training in structural cardiac interventions for junior faculty members in interventional cardiology.⁵⁵ This junior faculty pathway could be an option for training in interventional transesophageal echocardiography. A possible disadvantage of this option is that it may not result in adequate protected time for the junior faculty member to devote toward achieving competence and expertise in this clinical domain. Yet another option would be to offer a combined fellowship in adult cardiothoracic anesthesiology and interventional echocardiography at select institutions with appropriate interventional volume, which would last at least 18 months. This extended fellowship pathway is similar to a proposed model for pediatric cardiac anesthesiology training.⁶⁶ Regardless of the specific advantages and disadvantages of these options, all 3 share the common principle that they require additional training beyond the current 12-month accredited fellowship in adult cardiothoracic anesthesiology.

The following principles could guide training in interventional transesophageal echocardiography. The sponsoring institutions should have adequate case volume so that trainees can perform at least 50 interventional examinations during the training period. The designated institutions also should have experienced and dedicated faculty who can supervise these 50 performed interventional echocardiographic examinations and review additional examinations with the trainees for a total of 150 examinations. Because of the current provider mix at many institutions, it would be appropriate for the faculty to be trained in either anesthesiology or cardiology. The sponsoring institutions offering such training should have a mix of transcatheter procedures that require interventional transesophageal echocardiography, including valve replacement, valve repair, septal defect closures, transcatheter aortic valve replacement, and left atrial appendage occlusion. Trainees in structural heart

disease could follow one of the training pathways described after completion of a core residency in anesthesiology. The first possibility is that a trainee could complete a fellowship in adult cardiothoracic anesthesiology and then undergo mentor training in interventional echocardiography as a member of the junior cardiac faculty at an institution. The second possibility is that after graduation from a fellowship in adult cardiothoracic anesthesiology, a trainee could complete a dedicated fellowship in interventional echocardiography with a faculty appointment to support the salary of the trainee. The third training option would be an 18-month joint fellowship with at least 6 months dedicated to structural heart disease and the remaining 12 months designed to satisfy the requirements of an accredited fellowship in adult cardiothoracic anesthesiology. These multiple options for achieving competence and expertise in interventional echocardiography would facilitate the dissemination of this important skill set to better serve patients in an era in which interventional cardiology procedures are expanding rapidly.

The Way Forward

Current Status and Challenges

The evolution of adult cardiothoracic anesthesiology continues into the era of transcatheter procedures for structural heart disease.¹ The accompanying evolution in education in this exciting and dynamic specialty has spawned a dedicated fellowship that over time has become officially sanctioned and recognized by the Accreditation Council in Graduate Medical Education.^{1–4} This structured fellowship requires creative leadership of a talented team by a dedicated program director whose professional development is gaining increasing prestige and recognition, as outlined by the authors from the Cleveland Clinic in this article.⁵ The fellowship director must develop excellent skills in time management to balance the multiple tasks in providing an excellent educational milieu for the fellows, including best practices from the required committees, such as the program evaluation committee and the clinical competency committee.^{2–6} The importance of fellowship training also has received increasing attention in Europe with a structured approach to achieving recognized competence in the specialty.⁷ The fellowship leaders within the European Association of Cardiothoracic Anesthesiology have also developed a fellowship curriculum to augment the didactic milieu in Europe.⁶⁷ This focus on dedicated fellowship training also has received considerable attention in pediatric cardiothoracic anesthesiology.^{8,66}

The specialty of adult cardiothoracic anesthesiology is recognized and the fellowship has received official accreditation with official board certification possible in perioperative echocardiography.^{4–6} Where do we go from here? One of the next milestones is a board certification process for adult cardiothoracic anesthesiology that is currently in development.¹⁴ A milestone that likely will accompany this board certification will be an examination process to test competence and expertise in the specialty beyond echocardiography.¹⁴ This gradual development is analogous to the evolution process currently under way in pediatric anesthesiology.^{68,69}

Fellowship Quality

The success of these initiatives in adult cardiothoracic anesthesiology will depend on the adequate support and mentoring of fellowship directors and their trainees because they will translate these proposals into their clinical practice and subsequently build thereupon in a systematic fashion.^{11-14,16,17,22} The accreditation of fellowship training in adult cardiothoracic anesthesiology by the Accreditation Council for Graduate Medical Education has ushered in a systematic and high-quality approach to fellow education.^{18,19} Faculty development continues to be an important focus in the ongoing quality improvement process undertaken by accredited fellowships in the specialty.²⁰⁻²⁴ The emergence of master degrees in medical education has become an attractive part of faculty development for aspiring fellowship directors, as explained earlier in this special article.²⁵⁻²⁷ There are various formats for completing this type of advanced training in medical education.²⁸⁻³³ The cultivation of leadership skills in medical education can be the foundation for a rewarding and successful academic trajectory at a faculty level.³⁴⁻³⁶ This investment in leadership also can begin during residency and fellowship.^{37,38,40} The scholarly dividends may be enhanced in an academic milieu as a result of this encouragement and development in the principal stakeholders in the program, namely the fellows—the successful fellowship is of the fellows for the fellows by the fellows.^{38,40,41,43,45}

Fellowship Availability

Fellowship application for adult cardiothoracic anesthesiology in this current competitive environment requires careful consideration and preparation as keys for success.¹⁶ The anesthesiology trainee should research the available resources and deliberate which application approach is most likely to be successful.^{16,17} An additional way to boost fellowship availability is through the supportive roles of the Accreditation Council for Graduate Medical Council.^{18,19} The quality improvement processes of the program evaluation committee can foster growth in an accredited fellowship, including a gradual increase in fellowship complement such that more fellow positions are added to a program over time.¹⁻³

The accreditation process for a fellowship in adult cardiothoracic anesthesiology also can encourage the development and quality of new programs, as outlined by the authors from Cooper Medical Center in this special article. This process includes a self-study, close collaboration with the departmental leadership and the institutional office of gradual medical education, a site visit by a field representative, and an action plan to address any issues for remediation requested by the Accreditation Council for Graduate Medical Education.²⁻⁶ Although this cycle is indicated within the 2 years after the launch of an accredited fellowship in adult cardiothoracic anesthesiology, it also typically occurs every 10 years for accredited fellowships to maintain their continuing accreditation.⁴

Fellowship Evolution in Echocardiography

Transesophageal echocardiography has been a core component of adult cardiothoracic anesthesiology and continues to

evolve rapidly.^{64,65} This imaging modality also has spread not only to noncardiac surgery, but also to the intensive care unit and beyond.^{70,71} The rapid emergence of transcatheter interventions for structural heart disease and interventional echocardiography has been discussed in detail by the authors from Wake Forest University in this special article.⁵¹⁻⁶¹ This advanced skill set in echocardiography likely requires additional training beyond a standard 1-year fellowship in adult cardiothoracic anesthesiology with the training pathway options as outlined earlier.⁷²

Another major opportunity for the fellows in the specialty is the emergence of educational scholarship in echocardiography to evaluate the optimal methods for teaching these skills, including didactic lectures and simulation.⁷³ This educational focus also has included learning of echocardiography in the core anesthesiology curriculum in which fellows can play a significant role.⁷⁴ Furthermore, the scope of this educational effort extends beyond transesophageal echocardiography to include transthoracic echocardiography and additional point-of-care applications for ultrasound.^{75,76} It is likely that modalities in echocardiography increasingly will be included in the evolving fellowship curriculum for echocardiography.

The program faculty also can be included in the educational efforts for this expanding curriculum from 2 perspectives.^{77,78} The first educational perspective is to keep the program faculty updated and competent in emerging applications of echocardiography, including in noncardiac surgery.^{77,78} The second educational perspective is to develop and implement new ways to teach fellows advanced skills in echocardiography, such as workflow management through simulation.⁷⁹

The expanding curriculum in transesophageal echocardiography may include newer ultrasound modalities such as strain imaging.⁸⁰ Besides newer modalities, the expanding curriculum may also include newer patient populations such as adults with congenital heart disease.⁸¹ It remains essential for the program director and the core faculty to revise the curriculum on a regular basis so that their trainees in adult cardiothoracic anesthesiology are exposed to the full scope of practice in echocardiography, both in the established and emerging arenas. Given the ongoing expansion of knowledge in this area, it is possible that the fellowship will evolve to accommodate the expanded curriculum. As outlined earlier, one option is to extend the fellowship for those interested in acquiring special expertise in the realm of structural heart disease.

Quality Improvement as a Core Ingredient

The Accreditation Council for Graduate Medical Education has embedded quality improvement as a core principle in its accreditation process for fellowships in adult cardiothoracic anesthesiology.¹⁻³ This focus on continuous quality improvement is clear in the workflow processes for fellowship committees such as the program evaluation committee and the clinical competency committee.²⁻⁶ The proposals for best practices for these 2 central fellowship committees have been discussed in depth already in the journal.^{2,6} Fellows can be significantly exposed to the practical implications of quality improvement as members of

the program evaluation committee and by immersion in clinically relevant quality improvement projects.^{2,3} These activities offer multiple advantages for the fellowship milieu, core faculty development, refinement of clinical care delivery, and enhancement of program scholarship, all of which enhance program performance during a site visit.¹⁻⁶

The scope of quality improvement also includes echocardiography.^{62,64} The process of quality improvement could involve the ordering, acquisition, reporting, and interpretation and communication of echocardiographic studies to enhance the delivery of clinical care, including better patient outcomes.^{82,83} Each of these designated domains for an echocardiographic study can be analyzed further to generate a checklist of essential elements to serve as a framework for assessing quality in that domain.⁸² This process can apply equally to transthoracic and transesophageal echocardiography.⁸²

The implementation of a quality improvement process for perioperative echocardiography has improved reproducibility across the echocardiographic domains previously outlined, although additional research is still required.^{84,85} The processes of quality improvement also can improve the assessment of diastolic function and the compliance with guidelines for comprehensive transesophageal echocardiography through educational interventions.^{86,87} Given that the techniques of quality improvement enhance the clinical effect of echocardiography, the question becomes whether an accreditation process could further encourage echocardiography laboratories to embrace quality improvement as part of routine maintenance.

The accreditation of an echocardiography service line is offered and provided by the Intersocietal Accreditation Commission.⁸⁸ Although an in-depth discussion of this accreditation process is beyond the scope of this article, this comprehensive analysis includes an in-depth review of reporting, staff qualifications, image quality, protocols, continuing medical education, and continuous quality improvement.⁸⁹ Significant deficiencies in these echocardiography domains can result in delayed accreditation of an echocardiography laboratory.⁸⁹ Although additional trials are required, it is clear that an accreditation process can improve provider quality, study comprehensiveness, and report completeness.^{90,91} The advantages of this high-quality accreditation process have persuaded some health systems to consider this process system-wide for all their echocardiography locations.⁹²

There are opportunities for fellow participation in this quality improvement process in perioperative echocardiography. At the University of Pennsylvania, fellows prepare and participate in a monthly case-based conference for quality improvement in echocardiography. Fellows also spend a day each week in the echocardiography laboratory with echocardiographic faculty reviewing studies from a quality improvement perspective. This process recently was restructured to include the fellows in adult cardiothoracic anesthesiology and collaboration with echocardiographers in the cardiology department. It is likely that this quality improvement process for perioperative echocardiography will expand in a systematic fashion in the years ahead. The effect of this initiative will be assessed at regular intervals as part of the quality improvement process.

Conclusions

The fellowship in adult cardiothoracic anesthesiology has achieved formal accreditation for more than a decade. This special article has addressed current challenges in this educational milieu. The first challenge relates to becoming and being a program director in the contemporary era. The second challenge entails the initial accreditation process, including the site visit. The third challenge discusses the integration of structural heart disease and interventional echocardiography into the daily practice of the specialty. The fourth challenge deals with issues that face fellowship education in the near future. Taken together, these perspectives provide a review of the contemporary challenges facing fellowship education in adult cardiothoracic anesthesiology.

Conflict of Interest

None.

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