The Transradial Approach

Does your fellowship training program teach it?

BY JENNIFER A. TREMMEL, MD, MS

For more than 40 years, the femoral approach has been the dominant method of vascular access for diagnostic and interventional procedures in the United States.[1] Brachial artery cannulation, the original access point for coronary procedures, was quickly relegated to a backup strategy, and the transradial approach has been slow to catch on, despite being introduced more than 20 years ago.[2] However, a change of tide across the United States can be felt as interest in the transradial approach swells. This change is occurring as several factors converge to create a tipping point, including an increased concern regarding vascular access and bleeding complications, a growing interest in improving patient satisfaction, greater governmental and administrative pressures to reduce costs and length of hospital stay, and an improvement in transradial equipment and availability of training.

THE CASE FOR TRANSRADIAL TRAINING

Despite the recognized benefits of the transradial approach compared with the femoral, or even brachial approach,[3-12] there are several reasons for the longevity of femoral access as the default strategy. Femoral access is effective, easy to learn, and relatively safe. It also allows for the use of large-bore catheters, and most sheaths, catheters, and guidewires are designed with the femoral approach in mind. Perhaps even more powerful is tradition. Invasive and interventional cardiology training is an apprenticeship, and most teachers in the United States are femoral operators. Students, in turn, eventually teach what they have learned to someone else, and so the tradition continues.

Training program guidelines in the United States mirror our current system of teaching the femoral approach as the default strategy and make no specific stipulation for transradial training (Table 1). The third edition of Task Force 3 of the American College of Cardiology (ACC) Core Cardiology Training Symposium (COCATS) guidelines state that a level 3 trainee (interventional cardiology fellow) should possess the cognitive knowledge and technical skills outlined in the ACC training statement that was published in 1999.[13] This never-updated ACC training statement says, "Trainees should be experienced in the full range of arterial vascular access techniques. These should include both transfemoral approaches and approaches from the arm."[14] Likewise, the current Accreditation Council for Graduate Medical Education (ACGME) Program Requirements for Graduate Medical Education in Interventional Cardiology makes the statement that "fellows must have formal instruction, clinical experience, and must demonstrate competence in the performance of…coronary interventions [via] femoral and brachial/radial cannulation of normal and abnormally located coronary ostia." Although this document is undergoing modification, with the updated version expected July 1, 2011, there is currently no apparent editing to this particular statement.

> "It is time to update the training guidelines to clearly reflect this evolution in our tradition."

To be a level 2 trainee (one who will practice diagnostic but not interventional cardiac catheterization), the COCATS guidelines state that one needs the ability to "perform vascular access from the femoral, radial, or brachial route." Arguably, being able to perform catheterization from only one of these access points without being able to perform an alternative method, if needed, is not adequate. Ideally, a graduating fellow would be able

TABLE 1. CURRENT VASCULAR ACCESS SITE TRAINING RECOMMENDATIONS FOR FELLOWSHIP PROGRAMS

COCATS level 3	Transfemoral approaches and approaches from the arm
ACGME	Femoral and brachial/radial cannulation
COCATS level 2	Femoral, radial, or brachial route

to perform vascular access from the femoral, radial, and brachial route. Although transfemoral training is necessary, and proficiency in the brachial approach is desirable, neither adequately prepares an operator to perform a transradial procedure. If it did, there wouldn't be the growing demand for transradial training that we are currently seeing among practicing invasive and interventional cardiologists in the United States. To perform radial procedures, extra training is needed, even if it is a small amount, and there is no better time to do that than during fellowship.

Diagnostic and interventional cardiology training is an influential period when fellows acquire a fundamental framework of cognitive and technical skills. After fellowship, operators may trial and adopt new devices and techniques, but their ease in doing so varies depending on the breadth of the fundamental framework they developed during training. In addition, finding the time and patience to learn new skills and techniques after fellowship is a challenge. Therefore, fellows want to (and should) enter programs in which they can gain the broadest exposure possible to optimize their repertoire of abilities prior to entering practice. As the field continuously evolves, we too must continuously reflect upon how we are doing at preparing the next generation of invasive and interventional cardiologists. If we want our trainees to graduate with a fundamental framework of cognitive and technical skills that allow them to adapt with the times and provide the safest and most comfortable care to patients, we need to consider transradial training to be as important as femoral training. It is time to update the training guidelines to clearly reflect this evolution in our tradition.

FELLOW TRAINING

Training fellows is a challenging but rewarding process. Anyone in academic medicine knows the cycle of watching their fellows turn into independent operators as the academic year rolls on, and then suddenly in July having "production" come to a screeching halt. You stand there for minutes watching a needle go in and out of a groin, mysteriously unable to puncture a large, pulsating femoral artery. Teaching the wrist is similar, although the radial artery is even less forgiving, with spasm sometimes making multiple attempts at cannulation nearly impossible. Because of this, when to train fellows in the transradial technique and which fellows to train remain open questions. Our current practice is to have the first-year general fellows focus on mastering femoral access and its complications. Our interventional fellows get to do all available radial sticks during the first half of the year, and during the second half, senior (second-year) general fellows who are planning on doing an interventional fellowship or going into invasive cardiology can start to learn the technique. While there are no current competency guidelines, it is suggested that a well-trained graduating fellow will have done at least 50 transradial cases.

When last investigated, < 2% of all percutaneous coronary interventions (PCIs) in the United States were performed transradially.[9] However, many would argue that this number is quickly on the rise, with a growing number of interventionists obtaining training in transradial procedures. As more attending physicians learn and practice this technique, more interventional fellows are completing their training having truly mastered "the full range of arterial vascular access techniques."

Although data regarding this new generation of radially trained fellows and recent graduates are lacking, one senses they may soon be changing the landscape of interventional cardiology in the United States. To get an idea of this, I asked several current fellows and recent graduates from across the country to give their perspective on the transradial approach.

While the excitement of learning something novel is apparent in their use of words like "fantastic" and "sweet" to describe transradial intervention (TRI), certain other themes also emerge. Whether or not they know the data, they know firsthand that bleeding and vascular complications are less frequent and that their patients are more comfortable. They also report having

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FROM THE FELLOWS AND RECENT GRADUATES

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I was exposed to radial access right from my general cardiology fellowship. It started with one interventionist who was interested in using it as the preferred access site, with others using it in cases in which the femoral approach was not possible or not appealing. An initial period of increase in procedural time and learning curve on behalf of the fellows and catheterization laboratory staff has given way to a time in which a majority of the catheterization laboratory attendings now use the radial approach preferentially, and most senior fellows are just as comfortable with the radial approach as the femoral approach.

For me, the first challenge was being successful at access. It would always surprise me how easy it was for me to get an arterial blood gas via radial access, yet how difficult it initially was to achieve access for radial artery catheterization. Some of the learning points for me were careful planning of access, minimizing lidocaine injection, adequate pain control and sedation, paying close attention to the course while advancing the initial wire, using respiratory maneuvers to negotiate tortuosity, making very small movements with the catheters, and also being vigilant of hand perfusion after the procedure via pulse oximetry. I think it is important to make the radial approach the primary approach for most patients to acquire some degree of comfort with the procedure. We now even perform complex PCI procedures, including rotational atherectomy via the radial approach, feeling just as comfortable with it as the femoral approach.

The advantages to learning the radial approach for a general cardiology and interventional cardiology fellow are tremendous. My first reason for using the radial approach preferentially when I go into practice is that it makes cardiac catheterization a much better experience for my patients and eliminates the feared groin complications, particularly severe hemorrhage. It is also prepares me well for the patient in whom a femoral approach is not possible, especially in the ST-elevation cohort, in which time to revascularization is important. All cardiology practices that I have interacted with have been very eager to have a radial interventionist on board. Also, because radial access has been a fairly recent adaptation in the United States, it gives me the opportunity to teach and take leadership in the adaptation of this approach in whichever institution or practice I join.

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As a cardiology fellow, and now as an interventional fellow, I have had the opportunity to participate in hundreds of cardiac catheterization procedures, with approximately half being done via the femoral approach and half by the radial approach. Radial artery access is infrequently used in the United States, which has been attributed to a steep learning curve for performing cardiac catheterization through the wrist. However, because my training has included both radial and femoral access, I have not found one method to be easier or more difficult than the other. Certainly, there are patients for whom catheterization using the radial artery for access is significantly easier than the femoral artery and vice versa. However, for most patients, either radial or femoral artery access could be used with equal effectiveness and ease. I have observed that patients who have had both forms of access prefer radial access, and many patients have requested to have their procedure performed through the wrist. I have also observed that the nursing staff in our institution prefer taking care of patients who have had the radial artery used because access site and patient care is simpler. Radial artery access complications are rare and typically not severe, whereas I have seen a few patients with severe femoral artery access complications. Arterial access has been of particular importance in many acute cases in critically ill patients, and the ability to quickly and safely use either the femoral or radial artery for access has been a valuable skill. Many fellows in the United States receive little or no exposure to radial artery access, and this may be a disservice to them and their patients. As a fellow, I have appreciated the training I have received because I feel it allows me to be more flexible with the method of arterial access used and thus provide patients with the safest and most appropriate access. Because radial artery access is safer and preferred by patients and is as easily utilized as

femoral access, I certainly intend to use radial artery access in most of my patients in my future practice.

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One of the most rewarding parts of Australian cardiology training is the encouragement we get to train overseas. It offers an often once-in-a-lifetime opportunity to pick up a new set of procedural skills. TRI has been one of the most useful skills I obtained in fellowship. Australia has traditionally not had a strong TRI focus, and I had little exposure to it prior to my American training. My initial reaction was quite negative. TRI requires a different skill set than transfemoral, and I was frustrated by the difficulties I had initially with access, spasm, and engagement of the coronary ostia—I felt like a first-year fellow again! The learning curve was quite steep, but there was a noticeable improvement after about 25 cases, with my success rates increasing from around 60% to 90%. I quickly realized that guide support was often superior from a transradial approach compared with transfemoral, and I enjoyed the assurance that I was unlikely to be called back for access-site bleeding after leaving for the day. I also learned that almost all cases can be performed transradially, including grafts, infarct PCI, rotational atherectomy, and chronic occlusions.

I have since returned to Australia. My current practice is to perform approximately 75% of cases by a transradial approach. I now train my own fellows in TRI, and as much as possible, I allow them to struggle through the initial learning curve and am proud when they become confident and "converted" to TRI as I have been.

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I have always felt that the number of procedures and the speed with which they are performed are important but only secondary to the quality of care provided to the patient. At UCI Medical Center, I have been lucky to have great mentors who continue to emphasize this ideal. In this regard, we started training using a transradial approach to perform cardiac catheterization. Although the transradial approach has been technically challenging, access and overall procedure time has decreased with continued practice. Having experience with both the femoral and transradial approach is invaluable. I believe that being able to provide patients with an option that is associated with a marked reduction in the risk of both minor and life-threatening vascular site complications will only help me provide the best care possible in my future practice. Removing outcomes from the equation, I cannot emphasize more clearly how much our patients have appreciated the transradial approach in terms of sheer comfort and convenience. As cardiac catheterization techniques and intravascular stent technology advance, we are provided with tools that facilitate better outcomes for our patients. For example, when confronted with borderline coronary artery stenosis or indeterminate stent apposition, the use of fractional flow reserve or intravascular ultrasound helps us do the right thing. In an analogous fashion, knowing how to use and convert to a transradial approach in a patient with difficult femoral access will ultimately improve the care we provide. And that is what it's all about: doing the right thing for our patients. I have to admit that the transradial approach does take time to learn, and this is mainly due to learning which catheters to use and how to manipulate them because initial radial access is relatively easy; however, the end result is worth the steep learning curve.

TERENCE LIN, MD
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I am a big fan of the transradial approach. Virtually all of my patients who have had femoral and radial procedures prefer the latter. From my standpoint, with the radial approach, I sleep better at night—I don't worry about a late night phone call regarding bleeding, and I don't worry about the patient sitting up or lifting their leg. From the patient's standpoint, they love the fact that they can sit up right away, and that they are not immobilized for hours. I find the radial approach particularly favorable in the overweight patient—I find the wrist more accessible than the groin, and any bleeding is more readily apparent with the transradial approach. I find the radial approach favorable in patients with back pain who have difficulty laying flat for several hours. Achieving hemostasis is easier using TRI, and any rare rebleeding from the access site is easily managed. We've done ST-elevation myocardial infarctions (STEMIs) with excellent door-to-balloon times, left main stenting, graft cases, bifurcation lesions, and chronic total occlusions. In the overwhelming majority of cases, I have not felt at all limited by the radial approach. The access in the majority of cases has been very straightforward, with only a handful of cases having challenging tortuosity. There are a small proportion of patients who need to be converted to a femoral approach. By the same token, there are patients with poor femoral access who benefit from conversion to a radial approach. Transradial

training going forward will be an increasingly important part of an interventionist's toolset. I believe that it is important to learn both radial and femoral approaches. When you really look at what is best for the patient, I think transradial cases provide a higher level of patient safety without compromising interventional options. There is a learning curve—acquisition of a new skill requires practice. Having said that, within 3 months of earnest radial training, I am as fast or faster with angiography from the radial approach versus the femoral approach. When coupled with right heart catheterization from the antecubital veins, there is no question that this is a more efficient procedure, with decreased risk to the patient and shorter recovery times. When given the choice, most patients choose a transradial approach. The demand exists, and I think training in the transradial approach will help fulfill that demand.

PETER J. LARSEN, MD
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I am very grateful for having the opportunity to be trained in transradial PCI. We are the only catheterization laboratory in the greater Boston area doing a significant number (> 50%) of our cases via the radial approach. Having the opportunity to have appropriate, high-volume training in transradial PCI is fantastic. It has allowed me to consolidate a skill that is immensely useful and has direct benefits to all subsets of patients undergoing PCI.

The transradial program at Lahey Clinic has several strengths. It is led by a knowledgeable and skilled practitioner in transradial PCI, Dr. Chris Pyne, and we perform a large number of cases annually. This is important because there is a steep learning curve, and persistence and encouragement are needed to become comfortable and proficient with this skill. Completing a fellowship that offers such great training in transradial PCI means that I will be confident to offer and use the transradial approach in patients needing diagnostic angiography or PCI. Increasingly, there is strong demand for radial interventionists. Having this skill will provide more opportunities for employment, particularly in the United States where training in and the uptake of this approach, has been slower than in other parts of the world.

HOHAI VAN, MD
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As a fellow, learning the transradial technique is both frustrating and rewarding. After refining my skills performing cardiac catheterization primarily from the femoral approach, I was initially skeptical of the practical utility of the transradial approach. Most interventional fellows are more excited about guidewires, angioplasty, and stents than performing basic diagnostic studies. The learning curve is steep because you must retrain your hands to do things differently during the entire case, from obtaining vascular access to catheter manipulations. With patience, persistence, and confidence, eventually enthusiasm for the technique makes you wish all cases were performed radially.

The ability to perform transradial procedures is an invaluable asset when interviewing for positions. Practice groups are excited about adding associates who can offer patients alternative procedures that improve patient satisfaction and reduce complications, especially in the subset of patients that are at high risk for bleeding. There may be potential barriers in starting radial procedures. I cannot overemphasize the importance of support from the hospital administrators and the catheterization laboratory staff in order to become a successful radialist. Most community hospitals do not have the specialized equipment, or the current equipment in supply is outdated. Unfortunately, transradial cardiac catheterization has been stigmatized from earlier experiences that it is too time consuming or difficult. It can be a challenge to convince catheterization laboratories to invest money and time to support this modality. In addition, patient education needs to be stressed. Some patients in nonteaching hospitals may be hesitant to consent to procedures that are outside of what most cardiologists in the community are performing. In the end, if the procedure has a proven benefit to the patient and has demonstrated cost-effectiveness, the hospital will support the physician's needs.

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Our program began the transition to a transradial lab at the start of my catheterization laboratory rotation as a first-year cardiology fellow. This proved to be especially challenging because I was still in the process of learning the standard femoral approach. However, I initially noticed that there was less pressure involved with the transradial approach because you could worry less about high or low sticks, a major concern among first-year fellows. The learning curve was in fact steep, and we tested numerous new transradial catheters and hemostasis devices. Once we set a protocol in place and had a dozen or so cases under our belts, the procedure became more efficient. In fact, we now use the transradial approach for select STEMI patients.

As a fellow interested in interventional cardiology, having

this technique as part of your skill set is invaluable. It is an approach seeing significant growth currently, and exposure to it early in training is important. Prior to our transition, we would only attempt a transradial approach in a patient with significant peripheral vascular disease in whom femoral access may be limited. These are often not the ideal patients on which to learn. Now our approach of choice is radial, and we only switch to femoral if unsuccessful, or with renal patients. Patients are often surprised that we have the technology to offer them this approach. After the case, I have noticed that they are unanimously in favor of it, especially those that have had a transfemoral catheterization in the past. And from the fellow perspective, managing the wrist is much easier and preferable to managing the groin.

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I was first exposed to the transradial approach as an Interventional Cardiology Fellow at Geisinger while working with Dr. Kimberly Skelding. I felt lucky because most people would have to travel elsewhere and pay fees to be trained on transradials. It was sweet doing radial PCIs because I knew I would not have to deal with groin complications and an unhappy patient later on. The learning curve is there, but the compensation is well worth it.

Receiving transradial training as a fellow changes your view of the interventional landscape forever. Understanding that there is little you cannot accomplish via the wrist is somewhat radical. But the young mind of a fellow can digest this fact easier than someone already out in practice. It took me a while to digest it—until I saw Dr. James Blankenship do a rotational atherectomy case via the wrist and a STEMI via the left wrist. That erased any doubts I had thus far.

Receiving training on transradial has set me apart already. I have started a transradial program at my new job. We have been able to provide service (diagnostic and even complex interventional procedures) to morbidly obese patients, patients with severe peripheral vascular disease of the lower extremities, and fully anticoagulated patients successfully and without complications. We are using the transradial approach routinely in many of our outpatients. Being able to do this makes me feel accomplished and to be recognized this early in my career as the "transradial person" is fantastic.

It is time for general cardiology and interventional fellows to have mandatory training in transradial access. Only then will there be a significant increase in the utilization of the technique and a substantial reduction in the incidence of bleeding complications. Only then will routine outpatient radial PCIs be a reality.

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a skill that makes them a more attractive candidate when looking for a job. They acknowledge the learning curve, but also know that, as with everything else they have done, they get better with practice. Some fellows who have been equally exposed to the wrist and groin do not seem to distinguish between the two in terms of effectiveness or ease. I suspect that if we all had a similar early exposure to the transradial approach, we would all feel the same way. ■

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