

# Transradial Interventions

Experts discuss the advantages and disadvantages of radial access, how physicians can obtain radial training, and why radial access lags in the US.

## PANEL



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### What are the advantages and disadvantages of performing interventional procedures from a radial versus femoral access?

**Dr. Barbeau:** We have been using radial access as the primary access site since 1995, which translates into approximately 60,000 cases using the transradial approach. Of course, the femoral artery is a good entry site. The femoral artery is easy to palpate and is usually of a larger caliber to allow the use of large catheters (ie, 8 or 9 F), as well as new devices that require larger equipment.

However, for diagnostic coronary angiography, as well as for ad hoc or elective coronary angioplasty, we prefer using the radial artery, which we use in almost 90% of cases as a group (12 physicians) and which I personally use in more than 97% of cases. In our experience, the radial artery is the preferred access site in the vast majority of cases because we are convinced that it is as easy to use as the femoral artery, it is more easily compressed than the femoral artery (which reduces bleeding complications to almost none), there are no nerves surrounding the radial artery (which results in almost no chance of nerve compression or complications), and it is especially true in

patients who need multiple medications to inhibit thrombosis.

The disadvantages of radial access involve the size of the catheter that can be used at the access site (7 F or smaller) and possibly spasms in young patients or those with very small arteries. However, these are the only disadvantages that we consider to be associated with using the radial artery as the primary access for coronary angiography or angioplasty.

**Dr. Mann:** I have been using the transradial approach since the mid-1990s and use it exclusively in the vast majority of my patients. I think there are two major advantages to using transradial access. The first is that there is a significant reduction in access site bleeding complications because hemostasis is so easy to achieve. This was the main reason why we started performing transradial access years ago. The second is patient preference. Patients prefer radial access because they can ambulate immediately and are not confined to bed rest. This alone eliminates much of the morbidity associated with femoral access ("the three Bs": back pain, bedpans, and bladder catheters).

The disadvantages associated with the transradial approach are primarily related to the fact that there is a limited amount of transradial training available in the US, and therefore the technique itself is largely self-learned. Obviously, there are courses that you can attend, but it does take a concerted effort to learn the technique, which may be more technically challenging than the femoral technique. I believe that with experience, virtually every coronary intervention can be performed from a transradial approach, with the possible exception of simultaneous deployment of kissing stents or large-burr rotational atherectomy.

### Why should physicians be performing coronary interventions through the transradial approach?

**Dr. Barbeau:** There is increasing attention being paid to bleeding complications and why it is important to avoid bleeding. New pharmaceutical agents, such as bivalirudin, have demonstrated that, even though you may have similar rates of major adverse cardiac event, death, or myocardial infarction, if you can reduce bleeding, the result is a bonus. This bonus can result in fewer deaths from bleeding and fewer complications related to transfusion.

Our data, as well as published data, show that transradial access is associated with lower bleeding and lower vascular complication rates and probably would result in lower morbidity and mortality rates if given a large enough patient cohort.

**Dr. Mann:** The treatment of acute myocardial infarction now involves taking the patient directly into the catheterization lab for an emergency procedure. In our institution, we are seeing patients coming from outlying areas who have failed with thrombolytic therapy. In such a situation, the patient may have major anticoagulant drugs already onboard (ie, thrombolytics, IIb/IIIa, enoxaparin, or heparin) and have the highest risk for bleeding complications. In these situations, the reduction in bleeding complications due to transradial access is the most striking.

**Dr. Popma:** I find that there are several specific indications for the radial approach that provide far superior outcomes than access using the femoral artery or brachial artery approaches. Patients with peripheral vascular disease, including those with significant iliofemoral disease, are very well suited for transradial intervention. Although percutaneous access of the brachial artery can be performed, this is much less suitable for the patient and the operator, and the complications associated with loss of the brachial artery can be catastrophic. The default method in these patients should be transradial, which is generally easy to locate and cannulate.



Dr. Barbeau

“In our experience, the radial artery is the preferred access site in the vast majority of cases . . . ”

The second population of patients particularly suited for transradial access is obese patients in whom femoral artery access is problematic. We have found a reduced bleeding complication rate in these patients, and the added benefit is that the morbidly obese patients can sit up immediately after the procedure, which improves their breathing substantially. Finally, most “healthy” patients find the bed rest and groin closure a nuisance with the femoral access procedure. Patients who undergo cardiac catheterization using the transradial approach, who are sitting up and drinking their coffee after the procedure, are generally very satisfied.

### What are the contraindications of the transradial approach and what is the ideal patient type? How do you select the patient in whom the transradial approach is the best method?

**Dr. Barbeau:** The contraindication of the transradial approach in my institution is basically when we cannot prove that there is a patent palmar arterial arch, as determined by oximetry and plethysmography, as published in the *American Heart Journal*.<sup>1</sup>

So, in approximately 1,000 patients, we exclude 1.5% of patients in whom we would not be able to demonstrate if the palmar arterial arch is patent, which means there is a pulsatile flow from the ulnar artery or any other interosseous artery when the radial artery is occluded.

Of course, if we plan to use an 8-F catheter in an artery that is almost absent, or is so small that we know it will be painful to the patient, this would also be a contraindication. Overall, transradial contraindication at our facility amounts to 2% to 10%, at most, according to the physician. I generally experience a contraindication rate of 2%. Otherwise, there are no other contraindications at my institution.

**Dr. Mann:** I agree with the anatomic contraindications that Dr. Barbeau has mentioned. There are a few interventional procedures that are more easily performed from the leg. For example, left coronary saphenous vein bypass graft

interventions are more easily done from the leg. Also, if you want to use a large-caliber catheter for a specific intervention, the femoral route can provide more options.

**Dr. Popma:** From a practical perspective, lower body weight, elderly women with very feeble pulses, and patients with an unsuitable Allen's test result are patients in whom radial access is difficult to achieve. This is primarily due to the small caliber and fragility of the radial artery, as well as the fact that the small caliber of the vessel makes it difficult to advance equipment.

### How are physicians trained in radial access?

**Dr. Barbeau:** Our fellows are trained from their first day in the catheterization lab to begin performing interventions from the transradial approach. We have noticed that they very quickly scale the learning curve, especially when compared to how we initially learned the technique. This may be partially due to the fact that current device technology is better.

With regard to training other physicians, many years ago, we began offering training sessions and lab visits. Currently, we see that in many large meetings (especially European and Canadian meetings), there are workshops that are devoted to teaching transradial access techniques. If physicians are interested in learning transradial techniques, there are many avenues available for them to pursue.

**Dr. Popma:** At my previous institution almost a decade ago, we did not perform many interventions using the transradial approach. At that time, two of our faculty members, Campbell Rogers, MD, and Dan Simon, MD, visited with Dr. Barbeau and returned to implement an entire transradial program. This was a very important step because the training was not just about the fellows and attendings learning the technique; it was also an issue of training the physician's assistants, nurses, and support staff in the appropriate preparation and postprocedural care.

I learned to perform transradial interventions because I found that many patients were being specifically referred to my colleagues for the radial technique, and quite frankly, I did not want to be left out. At some centers, patients will preferentially seek out physicians who perform the radial artery technique. This aspect is a little different from Dr. Barbeau's program, in which the majority of patients are already offered the transradial approach. When patients are given the choice, we have found that they prefer to undergo a procedure using the radial artery approach. This is certainly a good way for individual practitioners to get additional patients based on word-of-mouth referral.



Dr. Mann

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**Dr. Mann:** Jeff, how many training centers in the US teach transradial approach now?

**Dr. Popma:** I don't know that answer specifically. I would imagine that most programs have a minority of operators who will perform a radial approach when pushed. But, I will bet that there are few centers, maybe five or 10, in which the radial approach is the preferred approach.

**Dr. Mann:** I think that fact has been a real hurdle for us in the US. Transradial access is just not routinely offered in most interventional fellowship programs. Unfortunately, other than specific courses and site visits, there are few other opportunities to learn radial techniques.

**Dr. Popma:** There are medical simulators now that allow physicians to learn some of the initial transradial techniques. It is possible to achieve some training via this method. I think the simulators are good because they can actually provide a variety of anatomic situations that might not otherwise be possible to learn in the clinical setting as quickly. Certainly, one of the challenges is that once you start to advance the wire, and you meet resistance, you cannot move past the forearm. Simulation technology allows one to work through several different techniques to understand what the variant anatomy is to access the proximal vessels where one can actually begin to do some work.

**Dr. Mann:** That is an excellent point. The Terumo simulator (Terumo Interventional Systems, Somerset, NJ) that has been developed is actually quite good and is available at most national meetings.

**Dr. Popma:** I agree. To summarize transradial training, you can be in a program, such as Dr. Barbeau's, in which the fellows learn because it is part of their routine clinical practice. You can certainly learn if you are already a

practitioner by undergoing some specialized training, potentially with a simulator. Such training progresses very quickly because many of the techniques are relatively common techniques (ie, guide catheter support, backup, and cannulation). The third piece is that from a fellowship training standpoint, if you do not get enough in your program, going to a simulator and working through some of these problems is another good way to train.

### What are the reasons for the disparity between transradial performance rates in the US as opposed to the rest of the world?

**Dr. Barbeau:** I believe it is associated with the learning curve. In Europe, interventionists were used to working with monorail, 6 F, and stents. Europeans were working in this arena before interventionists in the US. This familiarity was confined mostly to Europeans and resulted in their being much more comfortable with the device sizes and techniques required for transradial techniques. The problem in the US is that by the time interventionists in Europe were using 6-F and monorail technology, US interventionists were using 8-F and over-the-wire technology. They had to learn three learning curves to perform transradial angioplasty; they had to learn how to work in a small environment, such that the learning curve for the transradial approach was a little bit more complicated. The attitude to minimize the equipment was not there yet. Also, I think that in Europe, there were many people performing and promoting transradial techniques so that it was easier to obtain training.

**Dr. Popma:** I think there are several aspects that need to be considered on why the US is not performing predominantly transradial techniques. For busy practitioners, especially those who do not practice transradial techniques routinely, it does take a little bit longer and sometimes is a bit more challenging for some of the anatomy. Also, very often, the staff setup in institutions is not amenable to performing transradial techniques. The routine postprocedure nursing care is sometimes so standardized for the femoral approach that there is a different inertia required for getting patients ambulatory after they have undergone radial artery procedures. For that to change, there has to be individual physician champions who will then push the technology so that it does become part of routine care, and people become used to it. In the US, inertia is very much a factor because everyone is used to doing what they are comfortable doing, and there really needs to be a reason to change. I do not think that the majority of US physicians have appreciated the full benefits of routine radial artery access approach. There needs



Dr. Popma

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to be a cultural change driven by an individual champion in each hospital.

**Dr. Mann:** I think in the US there have been two reasons for the disparity. First, there has been a lack of a perception of a real problem. This is related to two factors, the first of which is what I call "the hope of the femoral closure devices." There has been an ongoing hope that femoral closure devices would eliminate groin-bleeding complications, and this has delayed acceptance of the transradial approach. Second, bivalirudin is now commonly used for femoral interventions, and it does reduce access bleeding complications because of its short half-life.

The second reason has to do with lack of training and the relative low volume of operators across the board in the US. It takes a concerted effort to learn transradial interventions in the US. I think there are physicians who have taken on this challenge but who have not stuck with it long enough to get through the learning curve. The length of the learning curve depends completely on the experience of the operator; for high-experience, high-volume operators, the learning curve is relatively short, but with new operators and fellows, it is obviously longer.

**Dr. Barbeau:** These days, the access site learning curve is basically mastered within 50 interventions. Of course, this depends on the operator's skill set. The rest of the learning curve is associated with manipulation of the catheter and the rest of the angioplasty technique that is required. The aspects that are different from the femoral technique, the radial access, and the advancement of the catheter up to the ostium of the coronary artery are well mastered by the majority of fellows and physicians within 50 to 100 procedures.

**Dr. Popma:** I agree. I learned after fellowship and after I had performed a couple thousand femoral access cases. I think the learning curve for a seasoned practitioner is really much shorter, probably in the 10- to 20-case range. I felt

that some of the techniques that are learned relating to backup support, diagnostic and guide catheter intubation, and dealing with great vessel tortuosity are actually fundamental principles for the interventionist, and an experienced interventionist is going to be able to learn very quickly.

However, I do not think that even the experienced interventionist should wait to do the most complex case that presents to them (eg, no femoral pulses and no other access other than the radial artery). It was certainly more useful to me to do some simpler cases just to get the maneuvers down. Yet once I was able to learn the fundamentals, I was “good to go” in being able to work through the rest of the challenges. Even during the learning period, I think most interventionists would be able to successfully perform transradial access in 95% of cases without a problem. Most of the learning curve is in those 5% of cases in which you encounter difficulty and need to do some real problem solving.

I think it is also important to note that it is not the end of the world to swap over to the femoral approach during the learning curve. In my first few cases in which I had dif-

ficulty, I switched to the groin, and the procedures were completed without problems.

**Dr. Mann:** I also think this is an important point. Especially early in the learning curve, interventionists should begin with normal (big) radial arteries before moving on to attempting some of the tougher ones. Cases with difficult femoral access are often also more difficult radial cases.

**What can be done to encourage more US interventionists to undergo training to perform transradial interventions?**

**Dr. Barbeau:** I think that the most compelling point would be if we could look at data from randomized studies in which some people underwent femoral access and some underwent radial access to determine if there was a hard endpoint that shows lower bleeding, lower complications, and lower mortality. If we could prove that, then of course, more people would be interested in transradial artery access techniques.

**Dr. Popma:** I agree that a clear focus for the advan-

tage of the transradial approach is to discuss transfusion rates after PCI. If we are honest about the postprocedural transfusion rates at our hospitals, they are probably higher than we would like them to be. Bleeding complications are clearly less with the transradial approach. And as we have mentioned, obese patients are particularly suited for transradial access, primarily due to reduction in bleeding. Targeting subsets of patients in which bleeding can be reduced would be a good place to start to convince US physicians that transradial is easy to perform and beneficial to patients.

**Dr. Mann:** One issue that we have encountered is that there really has not been a lot of industry-driven promotion of the transradial procedure in the US. I must say that in the past year or so there have been a few companies that have stepped up and are definitely looking at catheters and access equipment to help tackle the learning curve. That may well help.

**Dr. Barbeau:** There are also some financial incentives to transradial access that might appeal to US physicians and institutions. If you have a patient walking out of the catheterization lab immediately after the procedure, and able to go home after 8 hours without any fear or anxiety of bleeding, it would certainly cost less to perform radial access.

**Dr. Mann:** At our institution, we constantly seem to have a bed problem. As of this year, Medicare is reimbursing for outpatient interventions, and we have found that if you can do transradial, there is a significant increase in turnover in the catheterization lab, and it can be a real financial asset to the hospital.

### Should radial artery access be taught in fellowship programs, and how should it be introduced if it is not already present?

**Dr. Barbeau:** Interestingly, we had to ask the opposite question in our fellowship program. We had some fellows who had very little exposure to femoral access during their training. Of course, radial access should be included in fellowship training because the more access techniques you are trained in, the more options you have at your disposal to successfully treat your patients. How to implement that training certainly needs to be addressed, especially in the US.

**Dr. Mann:** I feel very strongly that transradial access training should be provided in all fellowship programs and have advocated it for years. It is slowly making inroads, but we are certainly far from accomplishing that goal.

**Dr. Popma:** In all honesty, the best way for motivated fellows to get this training is to ask their attending for transradial training in appropriate cases. We all experience peer pressure in different forms, and I think we all have a responsibility to encourage our fellows to hunt for the good radial cases at programs that do not routinely perform this technique.

### What are the best practices regarding techniques that you can share with us?

**Dr. Popma:** Best practices are those practices that a program would wish to emulate to implement optimal transradial access techniques. The subspecialties institutions, such as those at which Drs. Mann and Barbeau practice, work as a system that is dedicated to transradial intervention. They are successful because the physicians, nurses, and support staff have established critical pathways for the pre- and postrecovery care of their patients. Routine preprocedural evaluations include Allan's tests in both wrists and intravenous lines started in the arm that is not going to be accessed. A standardized method of prepping the wrist and setting up the image intensified to image the arm in case of access difficulties saves time and headaches during the procedure. There are some subtle modifications in the diagnostic and guiding catheter equipment and adjunct pharmacologic agents that are used. Finally, the team needs to appreciate the standard method of sheath removal and radial artery compression in order to effectively monitor patients after the procedure. Even the discharge instructions are somewhat modified for patients undergoing transradial intervention. The best practice methodology is clearly aided by the publications of these fairly fundamental methods that can be used as guides for the catheterization laboratory staff.

**Dr. Mann:** I would like to emphasize the importance in incorporating your nursing and technician staff into the process because it is a different mindset as opposed to the femoral approach. It is often necessary to remind the nurses that these patients can be ambulatory and they don't have to be in bed.

We actually have a special transradial area of 10 to 15 beds where all the transradial patients go after their procedure. The nurses, by virtue of the fact that these are the patients that they care for every day, are attuned to these issues and the specific needs of these patients. ■

1. Barbeau GR, Arsenault F, Larivière M-M, et al. Evaluation of the ulno-palmar arterial arches with pulse oximetry and plethysmography: comparison with the Allen's Test in 1,010 patients. *Am Heart J*. 2004;147:489-493.