# Radial Access in Practice

Tips for starting a successful program.

**BY MORTON J. KERN, MD, MFSCAI, FAHA, FACC**

In 2009, our laboratory followed the advice of Dr. Oliver Bertrand of Laval Hospital in Quebec City, Canada, and started a radial access program. Dr. Bertrand and his team performed more than 10,000 procedures with 3,500 percutaneous coronary interventions (PCIs) annually, nearly all from the radial approach with no retroperitoneal hematomas, femoral pseudoaneurysms, fistula or femoral artery bleeds, occlusions, or emboli. Complications from radial artery access are rare and mostly benign. 2015 will mark our cath lab's sixth year of appreciating the benefits of being a radial-first laboratory. This article shares 10 tips on how to initiate a successful radial laboratory (Table 1).

## TIP 1: ACCEPT THE CONCEPT AND BENEFITS OF THE APPROACH

Review the current literature, which describes the radial technique and outcomes.[1-7] Although most attending physicians in the cath lab have performed cardiac catheterization from the arm, albeit infrequently, in order to move successfully into the routine use of the radial approach, operators must apply their experience and new knowledge to gain confidence for radial artery access, negotiating the shoulder and manipulating the coronary catheters. To understand the unique and specific radial techniques, operators and their teams should attend at least one of the radial teaching courses, such

**TABLE 1. FUNDAMENTALS OF A TRANSRADIAL PROGRAM**

| | |
|---|---|
| **Overall benefits** | • Fewer bleeding and vascular complications<br>• Lower costs<br>• More patient satisfaction |
| **Training** | • Hands-on courses<br>• One-on-one teaching by local radialist<br>• Instructional videos, lectures, simulators |
| **Cath lab support** | • Involvement of cath lab staff in changes<br>• Personalized training for nurses and technicians<br>• Enlistment of colleagues and administrators |
| **Equipment** | • Hydrophilic wires and sheaths<br>• Dedicated radial catheters |
| **A longer learning curve** | • Minimization of radiation exposure<br>• Patience and perseverance<br>• Nonselective performance of radial cases<br>• Evoked by starting with a strong reason |

*Adapted with permission from Tremmel JA. Launching a successful transradial program. J Invasive Cardiol. 2009;21(8 suppl A):3A–10A.*

| TABLE 2. COMPARISON OF FEMORAL AND RADIAL ACCESS FOR CARDIAC CATHETERIZATION | | |
|---|---|---|
| **Feature** | **Femoral** | **Radial** |
| Access site bleeding | 3%–4% | 0%–0.6% |
| Artery complications | Pseudoaneurysm, retroperitoneal bleed | Rare local arteriovenous fistula, painful hematoma irritation, pulse loss 3%–9% |
| Patient comfort | Acceptable | Great |
| Ambulation | 2–4 h | Immediate |
| Extra costs | Closure device | Band |
| Procedure time* | Perceived shorter | Perceived longer |
| Estimated radiation exposure* | Perceived shorter | Perceived longer |
| Access to left internal mammary artery | Easy | Difficult from right radial artery |
| Use of artery for CABG | N/A | Unknown |
| Learning curve | Short | Longer |
| > 8-F guide catheters | No problem | Maximum 7 F (in men) |
| Peripheral vascular disease, obese | Problematic | No problem |

**Operator dependent.*
*Modified with permission from Kern MJ. Radial artery catheterization: the way to go. Cath Lab Digest. 2009;17:4–5.*

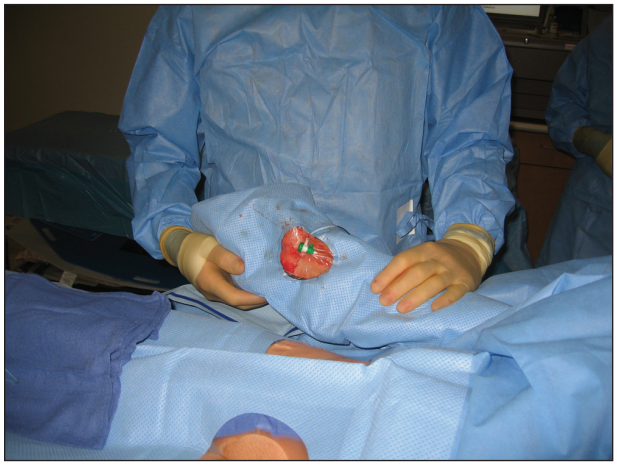

**Figure 1. After sheath insertion, the arm can be moved to the patient's side maintaining sterile technique.**

**Figure 2. With the patient's arm at the side, the procedure proceeds as done for the femoral approach.**

as that provided by the Society for Cardiac Angiography and Interventions.

## TIP 2: ENGAGE THE CATH LAB TEAM TO OVERCOME OLD HABITS

There is reticence among some cath lab technicians (as well as some attending physicians) to learn a new methodology. Address the concerns and misconceptions from the staunch advocates of the femoral approach. Remind the team that femoral access will always be needed, but that avoiding the radial approach for reasons such as, "we train fellows," "patients have coronary artery bypass grafting (CABG)," "femoral is faster," "there are great equipment choices" are not supported by the radial experiences across the world. A successful program does not abandon femoral technique but, rather, keeps a balance. Fellows in training need to learn both catheterization techniques. CABG angiography is done easily from the left radial approach. The femoral approach is faster initially, but the radial approach becomes easier and quicker with experience. Large-diameter equipment and the femoral approach will be needed on occasion. Table 2 compares the radial and femoral approaches to cardiac catheterization.

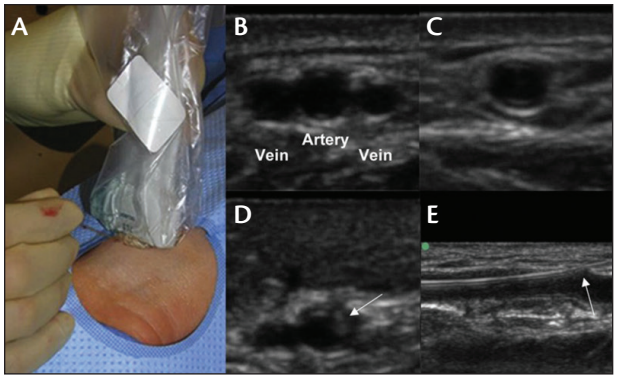


**Figure 3. Technique of ultrasound-guided radial access. Axial position of draped ultrasound probe over the right radial artery. The needle is inserted just below the center of the probe when the artery is in the center of the image plane (A). Visualization of radial artery and veins (B). Compression causes closure of radial veins and reveals pulsatility of artery (C). Visualization of the needle tip (arrow) compressing and puncturing the artery (D). Confirmation of wire position (arrow) in the radial artery in longitudinal plane (E). Reprinted from JACC Cardiovasc Interv, 8, Seto AH, Roberts JS, Abu-Fadel MS, et al, Real-time ultrasound guidance facilitates transradial access: RAUST (Radial Artery Access With Ultrasound Trial), 283–291, 2015, with permission from Elsevier.**

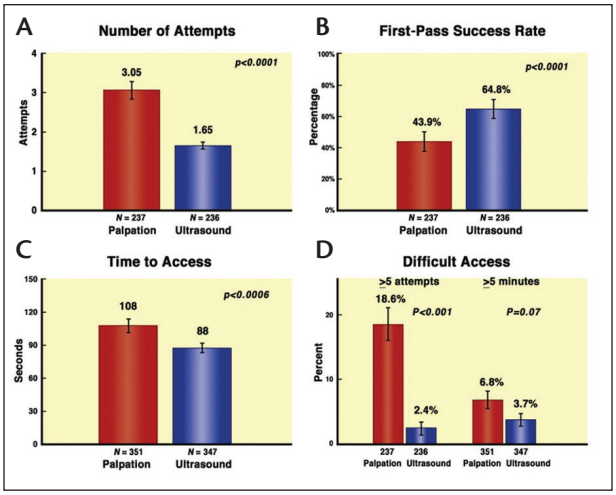


**Figure 4. Comparison of palpation-guided and ultrasound-guided radial access for the following: number of attempts (A), first-pass success rate (B), time to access (C), and difficult access (D). Values are mean ± SE or ± 95% confidence interval for proportions. Reprinted from JACC Cardiovasc Interv, 8, Seto AH, Roberts JS, Abu-Fadel MS, et al, Real-time ultrasound guidance facilitates transradial access: RAUST (Radial Artery Access With Ultrasound Trial), 283–291, 2015, with permission from Elsevier.**

## TIP 3: ADOPT KEY PROCEDURAL CHANGES

The key changes start with the preparation and subsequent positioning of the arm (Figures 1 and 2). There are many ways to prepare the arm for radial access. For example, a sterile glove reduces the use of overlapping drapes, which may fall during the procedure.[8] The specific method matters little, provided that the sterile drapes remain in place during the procedure. Another key change is radial access technique. Ultrasound imaging is very helpful during the initial learning curve, as well as for more complicated patients (eg, obese arm, small rolling radial artery) (Figures 3 and 4) once a radial access program has been established. After sheath insertion, the arm is repositioned alongside the hip, making the procedure nearly the same as femoral catheterization.

## TIP 4: BECOME COMFORTABLE WITH "UNIVERSAL" CORONARY CATHETERS

Although standard left and right Judkin's catheters can be used, a single "universal" catheter for both right and left coronary artery angiography reduces catheter exchanges and the propensity for vascular spasm. Initially, a learning period is required for mastering the manipulation and coronary cannulation with these catheters. Experience with several different types of universal catheters should be encouraged. Patience and practice will determine which catheter shapes are preferred by various operators. For PCI, most procedures can also be easily done using guide catheters specifically designed for the radial approach.

## TIP 5: START WITH UNCOMPLICATED PATIENTS

Begin your experience with middle-aged men (50–70 years) or patients without CABG or a dialysis fistula before taking on the complex and more challenging cases. In the beginning, we avoided small, elderly, frail women; patients with CABG; patients with dialysis fistulae; or those with suspected upper arm or chest vascular tortuosity. With experience, most patients can undergo PCI using the radial approach. The *Conditions in Which Radial Artery Access Should be Preferred* sidebar summarizes which patients will benefit most from the radial approach.

## TIP 6: INCREASE VASCULAR ACCESS SUCCESS WITH ULTRASOUND GUIDANCE

There are two puncture techniques, the front wall stick and the "through-and-through" puncture, and both may benefit from ultrasound visualization and guidance of the arterial puncture.[9] After placement, the sheath can be secured either with a stay suture or a clear Tegaderm (3M) patch with a hole cut for access to the sheath valve. Do not forget to prepare the groin in case of a need to cross over to

**CONDITIONS IN WHICH RADIAL ARTERY ACCESS SHOULD BE PREFERRED**

- Claudication
- Absent leg pulses
- Femoral bruits
- Prior femoral artery graft surgery
- Extensive inguinal scarring from previous procedures
- Surgery or radiation treatment near inguinal area
- Excessively tortuous iliac system and lower abdominal aorta
- Abdominal aortic aneurysm
- Severe back pain or inability to lie flat
- Downward origin of renal arteries (for renal artery stenting)

a femoral approach. Initially, radial access may fail (fewer than one in 10 after the initial 25 cases). The routine use of groin preparation in highly experienced cath labs is uncommon.

## TIP 7: FEMORAL CROSSOVER IS NOT A FAILURE

Radial operators, whether experienced or novice, should not be hesitant to cross over to femoral access when necessary. This is especially true during the initial learning period. When the radial procedure is too difficult or deemed certain to be unsuccessful, the team can simply access the femoral site and complete the procedure. Set a time limit for the beginner's initial experience. In femoral crossover cases, after femoral hemostasis is complete, the radial sheath is then removed with routine band hemostasis.

## TIP 8: AVOID STIMULATING ARTERIAL VASOSPASM

Although proof that premedication reduces artery vasospasm is lacking, many labs give intra-arterial verapamil 2.5 to 5 mg and/or nitroglycerin 200 µg while starting the radial access procedure. Using a Glidewire (Terumo Interventional Systems), downsizing from 6- to 5-F catheters, and limiting catheter exchanges have also been helpful in reducing arterial vasospasm. Good sedation and analgesia make the patient comfortable and often prevents vasospasm.

## TIP 9: TAKE A DEEP BREATH

This advice is good for both operator and patient during a difficult procedure, particularly when struggling to cross the shoulder to the central aorta. Severe angulation of the arch vessels relative to the aorta may be straightened by having the patient take a deep breath, which elongates the aortic arch and facilitates catheter positioning. For short (< 5 ft 5 in) patients who may have acute brachiocephalic branch angulation, left radial access is often preferred.

## TIP 10: SECURE HEMOSTASIS LEADS TO SATISFIED PATIENTS AND STAFF

One of the best parts of the radial experience for the new team is the satisfaction that comes with secure hemostasis using a radial pressure band. After applying the band, deflating the compression balloon to observe bleeding and then increasing pressure just above this point achieves "patent" hemostasis, which contributes to greater vessel patency after discharge. With the band in place, the patient can sit up and use his/her arm for normal activity during recovery. After hemostasis is confirmed, the patient can be discharged in 2 to 4 hours for routine cases and in < 8 hours for uncomplicated PCIs.

## CONCLUSION

After the initial experience and success using radial access in simple cases, more complex procedures, including those requiring right heart catheterization, will become commonplace. Femoral hematomas and concern for retroperitoneal bleeding will fade, and patient and cath lab staff satisfaction will be high. As the lab's experience grows, the radial-first approach will show its worth in both laboratory time and satisfaction, as well as in postprocedure bleeding rates. ■

*Morton J. Kern, MD, MFSCAI, FAHA, FACC, is Chief of Medicine, Veterans Administration Long Beach Health Care System in Long Beach, California, and Professor of Medicine, University of California in Irvine, California. He has disclosed that he is a speaker for St. Jude Medical and Volcano Therapeutics, and is a consultant to Merit Medical, Acist Medical, and Opsens Inc. Dr. Kern may be reached at (562) 826-8000 ext. 3825; mortonkern2007@gmail.com.*

1. Agostoni P, Biondi-Zoccai GG, de Benedictis ML, et al. Radial versus femoral approach for percutaneous coronary diagnostic and interventional procedures. Systematic overview and meta-analysis of randomized trials. J Am Coll Cardiol. 2004;44:349-356.
2. Kern MJ. Cardiac catheterization on the road less traveled: navigating the radial vs. femoral debate. JACC Cardiovasc Interv. 2009;2:1055-1056.
3. Jolly SS, Amiani S, Hamon M, et al. Radial versus femoral access for coronary angiography or intervention and the impact on major bleeding and ischemic events: a systematic review and meta-analysis of randomized trials. Am Heart J. 2009;157:132-140.
4. Rao SV, Ou FS, Wang TY, et al. Trends in the prevalence and outcomes of radial and femoral approaches to percutaneous coronary intervention: a report from the National Cardiovascular Data Registry. JACC Cardiovasc Interv. 2008;1:379-386.
5. Feldman DN, Swaminathan RV, Kaltenbach LA, et al. Adoption of radial access and comparison of outcomes to femoral access in percutaneous coronary intervention: an updated report from the national cardiovascular data registry (2007--2012). Circulation. 2013;127:2295-2306.
6. Jolly SS, Yusuf S, Cairns J, et al. Radial versus femoral access for coronary angiography and intervention in patients with acute coronary syndromes (RIVAL): a randomized, parallel group, multicenter trial [published errata appears in Lancet 2011;377:1408 and 2011;378:30]. Lancet. 2011;377:1409-1420.
7. Cooper CJ, El-Shiekh RA, Cohen DJ, et al. Effect of transradial access on quality of life and cost of cardiac catheterization: a randomized comparison. Am Heart J. 1999;138:430-436.
8. Kern M. The armen glove for radial access prep: a better way. Cath Lab Digest. 2010;18. http://www.cathlabdigest.com/articles/The-Armen-Glove-Radial-Access-Prep----A-Better-Way. Accessed July 16, 2015.
9. Seto AH, Roberts JS, Abu-Fadel MS, et al. Real-time ultrasound guidance facilitates transradial access: RAUST (Radial Artery Access With Ultrasound Trial). JACC Cardiovasc Interv. 2015;8:283-291.