

Training in congenital interventional cardiology: interviews with experts from around the globe – part one

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Abstract

The foundation of wisdom is rooted in experience, and thus we reflexively call upon our senior leaders, mentors, coaches, and family members for guidance in our personal and professional lives. Witnessing the weathered perspectives of others allows for an internal audit of one's own strengths and deficiencies, which ultimately inspires personal growth. This experience is heightened when both the mentor and the mentee, for example, share a common goal. The field of congenital interventional cardiology, with its constant evolution and diverse technical approaches, requires a lifetime of learning, as well as safe passage of knowledge to the next generation. While there are published recommendations for what to consider when completing this task, hearing the sentiments of those with experience may be more profitable for future fellows and current interventionalists. In part one of a series, we hope to accomplish this goal by presenting an opportunity to learn from our experienced colleagues on the topic of congenital interventional cardiology training. Specifically, we aim to share expert opinions on how to succeed as a congenital interventional fellow, illustrate the diversity of teaching styles and expectations in various healthcare systems, and for the mid-career interventionalists, provide insight into the character traits of a successful mentor of interventional fellows.

Key words: congenital heart defects, interventional cardiology, percutaneous interventions, training.

Introduction

The foundation of wisdom is rooted in experience, and thus we reflexively call upon our senior leaders, mentors, coaches, and family members for guidance in our personal and professional lives. Witnessing the weathered perspectives of others allows for an internal audit of one's own strengths and deficiencies, which ultimately inspires personal growth [1]. This experience is heightened when both the mentor and the mentee, for example, share a common goal. The field of congenital interventional cardiology, with its constant evolution and diverse technical approaches, requires a lifetime of learning, as well as safe passage of knowledge to the next generation [2, 3]. While

there are published recommendations for what to consider when completing this task, hearing the sentiments of those with experience may be more profitable for future fellows and current interventionalists [4–7]. In part one of a series, we hope to accomplish this goal by presenting an opportunity to learn from our experienced colleagues on the topic of congenital interventional cardiology training. Specifically, we aim to share expert opinions on how to succeed as a congenital interventional fellow, illustrate the diversity of teaching styles and expectations in various healthcare systems, and for the mid-career interventionalists, provide insight into the character traits of a successful mentor of interventional fellows.

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Sebastian Goreczny: What attracted you to interventional cardiology?

Prof. Shakeel A. Qureshi (Photo 1): I really wanted to work in a specialty where I could do practical things and show the results pretty much straight away rather than a specialty where you have to think hard and possibly not treat any disease. I didn't want to do something that I really enjoyed because if I did that, then I would be confining myself to psychiatry, gastroenterology, and obstetrics and gynaecology, which I really enjoyed. I thought that if I do those, within 10–15 years, I would probably know everything about them and I would get bored. I thought I ought to do a specialty that I didn't enjoy and that I didn't understand. So, I started my career in adult cardiology. In those days it was all angiography, right and left heart catheterizations. Interventions came in later. Even when I started training in adult cardiology, within 6 months or so I felt that this was fairly easy to become good at and may become boring in the future. The specialty that I hated whilst a medical student was paediatric cardiology because I didn't understand it. I also became stressed at seeing babies with congenital heart disease, who in those days had very low survival rates. I thought I would do this specialty because it would be a bigger challenge, which would keep me busy and challenge me for the rest of my career. Around the time I was starting my training, diagnostic catheterisations were challenging and stressful in children, and echocardiography was just coming in. I didn't always understand the haemodynamics, so I thought this would be something I should take up. Then interventions started, and this almost fulfilled some of my original ideas, which were to be able to do something practical and see a result fairly quickly rather

than not seeing the result at all. Interventions fitted in nicely with that concept even though they were in a subject that I didn't particularly understand or like.

Tell us about your interventional training. What did you like or dislike?

Originally, I trained in paediatric cardiology at Harefield Hospital, where at that time it was all diagnostic catheterizations and preparing patients for surgeries. Then I moved to Guy's Hospital, where I trained as a fellow, and interventions were just starting. I remember it being quite exciting, stressful and challenging because I was working with a very experienced senior colleague, Mike Tynan. He was making ballooning of a pulmonary valve look pretty easy, whereas to me it looked very challenging and difficult, because the equipment was not really designed for use in children. Then closure of defects like patent ductus arteriosus (PDA) came in, and that was also challenging, but at the end of the procedure in all of these cases you could see a good result, and that was gratifying.

What accomplishments are you most proud of during your interventional training?

The one that really stands out and I am proud of was burning through the valve in pulmonary atresia. Mike Tynan and I were trying to work out whether to do this or not, and it just happened that we met Eric Rosenthal, who was an adult cardiology trainee doing research with laser generators at Guy's Hospital adult cardiology department. We had discussions about whether the laser generator could burn a hole through the valve and, long story short, we hadn't tried any experimental work oth-



Photo 1. Prof. Shakeel A. Qureshi with his fellows and co-workers

er than testing if the laser could burn a hole through a newspaper. We had a baby with an atretic pulmonary valve and good outflow/infundibulum and so seemed suitable. The day before the procedure was planned, we tried burning a hole through a post-mortem, cadaver valve and it was successful. That was our level of practical experiment. The next day we burned the hole, ballooned the valve and got a really good result [8].

Do you have any regrets regarding your interventional training?

I have no regrets in the specialty, because I consider myself lucky. There were rapid advances all around the world in interventional techniques, and I just happened to step into the specialty at the right time. It did mean that I was wholeheartedly committed to trying to develop different methods, different interventional techniques. I was working all sorts of hours getting the buzz out of the interventions and emergency cases. My main regret is that I spent a lot less time with my family than I should have done. That was the cost of my commitment to my career.

What makes a good candidate for interventional cardiology? What type of skills or character features are required?

One is in-depth understanding of the morphology of congenital heart defects [1]. The second is to understand the physiology of the circulation. Without these two things, it would be very difficult to become an interventional cardiologist. Next, it is important to understand imaging. As a minimum, they should become good at echocardiography, they don't necessarily need to do practical computed tomography and magnetic resonance imaging (MRI) scanning, but they should understand the imaging and three-dimensional (3D) anatomy. In the first few months of training, we can tell one of the most important aspects of interventionist – that is manual dexterity; coordination of the hands of the person doing diagnostic catheterisations. From that, we should be able to guide people and say to them, “Your dexterity is not optimal, and therefore you are likely to struggle in interventions in the future, and let's think of another subspecialty.” Sometimes when you see a person moving catheters you immediately know that it is worth spending a lot more time training them because they will become a good interventionalist. I don't think trainers do enough of that, and trainees probably do not want to hear such assessments. Nowadays you have to be careful how you say such opinions.

What advice do you give to your trainees at the beginning of the training?

A trainee who is planning to do a catheter interventional procedure really needs to go through every single

minute detail of the patient's history, diagnosis, what procedures may have been performed before, look at the pictures, and not just read the reports. If somebody does this, it shows me the degree of their commitment and understanding, so that I know I can trust them. If a trainee comes to me and says, “Let's go through the steps of the procedure that we are planning and go through the equipment”, that is attention to detail. Those things, such as a full understanding of the patient's history and the procedures, full knowledge of previous investigations and then sitting down and planning the procedure in detail, are encouraging to me and give me a positive vibe about the trainee.

What are the most common mistakes trainees make?

One is cutting corners, just looking at two or three views of the echocardiogram or looking at one picture from the MRI without having understood all the information that is required. If previous catheterisations have been done, not having put emphasis on particular haemodynamics and not having all that information at their fingertips is when mistakes are made. So, I then feel I have some reservations about such a trainee.

What advice do you give to your trainees with regard to communication with patients and families?

Communication and interaction with patients and families is most important. At some stage the trainee has got to be able to do this independently, so that they are comfortable when they become consultants. If I was doing a consent or talking to the parents about the details of the procedure, I would want the trainee to sit and observe and learn from my interactions. It should not be up to me to say to the trainee, “I am going to consent this patient, come with me.” The trainee should insist on doing this. [They should] observe and then at some stage, I would tell them to do the consent and talk to the parents, and I would watch and give feedback. There are some trainees who are committed to doing this and others who stand back. I am always delighted if I say to a trainee that I am going to speak to the parents and they have done it already. Then I can go to parents and see if they have any questions. This way I can make a judgement on how well the trainee may have explained the procedure and how well they have taken the consent. When I have to ask the trainee to come with me, that shows less commitment.

How important is research during interventional training? Should it be conducted at a particular stage of their career?

Research is an interesting aspect of training. When I was starting out in my career, I was given very useful advice and that was, “Don't just concentrate on your training; do research, do case reports, do wider research,

publish in order to make yourself indispensable and difficult not to appoint to a post.” Research should be performed at all levels, from the beginning of training until the end and even continued afterwards. The trainees should be advised to look out for opportunities for publishing either case reports of unusual cases or collecting data on series and writing up those data. This helps to develop critical thinking and contributes to the research. Then if the trainees wanted to focus on a specific area of research later, they would have a solid foundation. Research should be on an on-going basis unless there is one particular subspecialised topic that they want to spend a longer time on.

How do you advise a former trainee who is starting an independent practice?

Nowadays, when a trainee is appointed to a consultant job, it is tempting when starting in a new unit to think that you are the only person responsible for a patient and capable of doing everything for them, whereas you should be looking for other colleagues in the unit to support you in your decision making, when you have doubts. You shouldn't be unrealistic and expect to have all the answers to every question raised in the patients' management. It should be possible for you to refer to a senior colleague and say, “I need advice on this patient; I need help with this catheter procedure.” Nowadays, you should not be expected to do interventions on your own with a trainee. There should be a lot more support available to you within the department. When I started at Guy's as a consultant, from very early on, Mike Tynan and I decided, that for some of the moderately complex or very complex procedures, we would scrub together and assist each other. That meant you were sharing the stress, the responsibility, and you were giving the patient the best chance of having a successful procedure. It wasn't one consultant who was getting frustrated and more tired with a complex procedure and at some stage likely to fail and give up. You had more than one person sharing the workload, responsibilities, experience, and decision making. During a procedure, if the two of you are discussing strategies, you are more likely to make a correct decision than a wrong one. That is what should be happening more and more, and I am pleased to see it is happening more widely. Otherwise starting a new consultant job could potentially be a lonely world, where you are suddenly responsible for everything, possibly slightly out of your depth, and you feel you are on your own. If you are doing interventions, sooner or later there will be complex procedures and complications. That is when it will hit you psychologically and it will become very difficult to sustain your level of enthusiasm and commitment. Having other colleagues supporting you in those times is absolutely essential. You need someone to refer to in cases of complications to help you get through the difficult knock-on effects.

Have you had experience with interventionalists who became dissatisfied with their career, who reached occupational burnout? How did you advise them?

It is rare, but I have seen one or two. Rather than a burnout leading to stopping interventions altogether, it was more related to the fact that they were leading the interventional programme and could not cope with the stress. I advised them to lower their expectations and allow another colleague or a junior colleague to take the lead. The affected individual could then continue at mid-level, at a level that they could cope with. I haven't come across somebody who had such severe burnout as to stop doing interventions altogether. I think there is more and more need for mentoring by either another colleague of similar level or senior colleagues. Mentoring could be from within the department, but also it could be from outside. I do a lot of mentoring of colleagues all around the world and there is a similar theme about how much stress they are going through and how to support them through it.

How can one develop and maintain a good mentor-mentee relationship?

There are several ways of doing this. For example, if a colleague wants to advance his/her interventional program, I go and visit them and help them do specific procedures. That helps them to develop the confidence in order to get to a higher level. Now there are quite a few friends around the world, who use FaceTime or similar technology, not just to discuss the patients, but on a few occasions in the middle of an intervention. I stay on FaceTime and talk them through alternative ways of doing interventions successfully. Those colleagues learn from these experiences and then can develop skills within their own environment and, even more importantly, within their country. They can then mentor other colleagues. The mentee should decide who they want to mentor them. In order to pick a mentor, you need to have somebody who is friendly, whom you can trust, and to whom you can open up your concerns with the understanding that they will keep everything confidential. Then you need to have the trust that this mentor will be absolutely honest and support you and advise you correctly. It is important not to wait for a complication to occur before you refer to the mentor. The mentee should have an on-going, every three to six months contact to go through issues. Within the department it is different, you can have as much or as little contact with the mentor as you want, but regular contact is very important for the development.

Together with Neil Wilson for many years you have hosted sessions entitled “My nightmare case”. How do you encourage doctors, particularly those in training, to open up and talk about complications?

I think that one of the best ways of learning in interventions and, it applies to other specialities also, is

to discuss difficult or challenging cases or cases when complications have occurred. Neil and I have organised these complication sessions for decades, and we still learn from presentations made by other people [9]. Inevitably some of those complications may happen to yourself. If you have seen how somebody dealt with these, you will then be able to do it yourself much more quickly without spending time thinking about how to deal with a complication. I have always encouraged people to present complications openly. In the UK for example, we have a two-day meeting each year, where you are only allowed to attend, if you are going to present complications and challenging cases. You have to be open, frank, and receptive to criticism, but it is all done for education, and constructively, not destructively. When you present your complication, somebody will immediately ask: "Why did you do that? This was the wrong way of doing it." Painful though this may be, that is the way to learn not just for yourself but for other colleagues attending. I would always encourage people to present complications and challenging cases and learn from others' mistakes.

Nowadays there are many ways of getting knowledge and skills, including structured training, mentoring programs, conferences, publications, and webinars. How would you prioritise them?

Training is an on-going process of consolidating knowledge. I don't think it can be done in stages. It would be wrong to say you shouldn't attend a conference in the first five years of your training. You should be attending these. There are many benefits quite apart from listening to world experts giving lectures on relevant topics [9]. It is even more important to develop a network of friends and colleagues that you can then relate to and refer to when you progress in your career. There is nothing like attendance at scientific meetings to update your knowledge.

How would you compare the UK training system to other systems? What are its strengths and weaknesses?

The strength of the current training system in UK is that it is more structured. The weakness is that you don't specialize in one particular area until you have completed your training. There are European countries where training systems are shorter and you do the subspecialty training much quicker. This has some positive points because, before you become a consultant, you do much longer interventional training and are therefore a stronger candidate. There are countries where training is mixed, which isn't ideal in my view. It would be wrong to say that one system is perfect. There are some positives about the training system in North America, but again sometimes people spend too long training in a subspecialty area and

not enough in the general paediatric cardiology, and vice versa. There isn't a single ideal training system.

Thank for your time.

Thank you.

Sebastian Goreczny: What attracted you to congenial interventional cardiology?

Prof. Ziyad M. Hijazi (Photo 2): This goes back to the mid-80s, to 1986–1988 in particular. I was a resident at Yale University and the cardiology team there was very strong. The cath lab director was Bill Hellenbrand and the division chief was Norm Talner, a well-known cardiologist and physiologist. The head of the echo lab was Charlie Kleinman. When I started my residency, Yale was among five sites in the world that had access to ASD (atrial septal defect) and PDA devices. Bill Hellenbrand and Norm Talner were great friends with the late Bill Rashkind. The beginning of the Rashkind umbrella was at CHOP (Children's Hospital of Philadelphia) with Bill Rashkind, but because of his close friendship with Bill Hellenbrand, Yale became one of the sites. Being an intern and resident to see these things happening there, I said, "I have got to be an interventional cardiologist, Yale is the place to be." When I started my fellowship in 1988, at Yale they had access to the Rashkind Umbrella, and in that year the friendship between Bill Hellenbrand and Jim Lock was there. Jim came, when I was a fellow, to proctor Bill with VSD (ventricular septal defect) closure. When you are a first-year fellow and the first operator is Bill Hellenbrand and assisting him was Jim Lock, "Wow this was unreal! I wanted to be an interventional cardiologist."

Tell us about your interventional training. What did you like or dislike?

The few weeks that I was not doing basic research during the second year of fellowship, I would go to the cath lab to work with Bill Hellenbrand. I said to Bill [that] I want to focus my third year on becoming an interventional fellow. He agreed, and the third year, which you spend primarily doing projects, I dedicated to advanced fellowship in interventional cardiology. I did a couple of projects with Bill and those projects were successful and led to publications [10, 11]. The moment I finished my fellowship, I was labelled as an "interventionalist" because I spent basically a whole year with Bill Hellenbrand learning intervention. Back then there was no advanced year because the interventional program was not well structured and quite honestly [there were] not many tools and techniques (valvuloplasty, angioplasty, coil embolisation, and closure devices) to require a dedicated year. The only few programs in the world that had access to devices were primarily in North America, and I trained at one of them. Of course, as time went by, more devices, more techniques, more stuff became available, and that



Photo 2. Prof. Ziyad M. Hijazi with his fellows and co-workers

is why we say now to an individual, “You will need a dedicated year.”

Do you have any regrets from your training? Is there something you would do differently?

No regrets. When I started my fellowship at Yale it was not easy. I had personal issues with Bill Hellenbrand. He did not treat me well. Later on I found out that that was his style of teaching. It was not personal. That was Bill Hellenbrand, you’ve got to take him the way he is. If you do, you will learn a lot from him. Bill does not come to you and say you do this, you do that. You watch him work and you learn from him watching. That, in my opinion, is the best way of teaching. When you become a fellow, now you are mature, you are not a medical student, you are not a resident. You are a fellow, you are advanced, you have the brain to read any article, any book, and make judgments. You just need to learn from the masters by observing them. How they conduct themselves, how do they think? I believe the worst way to teach a person is by spoon feeding them. You’ve got to watch and learn by watching. I adopted this in my way of training fellows. I have trained many fellows over the years and you can ask them, “How does Z teach?” I don’t sit and say, “You do this, you do that.” No, they watch what I do, like I watched Bill doing, and they become good interventionalists.

Perhaps the only regret I have going back, if you would ask me, “Would you become a paediatric cardiologist?” Probably I would say to you, “No, I would love to be an adult interventionalist with expertise in congenital heart disease.” The field is much wider, has more

depth, more cases, more everything. Perhaps because of that regret, when I became an attending in 1991, I co-invented a coronary stent. In 1992-1993 I took this stent to the animal lab, to test it for maintaining patency of the ductus. I did the animal study and at the end I said, “Ok, how many babies am I going to save a year with the ductus? Very limited” [12]. At that time coronary stenting was just being talked about. I decided to make an animal trial to put the same stent in the coronary arteries of pigs that were fed a high-cholesterol diet. I did the study and we published the results [13]. Now we needed to use this stent in coronary artery disease. Basically, I travelled the world proctoring adult cardiologists in coronary stenting. This continued until 2002–2003. Then, I became too busy with devices. I needed to decide – is it this track or this track? (congenital vs. coronary). That is when I decided to drop coronary stenting and focus primarily on congenital heart disease. I had the best life.

What factors were important for you when applying for a fellowship?

I chose Yale because I did my residency at Yale, so I had exposure to who Bill Hellenbrand was, and Charlie Kleinman and Norm Talner. But before I decided to spend three more years at Yale, I needed to visit one other program, and then a decision had to be made! That program was Boston Children’s. I went for an interview at Boston Children’s and the atmosphere was different than Yale. Boston Children’s was and still is a larger program, they have like twenty-five fellows. Yale had like six fellows, and the attendings knew the fellow on a personal basis.

There was intimacy, there was direct supervision, they would know you more. Once I interviewed at Boston Children's, I said, "I'm not going to go there, I'm going to stay at Yale." In retrospect it was the right decision because the program was small, Bill Hellenbrand got to know me, I got to know Charlie, and they were legends in the field of paediatric cardiology.

Based on your experience of training many doctors around the world, what makes a good candidate for an interventional cardiologist?

I get a lot of requests from people who want to train with me. I look at their CV, then I say, "OK, come to my place for an interview." When I interview these people, I want to see how hungry they are. I tell them, "Listen, you are going to spend a year with me, in this year no family at all. I am your family. I need you to do at least five to ten projects. I don't want any excuses. If I say to you give me a draft July 1st, you better have it July 1st or before. If you do not, that will be your last project." Every fellow that I have trained truly lived the year as if they were my shadow. Whatever we do, wherever we go, that is what they are doing. The family became totally secondary for them. It is a year. I told them, "If you want to be famous, that is what you need to do. If you don't want to do it, don't waste my time." Damien, Ralf, Wail, Dr. Fu from Taiwan, Dr. Du from China, Dr. Garay from Chile, etc. Every year I take one fellow. They do the projects, they deliver. The only fellow that I kept to join my program as a faculty was Damien Kenny. At that time there was an opening in the cath lab, so I offered him [the chance] to stay. The rest of them they all went back to their countries. That is one thing I decided, I wanted to take someone not from the US. I am taking international fellows because these people will go back to their countries and they will contribute to building programs in their countries, which they need more than the US needs them. That is why all my fellows were non-US, because they had to go back and build excellent programs wherever they were.

What should one avoid during interventional training?

The only behaviour that I tell the fellows to avoid: no arguing back with me. That's it. That I learned from Bill Hellenbrand. Don't argue. Accept it and when you become the boss do it your way, but for now it's my way. That's how I am going to train you, that's how it is. Of course, it is good to have dialogue, but there are certain things there is no dialogue in. This is how I do it, take it from there, and then once you become an attending, do it your own way, but when you are a fellow you listen to the boss. You came to learn from me, then you listen to my way or the highway. That is how all the fellows learned quickly, that if they start arguing on the first day they lose.

Now your fellow is out of training and is about to start an independent practice. What advice do you give to your ex-fellow?

The advice I give to all my fellows, that once you start a new job, people are going to test you, people are going to give you s**t cases. First of all, be selective!! Do not take every case they throw at you. You want to show them success initially. Until you build your repertoire, build your experience, then you can tackle the most difficult ones, but initially you have to be careful. There are a lot of malicious people out there – they want you to fail. They will send you things that are near impossible. Simply say, "I cannot do this." Number two, the line of communication between me and them is open 24 h 7 days a week. You have any case you are not sure about, you want to discuss, call me. We will discuss it and we will help you reach a good decision on that case. Even nowadays, after they have become senior, even me sometimes – I will not hesitate to call Bill and ask, "What do you think?" You have got to be smart and do what is best for your patient. Do not be a cowboy because one day, at one point, you will fail. That is the advice I give to people. First be reasonable, don't take on everything, be selective, then build your experience and go from there. Second, with your mentor have a line of communication open all the time so that if you need help, you will get it.

How can one build knowledge and experience after the formal training is over?

That is a great question. In my opinion, one of the best ways to keep your experience and your knowledge is meetings [9]. You go and attend good interventional meetings! Example, CSI (Congenital and Structural Interventions), PICS (Paediatric and Interventional Cardiac Symposium), or the IPC (International Workshop on Interventional Paediatric and Adult Congenital Cardiology) – you will see the experts in the world doing either live cases or discussing cases or giving lectures. From my travel around the globe, I didn't only teach but I also learned. The best example is sinus venosus atria septal defect (ASD). This guy (Hussein Abdelwahab, MD) during my visit to Iraq in 2011 told me, "I can close sinus venosus ASD with a covered stent." Of course, you don't get convinced until you see some cases. Then he sends you a description, a paper, a technique, and now it is established. Keep your mind open wherever you go. You will learn something. The best way to learn is by visiting people, visiting meetings, and discussing things. One thing I did for my fellows through the PICS meeting, I put them on the international stage as faculty, as operators. Becoming a faculty in the meeting is not about a blank check, you've got to work. You do the factoids; you do the slides. That is how you take a fellow from the initial stage, train them

to become your shadow, and once they finish, they become independent, but you continue to take care of each other. You provide them with opportunity writing manuscripts, suggest their names for other organisations and meetings.

If you were to compare training systems in the US, middle East, or elsewhere, what are the strengths and weaknesses of these systems?

This is a great question. Especially now in my position as the chairman of department of paediatrics I interview a lot of people not just for cardiology. Quite honestly, the training system in the US is so robust, so organised, and facilitates learning for the fellow or resident. What I have seen in many systems, this interrupted training that you come and spend three months with me and you go to another institution and you spend a few months with that person; I don't think this is a good way of training people. I think you ought to stay in a program for a specified period, be it 1 year or 2 years or 3 years, with the same group of people. It is not bad to do an elective one month or two months to go to other institution. That is fine. The bulk of the training has to be under one leadership and tutelage of one person. I think the advantage of the US compared to the UK is the robustness of the training that you get in one institution. That institution may not be the best place on Earth, which is fine, but at least they give you the basics and then after you have finished you can build on that. That is an important differentiating factor between the US and the others. The other one is the board certification. In the US there is a board certification for subspecialties. Every year you do an in-house exam to see how you are doing. Although sometimes exams don't necessarily test everything in you, but at least it gives you a background where you are, what areas you need to focus on. Sometimes failing has different aspects in echo, EP, in general cardiology, in heart failure. When you do an exam every year to test your knowledge in all these areas, you will find out what are the areas that you are weak, that you need to improve. The training in the UK, Poland, Germany – the trainee will encounter a lot of stuff, but the organisation, robustness of the training program itself is more structured in the US than the other places.

Thank you very much!
My pleasure.

Sebastian Goreczny: What attracted you to interventional cardiology?

Dr. Audrey C. Marshall (Photo 3): What appealed to me about interventional cardiology was the same thing that appealed to me fundamentally about paediatric cardiology from the very beginning. Like many of us I went into paediatrics so that I could do paediatric cardiology.

The first time Paul Weinberg at CHOP (Children's Hospital of Philadelphia) drew a box diagram for me and I thought about the circulation that way, I started thinking about how the heart pumps and how blood flows, and that was basically what I was pursuing when I went to cath. All the addition of the actual practice of interventional cath was even more appealing.

How do you remember your interventional training? What did you like or dislike?

I remember it largely with regard to the people who trained me, and the people who trained *with* me. I trained in interventions in Boston between 1996 and 2000, and that was primarily with Jim Lock, Stan Perry, Barry Keane, Peter Lang, and Mike Landzberg. I was really blessed to have that group of role models and teachers. I remember it as very challenging at moments. It was exciting, it was fun. There was tragedy, there was comedy, there was everything. It was terrific!

If you were to go through it again, what would you like to be different?

It took a physical and emotional toll, but more of an emotional toll than I had anticipated. It's very stressful for people who have very high expectations of themselves. A lot of what we do as interventionists is not something that has a clear success associated with it. There are a few very straightforward, cookbook procedures that we all execute pretty much the same way and with a successful outcome. But I must say, I don't know very many people in this world who are as goal-oriented and accomplished as many of my peers, who spend so much time trying so hard to do things that might fail. Think of long cases when you are trying to get to one vessel or trying to get a certain device a certain way and you spend so much time, energy, and effort. That's hard to do, to keep trying to do something that doesn't predictably always work. It would be nice to have less of that stress during interventional fellowship, though I think that's the part of training that everyone has to have in order to be successful.

What makes a good candidate for interventional cardiology? What type of skills or character traits are required?

Most good interventionalists are very intelligent and are quick processors. You have to care deeply about the patients, you have to be an excellent communicator both with your patients and your colleagues. You have to be able to process experience into judgment. You have to have a great deal of emotional resilience. I think if you are the kind of person who experiences things in a certain way, you have to be resilient. I have some colleagues who don't experience the same emotional engagement in cases as I do. But if you experi-



Photo 3. Dr. Audrey C. Marshall with her fellows and co-workers

ence it as I do, you have to be able to endure the tough parts and keep coming back. Obviously, you have to be technically competent, you have to understand the anatomy and physiology. You need to have a good three-dimensional understanding of cardiovascular anatomy and how you operate in it. All those things. It's a lot.

What advice do you give to your trainees at the beginning of the training?

I just started another senior fellow, so I can draw on the advice I gave. The biggest mistake people make when they start is that they are very focused on their own performance. I can literally stand at the table and I can almost read the fellows thoughts as they are thinking, "Should I be doing this? Did I do that well? If I do this, will that look like I know what I am doing?" I've worked with fellows who are so focused on their personal performance, that they aren't fully engaged in the case. What I do tell my fellows is, "Be in that case. Think about the case, think about the patient. Sure, think about what you're doing, but don't overthink. I can tell you what I need you to do, or what you should do if you're the first operator. Avoid thinking about how I am evaluating your performance, or how it's going for you." I was guilty of this myself. That probably colours my read. That would be my main advice. Think about the case, the patient, the task at hand. We always talk about situational awareness. Do all of that but don't be so much about your personal performance.

How important is research during interventional training? Should it be conducted at a specific stage of their career?

I think that probably fellowship is the best time to at least get a taste of success in research. It's hard to do meaningful research and gratifying research when you don't really understand the question you are asking: if you don't understand why it is important or what's the most meaningful answer. During a fellowship, being involved clinically makes it easier to do meaningful research. Frankly, during that year you also have really incredible access to mentors and material and questions. Unfortunately, there is probably not enough time for people to get something done productively in one short year while they're also learning how to cath and gaining experience as a cardiologist.

How does one find a good job? How does one survive the first year?

I have always told my fellows that they should interview for a senior fellowship broadly, even if they know where they want to go, or if it's likely they are going to one place. I think meeting the community is super important. I personally don't think it's about being at a big meeting and sidling up to somebody at the back of a lecture hall. If you have a chance to interview and spend time one-on-one for 30 min with someone through a senior fellowship interview, that person will remember you a year later or five years later when you are looking for a position. Even before people are looking for a position,

I encourage them to go out and get people to know who they are and develop a relationship.

The first question when finding a job in our field is, “where is a job available?” It’s very difficult to make jobs in our field. Really exceptional candidates can do that but for the most part look at what’s out there and don’t close doors. Entertain everything. There is something good about every position. Rarely, there is a position where everything is perfect. I was very fortunate to get the job that I wanted when I finished my senior fellowship year, and I stayed in that job for a long time and loved it. Having been helping fellows through that process for many years, I know not everyone gets that job as their first job. No question, it’s great when that happens. But someone who is really committed to this and is going to be really good at it, may need to start by taking a solid job that doesn’t throw their career off track, and then maybe finding the ideal job as a next step. Just be open minded; meet the people for sure.

How to develop and maintain a good mentor-mentee relationship?

With regard to finding a mentor, try to find someone who has a real track record. One thing that I’ve heard and I thought it was very valuable was, “bring something to that relationship”. A woman I heard speaking once said she had baskets full of people who said, “Could we have lunch so I can pick your brain? I’m so impressed with your career. I’d like you for a mentor.” That is not bringing anything. But if you’ve identified someone with a track record of mentoring, who’s doing something you’re interested in, who you have good a vibe from, and you’d like to engage him or her to help advance your career and teach you, *bring something*. Learn something they’re interested in or do a little work for them or work a little harder for them. That, for me as a person on the mentor side, is great and is a real differentiator. Rather than, “Oh, I’ve read your stuff. Oh, I’ve heard your name...”, if someone says, “I went and looked into something you said and it was interesting to me, and in thinking about it I wondered, has anyone tried *this*?” That’s one great way of starting a mentor-mentee relationship. When a busy, senior person is roaming the halls looking for someone to help with a difficult late case, and someone steps up, that can be a great way to get into a mentoring relationship.

Have you witnessed professional burnout in your fellows or interventional colleagues?

I can speak about the burnout among senior fellows. When I was in Boston, we talked about it, that there was a slump that happened your senior year about February. It seemed like a sort of necessary rite of passage of interventional fellowship that you came in enthusiastic, fire in the belly, steep learning curve for the first few months,

and then the honeymoon ended. It was winter in Boston, people started expecting more of you and you started seeing how much you still had to learn. People kind of nattered around February. I’ve seen that phenomenon many times, and I hate to say it but this “break you down to build you up” thing, which I really don’t believe in anymore, there was an element of that. Fortunately, most people would rebound and rebuild so that they left strong in June for their new job. There are people who experience a more profound burnout, but I don’t know whether it has explicitly to do with the jobs they’re in or particular events, cases, or patients. It’s probably a combination of those things.

What are your suggestions to deal with it?

I certainly don’t have an answer to burnout. When I saw fellows at that low place, I always felt that there needed to be somebody for them. I take it very seriously, that the trainer needs to come by at 8 o’clock at night, when you’re sitting there after a three-case day, after you made some mistakes and you’ve just had it, and your spouse is fighting with you, and you haven’t seen your kid in three days, you’ve got tons of paper work, and you feel guilty because you haven’t worked on your research project and you couldn’t get the access, you’re worried about the post-cath patient upstairs. Your mentor needs to come by and check and make sure you’re ok and say, “This is going to get better. We will get you through this. This is a necessary part of your growth.” I’ve tried to do that, and honestly it’s worked better with some people than with others, but I still think it’s our job. For me it was very helpful, having one or two people notice when I was struggling, and indicate that they were going to walk me through it. Another thing that’s very helpful in managing the low points is humour. Being able to take a deep breath and laugh is super helpful. Everyone has stories from their senior fellow year of hilarious things that happened. That has to do with the people around you. That’s one of the things I look for in people. It’s a really, really serious business but you can’t be dour about it. We all have to be able to find what to laugh about sometimes. It makes it fun. That keeps you in it. That’s what helps fight burnout.

What do you think are the strengths and weaknesses of the North American training system?

Most of my experience has been in the US system. When you look at big US paediatric cardiology centres at this point in time, there’s a very growth- and volume-orientated mind-set. One of the things that used to drive me crazy when I interviewed fellows was when I asked people what they were looking for in the program, and they would say, “I want a lot of volume. I want to go to a high-volume centre.” I understand wanting to see a variety of cases, but that’s not the same thing as volume. I’ve certainly worked in a centre where there was so much volume that it was hard to even process, let alone

learn, at the level of activity we were doing. In the US now, I think there is a reorientation toward seeing health care and procedures as deliverables, and that perspective risks what we owe to ourselves as a subspecialty and what we owe to our patients. We need to keep our eyes on the fact that we are actually obligated to train a generation of really excellent interventional cardiologists. Not just people to fill jobs, not just people to churn out 300 cases a year, not people to do the billing and documentation but actually the thought leaders, the caring doctors, the people who are going to push the field. I know that there will always be these people, it's not like they're going away, but it strikes me that there's less attention to care for that part of what we do.

What does training people mean to you?

It is the best part of my job! That is what I have left to do. I've done a lot of different stuff over the years, but what I really want to do now is to train people. It's so much fun and so incredibly rewarding. I won't accept responsibility for "training" everybody who I participated in the training of, but even being a part of a team that trains a new catheteriser, when you see all the people out there in practice, it is just incredible. These are largely people that I really like. They're super smart, super fun, talented, engaged, and caring people. Getting to know a lot of them as deeply as you get to know people, kind of like the 8 o'clock thing I was talking about, you get to know some very special things about people in our practice, and I enjoy that. I love training! I love watching people think, figuring out how to use the cath lab to take care of complex cases and share that with other cardiologist and families and then do therapeutic stuff. It's just great! I'm training so that more people can do that. I love being around younger people. I love watching people learn. I find it very gratifying to see people become more accomplished.

What is most challenging in the training of new generations of interventional cardiologists?

I'm primarily a clinician, and only incidentally a clinical researcher. For me it's challenging to feel like I am doing my job around academic training. I wish I had more to offer as a research mentor. As far as other challenges, one important one has to do with consistency. I really enjoy training people who I really like, but like everyone, working closely with someone who I don't naturally get along with can be difficult. For me, the challenge is, regardless of who my trainee is, to try to deliver the same great training.

What is the status of women training in interventional cardiology?

During my last couple of years away from interventions, I was part of putting together a group of women in paediatric interventional cardiology spurred by an email exchange with David Moliterno. He wrote a letter in 2018

about the JACC: Interventions reviewer pool. It turned out there were very few reviewers for the Journal who were women. I think there were only three on a list of the top fifty. I wrote him questioning why there were so few female reviewers, and he wrote back to me, "Well, it is proportional to the number of female interventional cardiologists." It turns out in adult medicine 7% of interventionalists are women. In paediatric cardiology approximately one in five in North America is a woman. In some ways, we're doing better in the paediatric world, but one in five is a striking minority when you consider that over 50% of paediatricians in the US are women. A group of us are now trying really hard to encourage and promote women, and get them into situations where they can do the same for the women who come after them.

What is the response from the field?

Well, we'll see. Some progress has been made, and there's more that needs to happen.

As far as getting women into the field, it starts with showing them they can do it, and giving them the opportunity. It would be great to have more centres with more than one woman in the lab, where having a woman walk into the room and start a case is the norm, rather than an exception. This is still only the case in a handful of centres in North America. Both in Boston and Toronto, I've seen the benefit of having a close female colleague in a predominantly male field. I think it enhances the environment of the lab and the dynamic of the whole multidisciplinary team.

You have mentioned Boston as an example of a predominantly male cath lab whereas for many years one of the busiest cath labs in Poland was all women.

Good point. The lab that was all women supports my hypothesis that when you're doing something that's such an intense experience, that demands such incredible skill, it's helpful to feel familiar with the people around you. Most people we know don't have any idea what we do for a living, but pedi interventionalists do have this very small club of people who understand each other's work, and what we're all capable of. This is overly simplistic, but maybe it's easier for people to wrap their heads around another person's experience when they're of the same gender. So maybe some groups organically become single gender, because it feels more comfortable. I don't think that should be the case, but kind of understand it. Ideally, pedi cath should be a co-ed sport.

I'd like to offer one last suggestion. When I train people, I tell them to really grab the opportunity of teaching moments. When you're in a certain state of mind, when you're in the trenches, exhausted, distracted by orbiters and add-ons circling, you've been cathing for how many days straight, you're not learning very much anymore. In

contrast, you can pick one case on a quiet day or one case out of three on a busy day, and if you're in the right frame of mind and your attending or mentor is standing there with you and wants to teach, you can get *so much*. I've had that experience. You take someone who maybe isn't even that interested in cath yet, and you really deliberately teach them stuff for one case, and they get so much learning out of that 90 min. That might be so much more than another person might get out of a whole month of just doing everything: exchanging a million catheters, wiping a million wires, delivering dozens of devices and all that stuff. If you can find those teaching moments when everybody is ready to teach and learn, that's gold. You don't need a firehose of volume for that, you just need enough cases to be able to come across those super special opportunities.

Thank for your time.

You are welcome.

Sebastian Goreczny: What attracted you to congenital interventional cardiology?

Dr. Evan M. Zahn (Photo 4): I found congenital interventional cardiology before I found interventional cardiology; it was a little bit backwards. I stumbled into a lecture in medical school where an anatomist was giv-

ing a lecture on congenital heart defects, and I was completely unaware of this whole subject, I just had never heard of it up until that point in time. I went to the library that afternoon and I ended up pulling up a review of cardiac interventions at that time by the late and brilliant Bill Rashkind. This is a really long time ago, around 1984. He was describing the concept of being able to close a hole or a vessel using hooks and patches; I thought the whole thing was amazing. I was fascinated by it. I did a little bit more asking around and research and I found out I would have to do a paediatric residency, which was very unexciting to me. I had no interest in children at the time. Then I would have to do an entire paediatric cardiology fellowship. But somewhere in there, I could start, if I went to a few selected places that were doing these kinds of things at the time, to begin to learn about paediatric interventional cardiology. So that is my pathway to becoming an interventional paediatric cardiologist. I had to do a complete career plan change as I was always planning on becoming an orthopaedic surgeon, but once I saw this... there was no going back for me.

Tell us about your interventional training. What did you like or dislike?

First of all, I stayed at the place that I had done my paediatric cardiology fellowship, which was Toronto Sick



Photo 4. Dr. Evan M. Zahn with his fellows and co-workers

Kids. There was some comfort in the sense that I knew my surroundings. I also did the training with a very close friend of mine and we provided much support to one another. We had been through the fellowship together, so we had known each other, and that was a great comfort to both of us. We were the second and third fellows ever trained in Toronto by Lee Benson in congenital intervention. Lee was a phenomenal teacher, but he certainly wasn't easy on us. He divided our year into clinical and research rotations, and it was remarkably enjoyable and educational. Toronto at the time was a very difficult and stressful place to do your fellowship. We had incredible teachers like Bob Freedom, Jeff Smallhorn, and Lee Benson, but there was a lot demanded of you and it was a place (where more times than not many of us training felt) inadequate. The fellowship year in intervention was quite different. We were treated more like junior faculty and given a whole lot more freedom. Lee, while back in that day, was quite intimidating to learn from, was also an incredibly good teacher. He stressed to both of us, and I have continued to stress this to my trainees, that doing intervention at a high level is really about the thought process. Most of us learn to manage the catheters and wires, although some people are innately more talented than others, but really I think what separates a lot of the great interventional people, people like Lee and Chuck Mullins and others, is the way they think about the case they are in and the way it impacts a patient's entire care spectrum. It is not just about getting a nice angiogram or reducing a pressure gradient, it is about the global patient and how to get from point A, not to point B, but to point Z. All of the steps involved to get your patient there, whether that is part of a particular intervention or their general course. It was a very logical, I would say meticulously well thought out process that I learned from Lee Benson, and that was probably the most important and impactful teaching I had in my career.

What are the biggest accomplishments or regrets of your interventional training?

I would say the biggest success during that time was having people in the field, who were really icons like Bob Freedom and George Trussler, begin to accept and express to me that I could actually do this and be successful at it. For most of the general fellowship we felt inadequate and stupid as I had said, and during that interventional training I started to have people, people I had great respect for, begin to accept what I was bringing out of the cath lab. I would say by far, up to that point, that was the greatest feeling of success I had had. I don't remember a specific case where I felt like a terrible failure but I think as you are training, there are things you feel you should be able to do better, cases you should be able to do better that you just can't accomplish yet. You just haven't seen enough, you don't

know enough, your hands and your mind aren't working together well enough and there were many of those cases where Lee would have to come in and with his great experience and expertise bail me out. I remember on a daily basis almost watching how simple he made it seem because he was so much more talented and experienced than I was. I remember feeling quite a failure on many occasions, and I think what got me through that was this close colleague Christine Houde, who I was training with at the same time. She was and is quite excellent and knowing that we both felt the same sense of failure and that we could share those feelings with a colleague made it much more bearable.

Who makes a good candidate for an interventional cardiologist?

I think, first and foremost, you really need to be a really good paediatric cardiologist. I have run across too many people in my years of doing this who have excellent technical skills but don't see the whole patient. What they see is an intervention. We shouldn't be treating interventions; we should be treating patients, and that means sharing the patients with the imagers and surgeons and intensivists and really having a global understanding of what you are setting out to accomplish. Sometimes the best intervention to do is no intervention at all. That is probably the hardest thing for all of us, (but sometimes and are) really good clinical decisions. I think the best interventional cardiologist are really excellent paediatric cardiologists. Second, but very high up the list, is I believe that peoples' brains are built differently from the get-go. For instance, there are some people, technicians, cardiologists, who just naturally think in three-dimensions, and these people often make incredibly good echocardiographers and MRI cardiologists, etc. For interventional cardiologists I believe one of the most useful skills is the ability to think sequentially, in other words, in a logical, progressive step-wise fashion, planning many steps ahead and allowing for many branch points in your thinking depending on the result the last decision produced. What I mean by that is when I am seeing a particular lesion, let's say a complex, intimidating aortic arch obstruction that is high risk, I am not just thinking what wire I need or what stent I need, I am thinking about ten things after that and if something is to go this way or that way, what would I need then, and verbalising this to anaesthesia and my staff so that everything is at hand and everyone in the room is mentally prepared for a variety of scenarios. There are some trainees who just innately think that way and there are some brilliant people whose mind just doesn't work in that particular sequencing. Sequencing is a very useful trait in addition to the obvious ones like reasonable eye-hand coordination and understanding of relatively simple physics of catheterisation. Some people

just don't have that ability to look at a catheter or wire on a screen and to relate to what is happening in their hands. I would say that anybody who can't do that with some reasonable proficiency, this probably is not the right thing for them.

What tips would you give to a person at the beginning of interventional training?

It starts before you start your interventional training, and that is to do your basic paediatric cardiology training at a place with really good general paediatric cardiology. If I had to pick one thing, I would pick imaging. I think most really good interventional cardiologists have a really good understanding of where they are working, and this comes from a really good understanding of anatomy and imaging. I was very lucky, we had incredible anatomic teaching, and we had incredible non-invasive imaging. I think that before you even start, you really want to be a master of those things as best you can. Then in terms of when you start your interventional training, I think it is vitally important to have as much case exposure during that year or two as possible, since we work in an area of relatively rare diseases. That translates to look to train at a centre where you will be exposed to a high volume of cases. I believe, that the best training centres almost universally are the largest volume centres because during training we only have a limited time to see so many rare things. Obviously, it is important to go to a place with excellent mentors and good support. Talk to people who have trained in that system and get their true impression. What was good? What was bad? And remember that once you get out of that fellowship, no matter how many cases you have done, there will always be things you haven't seen, but the more you can close that gap, the better.

What are the behaviours or mistakes to avoid during interventional training?

Not to pay an overt amount of attention to fine, technical, equipment orientated details. I remember being fascinated that people like Lee Benson knew each wire and each catheter and their name, the length and the size, etc. I remember thinking how important that was and how I didn't know any of these things, and how was I going to do this in the "real world"? It turns out that you learn that without even trying to learn it as you are in the cath lab for longer periods of time. I've had trainees who wanted to write down every wire we used in a case and it doesn't work like that. What you really want to do is get a greater understanding of the diseases you are able to treat, the safest way to treat them, and the best way to get out of trouble. Universally the best interventional cardiologists I have seen are the ones who are the best at getting themselves out of trouble. That is what saves your patient. I would

focus really heavily on those things rather than trying to memorise inventory.

How can one optimally use various training resources?

I would recommend to people when they are young in their career that exposure to as many different approaches as possible is a very good thing [3, 14]. It took me a while to learn this, when you are young you believe that what you have learned in training and what you do, is really the only way or the best way. As I have gotten a little older, I have learned there are many different ways to do things. I think attending meetings and really seeing cases that are done in different centres, particularly in different countries, different parts of the world, really makes you a better interventional cardiologist [9]. I advise people to keep an open mind and continue to learn. I have been doing this thirty-something years and I still go places and learn lots more than I teach. I am just a day back from Africa, and even though I am there to "teach" them, I continue to learn new things by seeing how other people do things over there. Don't think your training ends with your formal training, it's really just the beginning. The learning process continues, and at least in my case, throughout my entire career.

What are the strengths and weaknesses of the US training system?

I think the best way to judge the current system is to look at the results... the generation who's been trained formally in congenital intervention. I continue to be really impressed with the young people who are now entering the field or have entered it in the last ten, fifteen, twenty years after I did. I think the training programs for the most part are quite good. It remains a relatively informal process; there is still not a match program. People seek out positions, and it is still very much a word of mouth... very old school. I like that. Not everybody is meant to do interventions. I think people being able to express how they truly feel about a particular candidate freely is important. I think that training should be limited to centres that have significant volume and enough time and expertise dedicated to teaching. There are some high-volume centres that have a wonderful case mix, but perhaps they don't have enough faculty to dedicate enough time to training the next generation of interventional cardiologists. We really want to continue to train the next generation people at places where they get maximum exposure to both complex cases and experienced operators with a passion for teaching.

How does one survive the first years after interventional training?

Once I gave a talk on ten ways to survive your first year. No matter where you are trained, who you are or how good you are, those first few years you are on

a steep part of the learning curve. In other words, you really haven't seen the vast majority or learned the vast majority of what you need to know for the rest of your career. With that as a baseline, in an ideal world most people who come out benefit from joining a senior mentor. If you are trained by somebody like Lee Benson and you have this incredible training, ideally you would come out and go into somebody's lab who is a senior excellent interventional cardiologist. You are operating independently, but you have a strong support and a senior person there to bring you along and help you out of any trouble you may find yourself in. I didn't have that option. In my first job I was alone, and I still had so much to learn, and we had such a busy and intense program that it was a trying and difficult experience. What you need to do in that first few years is keep your colleagues and mentors close. Now it is so much easier. I get all these emails, Skypes, internet forums like the CCISC (Congenital Cardiovascular Interventional Study Consortium) and people sending cases for second opinions, etc. I get people calling me from the lab while the patient is on the table, showing me angiograms in real time, and this is just great! This is smart for young interventional cardiologists, because you have a lot left to learn. Get involved in the community, join national and regional committees, go to as many meetings as is practical in your setting. You want to get to a place where you feel comfortable reaching out to your colleagues, particularly the people who have mentored you. Also important in those first few years is to accept the fact that when you first come out of training you are not Chuck Mullins, you just haven't gotten there yet. If you are alone in a case and unsure of the risk versus benefit, there is no shame in *not* doing an intervention you are not comfortable doing. You might have seen it in a meeting, you might have heard somebody else making it sound easy, but if you're not comfortable at that point in your career, with that particular intervention, if it feels too high risk, or it feels like something you're just not comfortable doing, the best decision that a young interventionalist can make is not to do it. Bring the patient back to the lab later with a proctor or even consider sending him/her to a centre with more experience. What you don't want to do is hurt a patient because you're trying to prove something early in your career. This mistake unfortunately gets made by a lot of people, and I think it's avoidable.

How can one develop and maintain a good mentor-mentee relationship?

It is really incumbent upon anybody who takes on a trainee formally or informally, to be that person's mentor for the rest of their career. I have taken this very seriously for the people I have trained. Even now, within the last year, I have emailed or called Lee Benson to ask

his opinion on something, and this is thirty years later! That relationship never goes away and should only grow stronger. It goes beyond the interventions. The people I have trained, if they're up to the task, it is up to us as their mentors to facilitate their career, get them involved in clinical research, involved in committee work, in the speaking community if that's where their talents take them. I think the responsibility is with the mentor to commit to that sort of career long relationship. As a young trainee I would do all I could to ensure there is open access for that relationship to flourish over the years because I think this is really vital for a successful career. And this is not isolated to the person or people who initially trained you. For example, when you are doing new things, let's say you just got proctored on a new device, that proctor becomes in a way your mentor and you should have open access to contacting that person in real time during a case when you need the help the most.

How would you advise a person with professional burnout?

I've had this situation with one very memorable trainee, who was incredibly talented but during her first real job in the first year or eighteen months, she realised that it wasn't really her passion. She didn't love it. She was in a very difficult place with a difficult senior person. She was great in the cath lab and could have been wildly successful. She had the skill set but it wasn't bringing her pleasure, it wasn't bringing her satisfaction. We had many conversations on the phone and what I ultimately advised her was to come back to our centre, leave her interventional position, and return to where she was comfortable to discover what her real passion was. It turned out she became an incredibly good intensive care physician and then one of the first people involved in the development of high-risk infant clinics. She made a huge contribution to the field and was really happy doing that. It's only one example, but my general sentiment would be that interventional cardiology is not a field to sleepwalk through. If you don't love this, if this isn't your passion, if you don't wake up on Monday morning excited to go to do whatever cases are on your schedule, you probably want to rethink this as a career choice. It's too hard, it's too stressful, it's too high risk, there is too much at stake for our patients. Unless you are fully committed, I don't think there is any shame in saying, "You know, I thought I liked this, but it's not my thing and I am going to find somewhere else in paediatric cardiology that I can contribute." I have numerous examples, where people did that and they have gone on to be happy, productive, really good paediatric cardiologists who just don't do interventions, and I think it's just fine.

Thank you very much!

My pleasure!



Photo 5. Dr. Sung-Hae Kim with his fellows and co-workers

Sebastian Goreczny: What attracted you to congenital interventional cardiology?

Dr. Sung-Hae Kim (Photo 5): I must confess I was not interested in interventional cardiology. I was interested in imaging. It was my boss who taught me how to manipulate catheters early in my career. Gradually, I obtained new skills and became fascinated by being able to perform less invasive procedures to treat patients. I will never forget the first intervention I assisted. It was a baby of a diabetic mother with critical aortic stenosis. At that time, more than 20 years ago, we only had 5 Fr catheters, which we had to introduce to a femoral artery in a three-kilogram baby. It seemed very difficult and quite invasive. Fortunately, a single balloon dilation was successful, and that was enough for the baby to survive. Now he is a very active young adult. That concept of a less invasive procedure attracted me the most. Before that, those patients required an open heart valvotomy. During my residency, I saw several very young patients who did not survive that operation. This was how I got attracted to interventional cardiology.

Tell us about your interventional training. What did you like or dislike?

My interventional training was two years long. It was during the fourth and fifth years of my paediatric cardiology training. Prior to that I did a four-year paediatric training, of which the last 2 years I did at a district gen-

eral paediatric hospital. When I was finishing with this training my boss asked me to come back to Shizuoka Children's Hospital and continue training in paediatric cardiology. Unfortunately, a few years later he passed away, and I became the only interventional cardiologist at my hospital. Formally I was still in training, but I had to be a teacher at the same time.

In regard to your training, do you have any regrets?

My boss had always encouraged me to learn interventions abroad. He wanted me to study cardiology overseas. Unfortunately, he had a myocardial infarct and did not survive. At that time everyone in the department had to help each other to maintain our service, so I had to give up the idea of going abroad. That is my biggest regret.

How did you learn new skills being the only interventional cardiologist in your program?

Balloon angioplasty or valvuloplasty or coil embolisation was quite easy to learn. I had obtained these skills quite early. The real hurdle was stent implantation in pulmonary arteries or aortic coarctation. It required extensive knowledge and skills including proper vessel visualisation, stent selection, and accurate positioning. We had no experience with stents at that time, nor did many other centres in Japan. In fact, stent implantation in paediatric patients is still off label in Japan. I learned

the skill of stent implantation from another colleague, a very well-known doctor named Hideshi Tomita from the National Cardiovascular Centre. A few years earlier we had learned PDA closure in the same way.

Who do you think makes the best candidate for interventional cardiology?

Several features are important, but good manual skills come first to my mind. The way the trainee works with her or his hands gives me an early impression of the future potential of the fellow. The second feature is to be able to extract and summarise important patient information including previous procedures, current patient status, and planned interventions. Third is the desire for cardiac catheterisation.

What are the behaviours or mistakes to avoid during interventional training?

Some trainees worry too much about technical failure. I don't consider technical failure to be a trainees' failure. It is always our failure. We share the responsibility. The thing that worries me the most is not enough preparation. That has been the most common mistake of my fellows, including me when I was in training. For example, some trainees don't look carefully at the imaging or don't go through the entire patient's history. This always leads to suboptimal results of interventions. Some trainees put too much emphasis on the technical details of the intervention and sacrifice collecting information about the patient's current condition or the previous procedures. Ideally, they should know both, but sometimes they do not have enough time for it. If they have to choose, I would rather they learn more about the patient. It is my responsibility to walk them through the procedure.

When you think of your most outstanding trainees, what allows them to perform better than the others?

Good preparation is a desirable behaviour to start with. My fellow trains for 1 or 2 years, then they advise me about the interventional procedure. As they collect more experience and have more knowledge, they are expected to share their opinions not only in the cath lab but also during multidisciplinary meetings. Those who have developed independent thinking and are willing to express it outside are the ones that stand out and bring me the most joy.

What farewell advice would you give to your trainee on the last day of interventional training?

Altogether I have trained around fifteen doctors. Six fellows, including two women, have left to another centre after the fellowship. I am very proud of them. We have stayed in touch and we all meet during the Japanese Paediatric Interventional Cardiology (JPIC) meetings. We exchange our experiences. They talk about the new things

they have learned and what challenges they have. So, my first message is that this is not the end of our relationship. Then, I advise them to seek opportunities for further training overseas. That includes not only attending conferences but also visits to different institutions to learn new customs, new procedures. I also find it important to learn more about the patient beyond the currently required treatment, to find out their expectations and future plans. I tell my fellows to never forget that interventions are not only manual procedures; they influence the lives of patients and their families. This approach enables successful treatment with lower risk of complications but in a broader sense allows us to meet patient's needs.

What Japanese customs, in regard to training, are you proud of? What would you like to change in the training of interventional cardiology fellows in your country?

In Japan, particularly in my centre, fellows act as the first operators. From the beginning of training they have hands-on experience. My role is to assist them. I must anticipate potential problems and be ready to step in at the right time, but as long as a fellow has things under control I tend to assist only. This is what I like in our training system. On the other hand, the device availability in Japan is limited. The vast majority of the devices we use are off label, and several devices commonly used overseas are not available here. Hence, there are limited opportunities for trainees to get to know these devices. We have established a national registry of all paediatric cardiac interventional procedures. Fellows are welcome to get involved in the registry. It gives them the chance to learn about new technologies being introduced in Japan, to participate in research studies, and to network and get to know each other.

Thank you!

It was my pleasure.

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Conflict of interest

The authors declare no conflict of interest.

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