

A call to evolve cardiovascular surgery training programs

Una llamada a la evolución de programas de cirugía cardiovascular

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Evolution of cardiac surgical training

Surgical training and education began in 1890 at The Johns Hopkins Hospital. Here, the Halstedian training structure became the cornerstone for surgical education up to this day¹. Since the birth of the American Association for Thoracic Surgery in 1917, the field of cardiothoracic surgery has evolved along with its methods of education and training². Chest surgery arose from general surgery following the need to answer to the complexities of thoracic trauma during WWI warfare². By the third decade into the twentieth century, great milestones were achieved in the field of chest surgery in response to the evolving cardiothoracic pathologies and the need for specific expertise in these areas^{2,3}. By the mid-1950s, the advancing weaponry of modern warfare and thus trauma complexity, along with developing thoracic surgical pathologies such as TB, impelled a greater need for experts in thoracic surgical disease². In the late 1960s, the rapidly increasing worldwide pandemic of coronary artery disease gave birth to more sophisticated cardiovascular-focused surgeons and the development of coronary artery by-pass grafting surgery^{2,3}. As cardiothoracic surgical pathologies evolved and changed over the last century, so did the way younger surgeons are trained and prepared for the future of surgical chest disease. The resulting differences in geographic disease profiles and demographics have led to a variety of pathways

and training structures in training programs worldwide²⁻⁶. The paralleling challenge faced by younger surgeons in training today is the balancing of the “old” pathologies with the “newer” technology-driven therapeutic options. This constant contextualization of patient-disease-resource-setting culture has driven and guided cardiac surgical training for many years²⁻⁶. Today, stepping into the third decade of this Millennium, cardiac surgical training needs to once again evolve and adapt or perish.

Characteristics of training programs

In a study by Nguyen and colleagues, residents from 2-Y pathways (fellowships) reported feeling less prepared for independent practice and more likely to pursue additional training following residency in order to fill knowledge and skill gaps in comparison to 3-Y residents¹. Cardiac surgery training in the United States (US) has classically been 2-year programs until the 1980s when the expanding field of cardiothoracic (CT) surgery demanded additional years of training¹. This evolution of training structure has had benefits as 3-Y residents report feeling more technically prepared for independent practice¹. In Colombia, until 2021, five of the six cardiac surgery training programs were 3-Y pathways and one 2-Y. In order to answer to the expanding scopes of CT surgery, this 2-Y program based in Bogota made the transition to a 3-Y pathway^{3,7}.

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Today, Colombia's single general thoracic surgery training program remains as a 2-Y fellowship². In addition, the introduction of newer 6-Y integrated CT programs right from medical school in 2008 in the US, has been met with both positive and critical perceptions as many faculty consider previous general surgery training fundamental and even critical in CT surgery training⁸. Even so, many countries are constantly re-assessing and evaluating the needs and demands of their CT training structures and characteristics according to the evolving and advancing cardiopulmonary therapeutic options. One example is the Dutch training pathway. The Netherlands has classically offered and integrated 6-Y cardiothoracic training pathway consisting of 2 years of general surgery followed by 4 years of CT surgery³. In 2018, this training structure was modified into a 5.5-Y integrated program eliminating general surgery training in order to provide all 5.5 years of cardiothoracic surgical training³. This transition occurred as a result of the perceived needs of both the Dutch demographic surgical disease burden and the importance of streamlining resident training by exposing residents specifically to cardiothoracic pathologies.

Traditional versus integrated tracks

During the early 2000s, anticipated shortages of CT surgeons in the US, along with unfilled fellowship spots in CT surgery led to the development of integrated training tracks^{8,9}. These newer programs began in 2008 and offered a 6-year pathway consisting of only CT surgery excluding the previous general surgery training^{8,9}. This shorter pathway to becoming a CT surgeon has attracted more candidates and revived the interest in CT surgery mainly through the detouring of general surgery^{8,9}. Although many have supported this track design as many European countries have similar pathways, many CT faculty have responded to this change with mixed feelings^{8,9}. In their commentary, Zurcher and Grubb highlighted that through a smoother pathway to CT surgery, programs may no longer be recruiting the best candidates as the previous general surgery training in traditional tracks help refine and produce the best candidates for CT surgery^{8,9}. Indeed, the natural maturation occurring during general surgery helps produce top candidates for CT surgery fellowships^{8,9}. In a study by Keilin, cardiothoracic surgery faculty still preferred traditional pathway residents because of the maturity and skills acquired from general surgery^{8,9}. In our opinion, we believe that prior general surgery training helps develop "complete" surgeons and those who are

willing to make the long journey truly deserve CT surgery. Specifically in Colombia, and other Latin-American countries including the Caribbean, many CT surgeons practices in non-centralized areas and the skills developed from general surgery prove useful in these more remote regions^{2,3,10}.

Brazilian, Caribbean, and Colombian training programs

The Latin-American and Caribbean regions' demographics and epidemiology have led to the need for separate general thoracic and cardiac surgery tracks due to the high volumes of both cardiovascular and pulmonary surgical pathologies²⁻⁶. In Brazil, cardiovascular surgery training is done as a 5-Y integrated pathway for medical graduates^{3,6}. In addition, General thoracic surgery is also done as a separate track; this separate Brazilian pathway is similar to those in Spain^{2,3,6}. This integrated track was also recently introduced in order to expose residents as much as possible to cardiovascular surgical disease in this already compressed training process²⁻⁶. Caribbean CT training programs are located in Jamaica at the University Hospital of the West Indies and is structured as a 6-Y integrated track; on Cuba at the Universidad de Ciencias Médicas de Villa Clara as a 6-Y integrated track; and on Martinique at the Fort-de-France University Hospital also as a 6-Y integrated pathway¹⁰. Other nearby programs such as in Panama at the University of Panama, have both a traditional (5Y + 3Y) and a recently introduced integrated pathway (6-Y) focusing on endovascular therapy⁵. All of these programs have or are going through various track design modifications in order to evolve and adapt to the population needs and cardiovascular surgical disease burden of their countries. Likewise, Jamaica's program has developed high-fidelity simulation training in order to maintain quality resident training in a low volume setting¹⁰.

In Colombia, the six cardiac surgery training programs (two in Medellín and four in Bogotá) are offered as 3-Y fellowship tracks following general surgery³. The only general thoracic surgery training program based in Bogotá is a 2-Y fellowship also following general surgery². Each of these residency programs belongs to a University and are based at high volume centers, each institution and therefore training program has their own strengths and weaknesses. This 3-year structure has been essential in order to fulfill the residency needs in all scopes of cardiovascular surgical training such as

hybrid procedures, percutaneous procedures, robotics, and TAVI^{2,3,7,11}.

Adapt, evolve, or perish

In this ever-evolving field of cardiovascular surgery, keeping up with newer techniques, adapting to newer technologies, and mastering evolving therapeutic options are the key for survival. As fields such as interventional cardiology, endovascular therapy, and robotics keep on growing and evolving, so does the need for a paralleling evolution of our training programs to incorporate these newer scopes of CT surgery training. Although international observerships and rotations offer excellent learning possibilities and opportunities, the best learning process and environment are the residents' own center where faculty are aware of the residents skills and knowledge and are more likely to allow surgical independence^{2,3,7,11}. The past 20 years have marked the strongest technologically driven and advancing era in cardiovascular surgery. This is due to accelerating technologies such as extracorporeal membrane oxygenation (ECMO), minimally invasive cardiac surgery (MICS), robot-assisted cardiac surgery (RACS), and percutaneous procedures^{2,3,7,11}. Because of this fast-paced and evolving environment, residency training and curriculum designs are not keeping up with the speed of technology in our region. As a result, residency programs are lagging behind, resulting in prolonged post-residency training to achieve competency in various areas of CT surgery^{2,3,7,11}. In essence, programs are far behind the reality residents will have to face upon completing training. It is our duty to both residents and patients to evolve our training programs in order to develop curriculum structures that provide the most complete and efficient training exposure and technology-oriented training. Whether it is through simulation training, cadaveric training, early exposure to minimally invasive procedures, ventricular assistance training, ECMO, endovascular therapy, and structural percutaneous therapy, we as faculty have to prepare residents for a future that is very different from ours^{2,3,7,11}. Conventionally, in our Latin-American region, surgical competency is delayed through procrastinated awarding of resident independence, this is a problem since an established number of first-operator surgeries are required to achieve competence. "As faculty, we have the obligation to improve residents learning curves during training and decrease the need for additional post-residency fellowships".

Conclusions: developing long-standing and evolving programs

With expanding scopes in cardiothoracic surgery such as MICS, RACS, endovascular therapy, and newer hybrid procedures, younger surgeons are expected to master these newer treatment options in order to secure attractive attending positions at competitive centers. As a result, training programs offering greater exposure to a variety of techniques and therapeutic surgical options are more likely to attract higher achieving and ranking residency candidates. The end message is: our responsibility as CT surgery faculty is to develop and produce surgeons of the future ready to take on cardiovascular and thoracic surgical pathologies with all the armamentarium possible, which includes skills with contemporary technology including those overlapping with interventional procedures. Therefore, residents require strong foundational training and curriculum designs which fulfill their knowledge and skill needs in an evolving fashion.

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Conflicts of interest

Dr. Nguyen is a consultant for Edwards LifeSciences, Abbott, and LivaNova.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

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