



Editorial

Pediatric Cardiac Interventional Standards—Better Late Than Never!

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There is an adage in pediatrics that “children should not just be treated as small adults.” For cardiologists, this can be expanded to “congenital heart disease is not adult heart disease in a smaller anatomy.” The first comprehensive cardiac catheterization standards consensus statement was published more than 20 years ago¹ and established a detailed description of the ideal cardiac catheterization laboratory program standards to deliver quality care to patients. That document primarily focused on the adult population and devoted little space for the pediatric cardiac catheterization laboratory, encompassing only 4 pages of the 43 written. Given the relative immaturity of the field of pediatric interventional cardiology at the time, this may have been sufficient, but over the past 2 decades, there has been rapid development of devices, procedures, and techniques that have allowed the field to flourish and advance both in complexity of interventions and breadth of conditions treated. Professional societies for echocardiography and electrophysiology have published multiple consensus guidelines for the standards of care for pediatric patients,^{2–4} and while there has been an update to the training requirements for congenital interventional cardiologists,^{5–7} a pediatric cardiac catheterization standards document has not been published.

Therefore, this herculean task taken on by Holzer et al⁸ is a very welcome addition to the literature and the practice of congenital interventional cardiology. This thorough document replicates the model of a consensus statement regarding standard operating procedures as is present in other specialties and in the adult population but applies it to the pediatric cardiac catheterization laboratory. The report spans the breadth of care from preprocedural preparation to post-procedural care. The international and multispecialty composition of the writing group was intended to allow this document to be applicable to all regions and resource levels.

The authors should be commended for this effort to produce a long overdue document for the congenital heart disease (CHD) population. The sheer magnitude of the information contained in this document can be overwhelming, and perhaps not all aspects are applicable to every reader depending on their role and location, whether it is hospital administrator, catheterization laboratory support staff, anesthesiologist,

surgeon, or interventionalist. What can be appreciated is the sheer amount of collaborative work and expertise that is required to establish a successful congenital cardiac catheterization laboratory. With this editorial, we present viewpoints from the perspective of a junior and senior interventionalist from different eras and reflect upon the highlights of this document and what it means for the future of the field.

The senior interventionalist perspective—Shakeel Qureshi

The paper by Holzer et al has set incredible standards for guiding training in interventions in patients with CHD around the world. Currently the requirements and standards of training and competence in such procedures are inconsistent. This is not surprising considering the different levels of development of services in different countries, varying from none to very highly advanced. Much depends on the desire of the local teams to train and develop their skills, the commitment from their hospitals and units, and perhaps most important of all, the level of support offered by their governments.

When I started my training in pediatric cardiology and especially interventions, we were expected to be at the frontline, learning all aspects of care of our patients, such as assessment in the clinics, performing echocardiography, performing diagnostic cardiac catheterization, and later, interventions and care of the patients in the intensive care units after their surgery. My interventional skills developed not in a structured program of training but by assisting my consultants during interventions, learning from observing their skills, asking questions during the procedures, and then being asked to initiate the procedures while being observed myself. There were no required number of procedures to perform, no assessment of skills, and no attempt to meet desired standards. Much of the training was informal. We relied on our seniors/supervisors to support us subsequently in progressing our careers. There were no guaranteed posts, so we tended to stay in a post until the next level post became available. How did I know that I had gained competence in interventions? I did not! I had informal discussions with my supervisors and asked them for some feedback as to what sort of

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interventions I could perform safely. This meant that I had to develop insight into my own level of skills and competence.

When I became a consultant and started to take responsibility for training young doctors, I tried hard to avoid putting the trainees through the same style that I had gone through (not that my training did me any harm!). I looked at different aspects, such as imparting knowledge about the types of equipment and how to use them, the radiation exposure to babies, detailed hemodynamic assessment in our patients, and the decision making involved in interventions; however, the biggest challenge was how to make someone competent and how to assess it. In the United Kingdom and subsequently in Europe, through our respective national and international associations, steps were taken to develop standards in the catheterization laboratories and the curriculum requirements for trainees. Since there was no evidence base, much of the competence requirements were based on consensus. An approximate number was considered adequate for a particular type of intervention and was then written into guideline documents; however, it was difficult to obtain any consensus across continents.^{6,7}

The document by Holzer et al has been an incredible achievement in obtaining international consensus about the best practices for cardiac catheterization and transcatheter management of pediatric and adult patients with CHD while considering resource-limited countries. Because of the profound lack of evidence, the document had to rely on consensus from the different international societies.

When I was training, there was no position such as director of a catheterization laboratory, as we were expected to perform all aspects of the care of our patients with CHD. Today, the position of director has taken on an important role in some countries, although in the majority, because of resource limitations, there is no such position. It is a challenge in the majority of countries to have a fully trained interventional cardiologist more than 5 years beyond completion of fellowship with “verifiable experience of at least 500 congenital cardiac catheterization cases performed as first operator following completion of training.” Although many pediatric interventional cardiologists will have acquired such experience over time, there is no system of verification in these countries, so this will be an important limiting factor for such a consensus document. Many of the other requirements such as staffing and reimbursement of physicians are a great wish list but are not achievable by resource-limited environments, but that does not nullify the recommendations and should not prevent their aspirations.

When it comes to competence, what the paper by Holzer et al highlights is the lack of evidence, so the numbers again have had to be agreed by consensus as to what the trainees need to fulfill basic, intermediate, and advanced levels of training. There are areas in which most countries would struggle, such as procedural competency for nonphysician staff, as there are no mechanisms in these countries for data requirements for such staff to be assessed.

Where the paper by Holzer et al will have an important role in most countries in the world is in the requirements for the ideal pediatric and congenital cardiac catheterization laboratory suite. This is an area that all operators in all the countries can use to negotiate with their hospital administration when planning new catheterization laboratories; however, this area is only now assuming great importance around the world. A slight concern in the document is the area of “resterilization may be required.” In the current day and age with many transmissible diseases, this should have been expanded, as the standards of resterilization are completely variable and, in some countries, unacceptable.

The number of procedures required for competence is one of the major challenges in this paper, as it is difficult to apply consistently around the world as the authors have pointed out frequently throughout the paper. The requirements of competency for the nonphysician staff are another challenge, as even in developed countries, such staff are either rotated on a short-term basis and therefore cannot commit to such training or do not receive enough support from their institutions to help them develop.

There is a great deal of emphasis on mentorship, something that was completely lacking in my training days. The trainees in those days needed some luck in finding a trainer who cared sufficiently to follow their future progress and provide advice.

The area of adult congenital heart disease (ACHD) interventions being performed by noncongenital cardiologists is another challenging area that is important in all parts of the world, whether developed or resource-limited. In many of these countries, political influence seems to determine whether these cardiologists practice interventions on patients with ACHD. Again, these recommendations may be of value in countries where they can be used to negotiate these issues.⁹

The practice of operator-managed sedation has drawbacks as it requires the operator to not only concentrate on the practical procedural steps of an intervention but also worry about anesthesia and sedation. This can interfere with the interventionist's levels of concentration and may be a distraction, so this area will always need careful consideration. This may be even more important in resource-limited countries.

A great deal of emphasis has been placed on radiation exposure to patients and staff, a hugely important area. In my training days, this was underemphasized, and so there are many pediatric and adult cardiologists who have suffered the long-term effects of exposure to radiation. The younger generation needs to pay meticulous attention to this for their long-term benefits. Of particular concern is the fact that in my travels around the world to different catheterization laboratories, there is either no or inadequate radiation monitoring of patients and staff in congenital interventions.

The junior interventionalist perspective—Mohammad Alnoor

From an early career standpoint, I see this document as a reflection of the past, present, and future of an interventionalist's career. One of the useful tools of this document is Training Evaluation Form (Supplementary Appendix S2). While serving as a framework for maintaining an adequate training program, it also is a good reflection of the changes and advancements to the field that may occur, even within a few years of interventional training. The authors point out that the first few years of an interventionalist's career serve as a continued time to train, and with the rapid development of new procedures and devices, this form shows how rapidly the field is advancing. In this update to the 2014 statement on interventional training,⁵ a welcome addition would have been a reciprocal evaluation form for the training institution. The authors highlight the importance of mentorship for early career physicians, but there is currently no standard for the type of mentorship that would be most effective for trainees. As congenital interventional training is not currently accredited by any governing body, an evaluation of the programs and mentors would be a beneficial tool to identify strengths and weaknesses for each program and mentor to allow for growth and improvement in the training of future interventionalists.

Additionally, this document is a valuable resource as it brings in multiple individuals from different regions of practice to highlight the standard operational procedures on a global scale. The knowledge garnered from this document would otherwise require an individual to travel and visit multiple laboratories in different locations to achieve the same level of regional experience. This type of standards document allows early career interventionalists to better understand the basics for best practice to set themselves up for success and to identify areas for improvement now and in the future. Having this reference is a valuable resource in negotiations with current or future employers to ensure that the cardiac catheterization laboratory is set up to provide the best care for our patients both for interventionalists negotiating for support and for administrators to justify investment.

In looking ahead toward a (hopefully) long career, a document such as this also provides a direction of where to invest time and effort to advance the field. One of the most prominent aspects of this report is

the special attention and recommendations for adult congenital care. Similar to pediatric interventions, and the special considerations in the initial consensus statement in the adult cardiac catheterization report published 20 years ago, special considerations for ACHD care are included in many sections of this report. As pediatric interventions and overall cardiac care continues to develop and improve, the ACHD population will continue to rapidly grow and will have new needs as they reach adulthood. However, as is pointed out by the authors, there remains a lack of clarity of the best interventionalists to care for these patients, as their medical requirements straddle that of both pediatric and adult cardiologist expertise. Until clear training requirements are established, the expertise of those performing procedures on the patients with ACHD will remain heterogeneous, so the younger generation of congenital interventionalists should set the framework for their care. The interventions and decisions we make for the pediatric CHD patients in their early years can have long-term impact and stay with them into their adulthood. While pediatric congenital interventional experience is clearly advantageous in the ACHD population, to a certain extent it is also our responsibility to take on the challenge of addressing our decisions decades down the line when our patients become adults and solve the challenges that we assist in creating.

Ultimately, this guideline document sets a clear standard of best practices, a very detailed list of goals, and a requirement that we should try to achieve the standards of care in our own laboratories. Now that we finally have this reference, there is no time to rest; rather, we have more opportunities to identify areas in which we can improve and use this document as a launching pad to continue improving care in our rapidly changing field. We should already be thinking about the update to this document and be able to provide more data and evidence-based recommendations to supplement the consensus statements. Hopefully, we can be a more proactive force in setting the standards of care and be the example for the rest of the interventional fields. Although adults are not just large children, every adult started off as a child, and so it is fitting for the standards of care to be established early on and used as the model as patients transition to adulthood and beyond.

Declaration of competing interest

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