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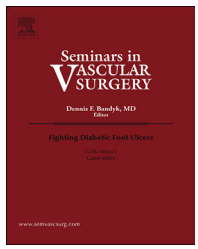

The role of the Vascular Surgery Board in surgical education

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ABSTRACT

The American Board of Surgery (ABS) has more than 80 years of both direct and indirect involvement in US surgical education, with its primary role being certification of graduates of Accreditation Council for Graduate Medical Education–approved surgical training programs. The ABS's impact on education has been at multiple levels, including the development of the content and administration of qualifying and certifying examinations; original education research based on the Board's unique data sets; and surgical training and education-related initiatives in partnership with multiple regulatory bodies and surgical societies. Within these efforts, by incremental steps, the specialty of vascular surgery attained recognition as a primary specialty of the ABS, and the Vascular Surgery Board of the ABS was established 20 years ago, in 1998. The 2 decades that followed have witnessed significant transformations in the evaluation and treatment of vascular disease, the paradigms for training vascular and endovascular surgeons, and the Vascular Surgery Board has partnered with stakeholder organizations to continually ensure quality education for the evolving vascular surgical workforce. Looking forward, while surgical education remains outside of its primary mission, the ABS and Vascular Surgery Board will continue as key stakeholders and leaders in the complex network of professional societies and training institutions that will guide the evolution of vascular surgery training.

1. Introduction

The final formal surgical education landmark for surgeons in the United States is voluntary certification by the American Board of Surgery (ABS). This independent, non-profit, private, autonomous organization is a member of the American Board of Medical Specialties, the umbrella organization for 24 approved medical specialty boards. To understand the Vascular Surgery Board (VSB) of the ABS, one must understand the origins of the ABS because their respective missions and processes are fundamentally similar with regard to surgical education.

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2. Brief historical context and contemporary education-related initiatives of the American Board of Surgery

One hundred years ago, the standard process for training surgeons was via apprenticeships, but there was considerable variation in the quantity and quality of the surgical training experience [1]. Dr William S. Halsted's well-known efforts spearheaded a transition to a more structured surgical education. With the primary goal of protecting the public, the ABS was established in 1937 through the efforts of several national organizations, including the American Surgical Association, American College of Surgeons (ACS), American Medical Association, and regional surgical societies, as a means of recognizing surgeons (distinguished from "standard" medical doctors) who met a minimum defined benchmark of education, training, and knowledge [2]. The ABS was one of the first member boards of the American Board of Medical Specialties to recognize the importance of lifelong learning toward improving the care of surgical patients by requiring board-certified surgeons to maintain their certification through a defined education and testing process throughout the surgeon's career.

From a practical standpoint, surgeons have viewed ABS certification as a strategy to bolster patient confidence in qualifications ("protection of the public"). While on a local level, board certification is required by most institutions and heath care systems to obtain hospital privileges, and by payors for reimbursement, the ABS and the VSB are specifically not engaged in the adjudication of surgical privileges and hospital staff membership. These are clearly local credentialing issues.

With its historical focus on the final steps of transition from surgical training to independent clinical practice, one might surmise that the ABS plays a small role in the more proximal processes of education. However, the ABS has played a largely indirect but appropriate oversight role in surgical education by establishing standards for clinical training and medical science knowledge, because these were pillars to be evaluated by the board for eventual certification. Furthermore, the ABS views itself as a leader in surgical education, as exemplified by its mission statement (Fig. 1).

Clearly, one of the most powerful mechanisms by which the ABS impacts the course of surgical education is through the content of its qualifying (written) and certifying (oral) examinations. Questions for both examinations are written and vetted through the ABS, giving the board the ultimate control of the content of this certification component. The ABS leadership and directors generate the template for what will be tested in ABS examinations, that is, the "blueprint." The exam blueprints are frequently evaluated and refined, as the leadership of the ABS recognizes the importance of defining and continually updating the surgical training curriculum [3]. The VSB exercises a similar and completely independent role in the development and administration of the vascular surgery certification process, which will be discussed.

The earliest ABS certifying examination was administered in 1938, and included not only an assessment of the candidate's knowledge, but also the performance of an operative procedure [2]. Like today, a fee was paid by the examinee, and the fail rate was 20%, and minor variations around this average rate have generally persisted. The examinations transitioned to events, including oral and written components (but no surgical procedure), at major academic medical centers over the subsequent decades. By the late 1950s, the use of actual patients for histories and physicals was discontinued. Finally, in 1970, the certifying examinations were moved from academic medical centers to hotels or formal testing centers.

Mission Statement
American Board of Surgery

The American Board of Surgery serves the public and the specialty of surgery by providing leadership in surgical education and practice, by promoting excellence through rigorous evaluation and examination, and by promoting the highest standards for professionalism, lifelong learning, and the continuous certification of surgeons in practice.

Fig. 1 – American Board of Surgery mission statement.

Contemporary qualifying examinations and certifying examinations are rigorously controlled processes. The ABS relies on criterion-referenced standard setting methods, which involves setting a passing score on an examination that is directly mapped to the minimally acceptable levels of candidates' knowledge, skills, and abilities that are expected of certified individuals. This benchmark is then held to an equivalent standard in subsequent examination years. Professional psychometricians oversee the process.

Beyond these early career examinations, as noted, the ABS was one of the first specialty boards to introduce recertification in 1980. In 2005, the ABS Maintenance of Certification Program was launched, requiring ongoing learning and assessment activities beyond recertification at 10-year intervals. The program is currently engaged in a major revision [4,5], with the new Continuous Certification Program featuring an online, open-book, open-computer assessment of 40 questions (half are practice-related) completed every 2 years. The goal of this transition is to provide surgeons with a convenient and flexible lifelong learning experience rather than a high-stakes testing program.

Additionally, just as the educational assessment value of ABS examinations has been extended to the surgical resident in-training by way of the ABS In-Training Examination (ABSITE), the VSB has developed the Vascular Surgery In-Training Examination (VS-ITE, which will be discussed). Another related example is the collaboration to develop Milestones in General Surgery for assessment of resident physician performance in Accreditation Council for Graduate Medical Education (ACGME)–accredited residency programs. The Milestones provide a structure in which there is ongoing assessment of the resident in each of the six domains of physician competency. Again, by thoughtful development and review of the content of exams and standards, the ABS holds great influence on the surgical education process in the United States.

Beyond these examinations, the ABS has actively engaged the network of organizations tied to surgical education to

explore new paradigms for surgical training. A 2016 statement (http://www.absurgery.org/default.jsp?news_resredesign0416) exemplifies such initiatives. This piece broadly supports the American Surgical Association's Blue Ribbon Committee "Core Plus" framework for training—a general surgical "core," followed by additional training in general surgery or a surgical subspecialty ("plus" years), as in Early Specialization Programs [6]. The ABS in 2011 created a policy to allow program directors to devote up to 6 months per year from postgraduate year 3 year onward to specialty rotations during residency, with a total limit of 12 months during the 3 years. Such a structure allows for more vascular and endovascular surgery exposure during general surgery training for those contemplating a vascular surgery fellowship after a general surgery residency.

In general surgery, the ABS directly influences the educational process by requiring certification in the programs advanced Cardiovascular Life Support, Advanced Trauma Life Support, Fundamentals of Laparoscopic Surgery, and Fundamentals of Endoscopic Surgery. These all reflect an overall desire by the ABS and others to move away from time-based and toward competency-based education.

Beyond these activities, the ABS has led many surgery education initiatives specifically related to vascular surgery [7–12]. Education research tools developed by the board include surveys and resident operative experience data sets, as well as its own internal examination results. An important vascular surgery initiative in 2011 compared the operative experience of trainees and practicing vascular surgeons [10]. The operative logs of vascular surgery residents were compared to the logs of practicing vascular surgeons applying for recertification. The results revealed that the volume of major open vascular surgery cases reported by recent vascular surgery residents has remained relatively stable since the mid-1990s, and that endovascular procedures have been rapidly incorporated into clinical practice by most practicing vascular surgeons. These findings confirmed the concept that vascular surgery residents must receive an operative experience rich in both open and endovascular procedures that is reflective of the actual clinical practice of modern vascular surgeons [10].

3. The Vascular Surgery Board origins and education-related activities

In 1982, vascular surgery became a certified subspecialty of the ABS, and in 2005 a primary certificate in vascular surgery was approved [13]. The VSB was established in 1998, and is solely responsible for defining all requirements and processes related to ABS certification in vascular surgery. Five new members to the VSB were added in 2017, bringing the total to 13 director positions, with an associate executive director for vascular surgery on staff. In fact, vascular surgery is the only specialty in association with the ABS with its own associate executive director. Currently, there are 15 directors who serve on the VSB; this includes 2 vascular surgeons nominated to the ABS through other surgical organizations.

Through work of the VSB and other stakeholders, options for training in vascular surgery have evolved considerably over the last 15 years. In 2002, the VSB endorsed the concept of Early Specialization Programs (4+2 program allowing dual board certification in general and vascular surgery) with the ABS. This program was implemented in 2003 and is still an option today; however, to date, few trainees have been brought through this paradigm with limited institutional involvement. In fact, vascular surgery is the only specialty within the different ABS specialties to use this model [14].

Subsequently, the VSB, Society for Vascular Surgery (SVS), and Association of Program Directors in Vascular Surgery (APDVS) jointly applied for a Primary Certificate in vascular Surgery, which was approved by the American Board of Medical Specialties in 2005. This primary certificate allowed for additional new training paradigms that did not require general surgery training and certification as a prerequisite to board certification in vascular surgery. In 2006, the 5-year integrated vascular surgery residency program (0+5) and the 3+3 vascular residency program were created, and the 5-year integrated residency exists today. In 2017, one hundred and five independent and 54 integrated vascular surgery training positions existed.

Similar to general surgery, vascular surgery has a qualifying exam and a certifying exam. The written Vascular Surgery Qualifying Examination has been given continuously since 1983. The oral Vascular Surgery Certifying Examination was first administered in 1986. In 1991, the Vascular Surgery Recertification, or Maintenance of Certification, Examination was introduced, requiring examination at 10-year intervals to document current knowledge. In total, 162 examinees took the Vascular Surgery Qualifying Examination in 2017. Seventeen percent of the examinees were international medical graduates and 38% were female. Thirty-eight were from an integrated "0+5" pathway. The failure rate was 2.5%, a historical low. In the same year, 161 young surgeons took the Vascular Surgery Certifying Examination, and the overall failure rate was 13.7%. Finally, 203 examinees participated in the 2017 Vascular Surgery Recertification. The failure rate for the test was 6.4%.

The latest change will be the discontinuation of the every 10-year Vascular Recertification Examination, with 2018 being the last year this traditional exam will be offered with 10 years of credit. This exam will be replaced with an online, open-book, open-computer assessment with 40 questions based on the important current literature in vascular surgery. The assessment will be required every 2 years. This assessment will be a fundamental component of a Continuous Certification lifelong learning program. The goal is to have a process that is more meaningful and educational to the practicing vascular surgeon.

As noted earlier, the VSB, working with the APDVS, in 2008 released the first annual VS-ITE. The 2017 VS-ITE was taken by 563 examinees, representing 123 vascular surgery training programs, including 6 Canadian vascular surgery programs. The total group was larger than last year (n = 545 in 2016). Examinees included 247 residents from 5+2 programs, 314 from 0+5 programs and 2 Early Specialization Programs examinees.

Separate from its exams, in 2014 the VSB required surgeons to obtain the Registered Physician in Vascular Interpretation credential as a prerequisite for taking the certifying exam. This requirement emphasizes the vascular surgeons' role in

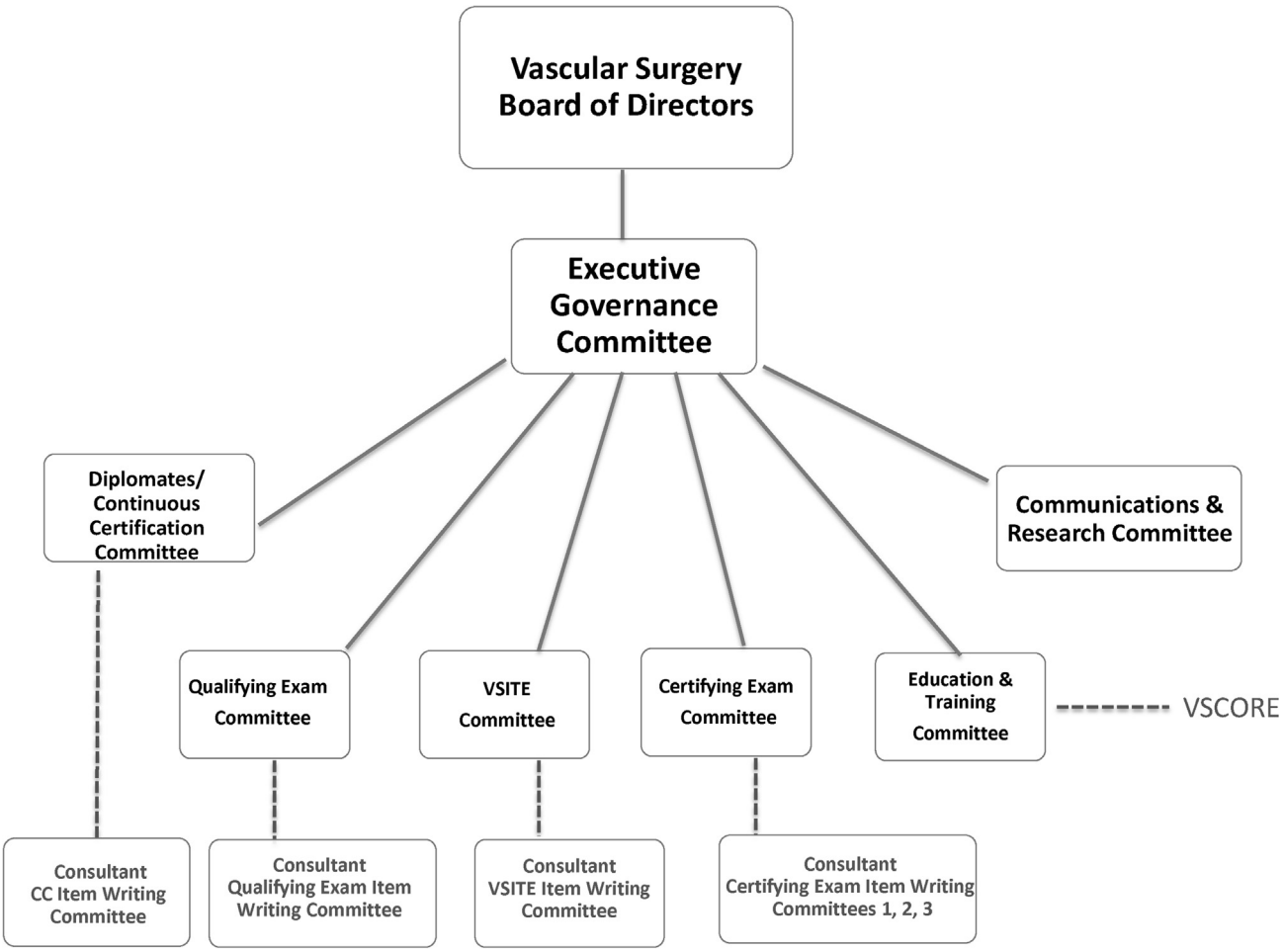

Fig. 2 – Administrative structure of Vascular Surgery Board.

vascular testing. While currently no technical adequacy assessment exists, the VSB is awaiting the results of the pilot study by the APDVS for a technical skills assessment for the vascular surgery trainee.

Similar to general surgery, the VSB, along with the ACGME and other stakeholders, developed Milestones for the vascular surgery trainee, which are evaluations on a continuum from an early trainee to a graduating resident. As of 2015, the Milestones in Vascular Surgery are used to evaluate resident physician performance in ACGME-accredited integrated or independent residency programs. They provide a structure in which each of the six domains of physician competency is assessed.

The recent increase in the number of directors in 2017 allowed the VSB to revise its administrative structure (Fig. 2). The addition of directors from the regional vascular societies provided a critical mass of vascular surgeons to more thoroughly enhance the quality of examinations and proactively guide the specialty within the board mission, while leveraging the structure and resources of the ABS. Note that beyond its specific Education and Training Committee, all the other work groups also directly or indirectly relate to surgical education via surgeon testing, or via conducting and reporting research that may inform education.

As the vascular and endovascular surgery specialty has evolved, there has potentially been an impact on the general surgery resident vascular experience, historically a concern for the ABS and related general surgery organizations. While a report from the ABS using 2009 data from the ABS showed no detrimental effects on general surgery residents' operative experience when comparing programs with and without a vascular surgery fellowship, there was an overall decrease in the number of vascular procedures done by general surgery residents [9]. Furthermore, this study found that general surgery residents bound for vascular surgery fellowships tended to do more cases than their peers for cerebrovascular, peripheral obstructive, endovascular, and dialysis access [9]. Recognizing this transitions to fewer vascular procedures by graduating general surgery residents, the VSB collaborated with the ABS on updating the definition of general surgery to remove vascular surgery from the standard scope of practice (http://www.absurgery.org/default.jsp?aboutsurgerydefined). With the advent of endovascular therapies for peripheral artery disease and endovascular graft treatment of aneurysmal disease, most general surgeons now lack sufficient experience with these more advanced procedures, effectively removing aortoiliac vascular disease from the conditions that most general

surgeons treat [3]. These workforce skill and practice issues are likely to continue to evolve in coming years.

4. American Board of Surgery and Vascular Surgery Board Relationships with other education stakeholders

As exemplified by this issue of *Seminars in Vascular Surgery*, the genesis, governance, and execution of modern surgical education is most accurately described as a network of partnerships among invested stakeholder organizations. The list of institutions below is not meant to be exhaustive but rather representative of the complexity and robustness of contemporary education, especially pertaining to vascular surgery training.

4.1. *Surgical Council on Resident Education*

In 2006, the Surgical Council on Resident Education (SCORE) was formed (ABS participates as one of seven member organizations) to improve the education of surgical trainees through development of a national curriculum. The ABS was an important leader and investor in this educational mission. The curriculum content is available through its web portal (www.surgicalcore.org). When the ABS evaluated the impact of the SCORE curriculum, overall operative volume of graduating surgical residents increased by 21% from 2005 to 2011, though major open cavitary procedures declined, showing a need to improve the efficiency of teaching for specific cases [12].

SCORE has been expanded to include content from vascular surgery and other specialties. The VSB, in collaboration with the APDVS, is in the process of creating SCORE for Vascular Surgery (V-SCORE), a structured curriculum for vascular surgery trainees. V-SCORE is being designed to emphasize the important topics that every vascular trainee should know and expect to be tested on. The curriculum outline is publicly available on the SCORE website. A key goal is alignment of the curriculum outline of V-SCORE study materials with examination content outline used in the examinations developed by the VSB.

4.2. *American College of Surgeons, Society for Vascular Surgery, Society for Clinical Vascular Surgery, Vascular and Endovascular Surgery Society, and Regional Vascular Surgery Societies*

The ACS is the largest surgical organization in the world, and it focuses on continuing surgical education through its annual Clinical Congress and surgeon advocacy in the public policy arena. Historically, the ABS and ACS have collaborated on surgical training issues, such as the FIRST trial (Flexibility in Duty Hour Requirements for Surgical Trainees Trial) to compare the effect of fixed work hour policies with more flexible policies [15–19].

The SVS in many respects parallels the functions of the ACS for general surgery, but with a focus on the vascular surgery community. Founded in 1947, the SVS is a nominating society for directors to the VSB. Other nominating organizations include the APDVS, Society for Clinical Vascular Surgery, and Vascular and Endovascular Surgery Society, as well as the Eastern Vascular Society, Midwestern Vascular Surgical Society, New England Society for Vascular Surgery, Southern Association for Vascular Surgery, and Western Vascular Society. The latter five regional vascular surgery societies were recently added in part to increase outreach to our vascular surgical Diplomates, some of whom may not be members of the national societies.

4.3. *Accreditation Council for Graduate Medical Education and the Review Committee for Surgery*

The ACGME focuses on ensuring and improving the quality of graduate medical education by evaluation and accreditation of residency programs in the United States. The ACGME operates 28 Review Committees, including one for surgery, the Review Committee for Surgery (RC-S). Membership of this 12-member committee is appointed by the ABS, ACS, and American Medical Association. By convention, three vascular surgeons sit on the RC-Surgery and one vascular surgeon is the primary reviewer of every vascular program. The VSB and ABS and the RC-Surgery work together to ensure that the ACGME's program training requirements are consistent with ABS requirements for certification. Only residents from programs accredited by the ACGME or the Royal College of Physicians and Surgeons of Canada can qualify for the VSB certification process.

4.4. *Association of Program Directors in Surgery and Association of Program Directors in Vascular Surgery*

The program directors of ACGME-accredited surgery residency programs comprise the Association of Program Directors in Surgery (APDS). This organization provides an information exchange forum related to graduate surgical education, and it represents the interests of these program directors to external organizations. The ABS executive director serves ex officio on the board of directors of the APDS. Recently, the ABS has convened representatives of the APDS, RC-Surgery, and ACS to investigate the use of Entrustable Professional Activities for surgical residents in an additional effort to move toward competency-based education.

Within vascular surgery, a similar relationship exists between the VSB and the APDVS, and the APDVS is also a nominating organization to the VSB. As with general surgery, the program director of each applicant's vascular surgery training program must attest to the candidate's surgical skills and professionalism and ethics. The APDVS began as an informal vascular program director meeting at the annual SVS meeting [13]. The APDVS was formally incorporated in 1993, and in collaboration with the VSB and RC-Surgery, has proactively defined training curricula in basic vascular science, clinical vascular surgery, and the diagnostic vascular laboratory.

4.5. *The Vascular Summit*

The VSB developed the Vascular Summit in 2012, a meeting to foster alignment and important collaborations across key

organizations that affect the education and training of vascular surgeons. The Vascular Summit is attended by the leadership of VSB, APDVS, RC-Surgery, and the ACGME, with face-to-face meetings at least annually. This format has been successful in moving important educational initiatives forward. Based on the success of the Vascular Summit, a similar Summit was developed for general surgery with representation from the ABS, the APDS, RC-Surgery, and ACGME.

5. Summary

Societal needs for highly trained vascular and endovascular surgical specialists will most likely remain high, with trends such as the aging population and increasing worldwide prevalence of the metabolic syndrome. The explosion of new knowledge, accelerated introduction of novel technologies, public demand for greater accountability and patient safety, and medical cost containment issues will all undoubtedly impact the evolution of vascular surgical training. Compounding these pressures are now better recognized needs and associated challenges [7]. While surgical education may reside outside of their core purpose, the ABS and VSB, are key stakeholders and leaders in the complex network of institutions who guide this vital function as they ultimately pass judgment on the qualifications of graduating trainees and, therefore, the quality of their respective educational experiences [3].

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