

## Transradial Access Celebrates 25 Years

*Radial access pioneer Ferdinand Kiemeneij explains why it was started and where the future is going*



*Ferdinand Kiemeneij, M.D., explains the history of the transradial access during an interview with DAICat TCT 2017.*

Interventional cardiology has witnessed a rapid and constant evolution in both techniques and device technology since its start in the 1980s. One of the chief motivators for this has been operators continually looking to build a better mousetrap that overcomes new problems encountered to improve patient outcomes. A key technique that has had a lasting impact on interventional cardiology was the development of **transradial vascular access** for percutaneous coronary intervention (PCI) a quarter century ago. While there has been debate since its introduction whether radial is better than the U.S. gold standard of femoral access, the tide is beginning to change in favor of transradial, which is translating into steadily increasing usage.

**Ferdinand Kiemeneij**, M.D., Ph.D., from The Netherlands, is often nicknamed “the father of radial access” for being the first to begin to use the technique as a new standard of care for patients. He is credited with developing the first protocols for using radial access and promoting the technique, which grew rapidly internationally because it helped solve the high percentage of serious bleeding complications associated with early stent use. *DAIC* spoke with Kiemeneij at the 2017 Transcatheter Cardiovascular Therapeutics (TCT) meeting about the 25th anniversary of radial and what it means for interventional cardiology.

### **Very High Bleeding Complication Rates**

In the late 1980s, when interventional cardiology was beginning to move away from stand-

alone balloon angioplasty to using stents, bleeding and early stent thrombosis were major concerns. The large sizes of the first-generation stents required use of large bore catheters and introducer sheaths. Kiemeneij said all of the early bare metal stents used at the time were thrombogenic, so anticoagulation therapy was required. Back then, interventionists commonly used coumadin, heparin, dextran and aspirin. He said the high level of anticoagulation required days of hospitalization following PCI in order to stabilize the patients and created issues with introducer sheath removal.

“Once the stent was implanted, we had to find this delicate balance between hemostasis on the one side, because it is a deep artery and you don’t want bleeding afterward, and on the other side we needed prevention of coronary stent thrombosis,” Kiemeneij explained. “It was a big decision to decide when to remove a large bore sheath from the groin, because once the sheath was out you really had to press hard for a long time. And, you had to do this when the INR [international normalized ratio] was at an adequate level and the aTTP [activated partial-thromboplastin time] for heparin was at an adequate level. Sometimes this took more than 24 hours. So after 24 hours the patient was immobilized, you pulled the sheath and you compressed for a very long time, but still bleeding could sometimes not be prevented. It was all about bleeding complication prevention.”

Kiemeneij participated in the Benestent Trial, which was one of the first big trials to compare angioplasty alone versus angioplasty with stenting.[1] He said an interim analysis of the data from that trial showed operators had a major bleeding complication rate of 20 percent. The final trial data showed a lower rate of about 14 percent, but he said even that was way too high to be acceptable to many people. “This was a major problem, not only in our clinic, but it was a worldwide problem and we were looking for solutions,” Kiemeneij said.

Watch the [VIDEO: History of Radial Artery Access](#) - an interview with Ferdinand Kiemeneij, M.D., Ph.D.

### **The Origin of Radial Access**

In 1989, Lucien Campeau at the Montreal Heart Institute published a paper that proposed the use of 5 French diagnostic catheters to access the small radial artery as a way to possibly cut bleeding complication rates. Campeau is credited with performed the first radial angiogram. “After reading that, a thought occurred to me that if you want to avoid groin bleeding, it is better to stay away from the groin. I thought maybe this would be the ideal way to implant stents, because the radial artery runs very superficially under the skin, which is a big difference compared to the femoral artery, which is a deep structure, especially in obese patients. With the radial artery, bleeding can easily be controlled, and after the procedure you can immediately pull out the sheath and just put a pressure band over it. With radial, the patient can walk the same moment after stenting. That was really a mind-blowing experience if you saw that for the first time.”

However, in 1989, there were not any catheters small enough to facilitate radial access PCI. Operators would have to wait for smaller catheters to become available in the early 1990s. Kiemeneij said he was very excited to get these catheters into his lab because it opened the road for possible transradial procedures. He performed his first radial access interventional coronary procedure on Aug. 14, 1992.

When scheduling a patient for a PCI procedure in the early 1990s, doctors had to reserve a hospital bed for days so the anticoagulated patient could be stabilized. But it was quickly found when performing PCI stenting procedures using radial access, patient could be discharged much faster. “Femoral patients had to be hospitalized five to seven days and radial patients could be discharged the next day. So in the end, it was really the patients who were driving us to adopt radial. In the ward, you could tell who the radial patients were. Some

patients were lying in their beds immobile and the other patients were up walking around and buying a newspaper.”

### **How Transradial Access Grew From Local Project to International Trend**

Radial access started as a local project in Kiemeneij’s hospital and no one knew his name. That changed the next year in 1993, when he had exposure at the American Heart Association (AHA) meeting. He presented a poster on the radial technique his clinic had developed. He said people had an academic interest in the idea, but it was apparent that it was not something operators would try on their own.

“I could see in their eyes this is not something they were going to go back to their labs and try on Monday morning,” Kiemeneij explained. “It is a completely different technique, and you have to access the coronary arteries by a much smaller vessel. People were really looking at all of the downsides of radial, including the use of smaller catheters in a smaller vessel. That was important back then. Today, the stents are very small and sleek, but back then they were quite bulky and you had to crimp them manually onto the balloon. You also had limited access to techniques like atherectomy and intravascular ultrasound [IVUS], and everyone had their training accessing the femoral artery, so it was a big step to try this new technique.” However, some interventionists were interested in the technique and saw its value in reducing bleeding rates. One noted cardiologist who took notice of his AHA poster was Jean Fajadet, M.D., co-founder of the interventional cardiology unit at the Clinique Pasteur in Toulouse, France. “He was at my hospital a few weeks later to see with his own eyes what was happening there. We did a case and he saw the patient was immediately mobile and walked from the cath lab to his bed. For him, it was like seeing Jesus walking over water and he was convinced.”

Fajadet told Kiemeneij he wanted to learn the procedure quickly and practice it on patients so he could demonstrate it during a live case for TCT a few weeks later. Kiemeneij was very nervous, because any problems during the case could potentially have killed the future of radial access. However, the case went very well and it was the start of the international exposure for transradial. Kiemeneij said several centers around the world started using radial access and training operators within their own circles. He explained these circles continued to grow and spread out during the mid and late 1990s. Soon these radialists were meeting at annual meetings to compare notes and they started to gather data, including randomized studies.

“During the first few years, all the small papers showed the promises of radial. But at a later time, when the large randomized trials began, then the evidence began to come in. There was a larger community that was able to train operators, and as the evidence started to come in, it really got the ball rolling,” Kiemeneij explained.

Some regions of the world quickly and fully embraced the new technique as the new standard over femoral access. This was especially true in Asia. Kiemeneij said cath labs in Japan and China today perform 80-90 percent of their procedures using transradial. In many European countries, transradial access is now the default method for interventional access. Some countries lag behind in adoption, but Kiemeneij said market forces will likely change this. “In the end, I think it is the patient who will drive the doctor,” Kiemeneij said.

In the United States, radial access adoption has risen rapidly in the past decade. Its use was less than 5 percent in the early 2000s, but has grown rapidly in the last few years to around 30 percent of PCI procedures. This is according to data from the American College of Cardiology (ACC) National Cardiovascular Data Registry (NCDR) researched by U.S. transradial champion **Sunil Rao**, M.D., FACC, FSCAI, an associate professor of medicine with tenure at Duke University Medical Center, section chief of cardiology and director of the cardiac catheterization laboratories at the Durham VA Medical Center, and an

investigator at The Duke Clinical Research Institute.[2] Transradial access use in STEMI patients increased from 2 percent to 23 percent from 2009 to 2015.[3,45]

### **Limiting Factors on Radial Access Adoption**

While radial usage is increasing in the United States, Kiemeneij said there are some limitations, including older operators who do not want change their methods, legal considerations and improvements in femoral bleeding rates.

“Things today are so much different than it was 25 years ago,” Kiemeneij said. “Today, we have excellent transradial tools, we have training options, and there are many young doctors who are now proficient in this technique.” He said older operators can learn radial access, but he said it takes a lot of guts to be able to step out of their comfort zone to try a new technique.

“I believe femoralists today do excellent work, because femoral access technique has also greatly improved. Bleeding complications really went down. So the urgency to cross over from femoral to transradial is much lower than it was 25 years ago,” he said.

Kiemeneij added there are legal issues that keep some operators from adopting the technique. For example, if a patient suffers hand dysfunction after a procedure, the physician may be open to liability, and American doctors work in a different legal environment than doctors in Europe. “But, that is going to reverse,” he said. “Because in Europe, radial is now a guideline standard of care for treating STEMI and non-STEMI patients. So now, if you have a patient with a femoral groin bleed because you have not used radial, you must have a good reason. That is something that is going to happen in the United States sooner or later, and it is the patient who will be driving that,” he explained.

Another barrier to radial proficiency is the need to have a high volume of patients to become good at radial access, as with any procedure. Kiemeneij said data from the RIFLE study showed radial was better performed in experienced hands, and centers with lower volume of radial procedures did not perform as well.[5]

### **Future Directions for Radial Access**

Even though Kiemeneij is credited with creating radial access, he said he can still be taught a few new tricks from operators who have made new advances with his technique.

“I was in Iran in 2016 giving a radial course and I saw **Dr. Farshad Roghani from the Isfahan Cardiovascular Research Institute and he was doing radial procedures from the anatomical snuff box at the base of the thumb, and I was amazed.** It has several advantages because it is more comfortable for the patient and it has very low rates of radial artery occlusion,” Kiemeneij explained.

Another advantage of the new technique is that the right hand can be used. Kiemeneij said most patients are right handed, so they prefer to be cathed using the left radial artery, However, this places the access site on the opposite side of the table from the operator, requiring them to lean over the patient while wearing lead aprons. “The operator has to work over the patients, and with a short operator and a obese patients, I know who is going to be going home with back pain.” But by using a left distal radial artery access, operators can have the patient's hand bend across them, so it is much easier to reach than across the table. “I believe this new technique will become the default. It is a refinement of radial and I think it is worthwhile exploring,” he said.

### **Related Transradial Access Content:**

**VIDEO: History of Radial Artery Access** - an interview with Ferdinand Kiemeneij, M.D., Ph.D.

**Radial Access Adoption in the United States**

**VIDEO: New Frontiers in Radial Access** — an interview with Mladen I. Vidovich, M.D.  
**Radial Access, Same-Day Cardiac Procedure Could Save \$300 Million Annually**  
**VIDEO: Update on U.S. Transradial Access Adoption** — an interview with Sunil Rao, M.D.

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