# Adopting Radial Access

A review of preparation, technique, and postprocedure considerations when using transradial access.

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The use of transradial access (TRA) has been a selectively accepted approach used by a small group of interventionists since the early 1990s. At that time, training courses were offered in Canada by Gerald R. Barbeau, MD, and others to stimulate interest in this technique. As a cardiologist, I was fascinated with the possibility that every coronary intervention could be accomplished successfully through the radial artery with a lower risk of bleeding complications and a higher rate of early ambulation. Despite the skepticism of my peers and the need to achieve competence in this new technique, I embarked on mastering this approach. To ensure that quality of care was maintained, we collected outcomes data on this new technique beginning in July 1998. That early experience included diagnostics and interventions; these were successful even in the elderly and female populations.

In 2001, our early results using more than 1,000 interventions were analyzed and presented at the Society for Cardiac Angiography and Interventions scientific session in Houston by Ines Ardid, MD, an interventional cardiologist from Buenos Aires, Argentina. She then continued to publicize the technique at meetings throughout Central and South America over the next several years while introducing the technique in her own catheterization lab. I continued to push forward as I gained expertise and competent caution in the use of this approach technique for all varieties of interventions. In 2002, Eduardo de Marchena, MD, and Alexandre Ferreira, MD, requested that I prepare a chapter on the transradial approach for *Interventional Cardiology Secrets*, which was published in 2003.[1] That effort forced me to review and reflect on the progress I had personally made in improving my techniques over more than 7 years of interventions, then consider the further applicability of the technique.

When I first started using this approach, there were very few dedicated specialty catheters, but most of the procedures (both diagnostic and interventional) could be accomplished with a single catheter, the Kimny. Other catheters soon became available (Barbeau for the right coronary artery and Fajadet for both the right and left). However, standard Judkins catheters can be used for both right and left radial access. More recently, with increased interest in radial access, industry has developed a variety of curves that permit easier coronary cannulation. However, this only applies to coronary catheters at this time; there are no peripheral specialty catheters. Of course, gaining access and navigating through radial, brachial, and subclavian tortuosity is the real challenge (Table 1).

**TABLE 1. COMMONLY USED GUIDING CATHETER SHAPES**

| Left Arm Approach | Right Arm Approach |
|---|---|
| For Lesions in LCA<br>- XB 3.5<br>- JL 4<br>- Kimny | For Lesions in LCA<br>- XB 3.0<br>- JL 3.5<br>- Kimny |
| For Lesions in RCA<br>- JR 4<br>- AL I or AL II<br>- Castillo 1 and 2<br>- Kimny | For Lesions in RCA<br>- JR 4<br>- AL I<br>- Barbeau<br>- Kimny |

*LCA, left carotid artery; RCA, right carotid artery.*

**Figure 1. Preparation of the wrist access should be accomplished to achieve approximately 60° hyperextension by supporting the wrist on a towel roll. The correct amount of hyperextension increases successful access.**

**Figure 2. Use a thin wall needle (2.5 cm/21 g) and ensure that you have brisk arterial flow at puncture before advancing the wire.**

**Figure 3. Make a small incision with a scalpel (after advancing the wire) to facilitate entry of the introducer.**

## PATIENT SELECTION AND PREPARATION

Although the staff of the interventional suite will need to learn correct preparation and positioning of the arm, these aspects are easily achieved. Proficiency in the assessment of radial/ulnar artery circulation to the hand should be included in the educational process for the staff. Ninety percent of the population has dual circulation to the hand, so it is imperative to assess and document that circulatory pathway. The assessment of the integrity of the radial and ulnar arteries is a first step to ensuring safety for the patient and efficacy overall.

The Allen test is the essential assessment technique, which involves compressing both the radial and ulnar arteries until blanching of the hand occurs and then releasing the pressure on the ulnar artery to determine if flow returns (expect hyperemia within 5–7 seconds). If hyperemia does not occur, the patient does not have dual circulation to the hand; thus, radial access should be avoided in these patients. Using photoplethysmography (the intensity of light reflected from the skin and red blood cells determines the volume of blood available to the hand) can offer additional ensurance that dual circulation is present. A recent study by Greenwood et al[2] found that although collateral circulation to the hand is dynamic, there is a substantial risk of radial artery occlusion when the patient presents with an abnormal Allen test. For that reason, we do not recommend radial access in these patients.

### Cannulation

There are several steps that should be followed consistently to ensure successful transradial cannulation (Figures 1 through 3). Correct positioning of the wrist with support and stabilization should be followed by generous local anesthesia. The artery can then be easily entered with a thin wall, 21-gauge needle followed by the advancement of a 0.025-inch guidewire and/or one of the microcatheters designed for radial access. Most diagnostic procedures can be done through a 5-F introducer, and a 6-F size or larger can be used for interventions. It should be noted that thrombosis of the radial artery is directly related to the size of the introducer catheter. Injecting a cocktail of 2 mg of verapamil, 2% lidocaine (1 mL) diluted in normal saline, followed by 50 units/kg heparin bolus and 100 to 200 µg of nitroglycerine can be used to reduce spasm of the artery. The use of anticoagulants is mandatory for transradial procedures.

**Figure 4. Navigation through radial artery tortuosity could result in perforation.**

**Figure 5. Use a 0.014-inch soft (floppy) coronary wire followed by the radial catheter.**

## ANATOMIC VARIANTS OF THE RADIAL ARTERY

Until recently, there was no definitive classification of the variants of the radial artery affecting access. Burzotta et al[3] recently published a new operative classification of anatomic variants that affect successful TRA. The identification of either an absent radial artery or radial pulse due to previous occlusion accounted for approximately 10% (4%–13%) of the cases. The second most common variant was high origin of the radial artery from the brachial or axillary artery (3.4%). The rate of radial and brachial tortuosities (a bend approximately 60º) was 5.9%. The presence of a recurrent radial artery or a radial artery loop was also identified at approximately 1%. Because the documented failure rate of TRA is higher in general than the femoral approach, understanding the presence of these variants creates opportunities for overcoming the variant in some cases and choosing the femoral approach in others.

The basic technique to navigate through these roadblocks is to first identify the variant with radial angiography while using a 0.014-inch floppy coronary wire (Figures 4 and 5). This wire can easily move through a radial artery loop and is also useful in the case of tortuosity. Avoiding perforation and/or dissection may take additional time and patience. Once the wire is safely in the ascending aorta, advance the catheter. For subclavian tortuosity, a Wholey (Covidien, Mansfield, MA) or Bentson wire (Cook Medical, Bloomington, IN) is preferred.

## APPLICATIONS

From this approach, it is possible to complete any coronary intervention. For noncoronary cases, radial access lends itself to successful aortic runoff, renal artery interventions, and subclavian and carotid interventions in selective cases. Contralateral carotid intervention may not be possible if the anatomy of the aortic arch is unfavorable. The length of the current catheters limits distal peripheral interventions, but this may soon change as dedicated devices continue to be developed. Certainly, for patients with severe occlusive aortoiliac disease, the radial approach would be preferred. It also avoids complications associated with the femoral approach, including pseudoaneurysm, arteriovenous fistula, transfusions, and/or embolectomy. Early ambulation is an advantage, and this approach does not require the use of a closure device.

As expertise is gained in achieving successful access via the transradial approach, increasingly complex cases can be managed successfully. The use of the radial artery for patients with ST-segment elevation myocardial infarction does not extend the door-to-balloon time and offers advantages for that population because of the reduced incidence of bleeding. Recent findings from large trials have shown that bleeding is a comorbidity for mortality in patients undergoing percutaneous coronary intervention. Because the coronary patient is often the peripheral patient, the use of radial access can improve outcomes for those cases as well.

Because I am often intervening on morbidly obese patients, the radial approach helps me to avoid a fishing expedition in search of the femoral artery. The advantages of this approach are also readily seen in elderly patients as well as females, who generally have smaller access vessels.

## ADDITIONAL TIPS AND TRICKS

Over the past 14 years, I have become an expert in transradial intervention. I have been able to learn from the challenges as well as the successes. Presentation of tips and tricks and challenging cases is a popular topic at conferences, precisely because learning vicariously from one's peers is second only to being in the interventional suite doing a case. With that in mind, some of the cautions that I always follow include:

- Never force the catheter over the wire to avoid perforations, because the most feared complication of radial access is compartment syndrome. Switch to a soft coronary wire if any resistance is felt.
- Avoid arterial spasm by having the patient properly sedated and well hydrated.
- Always verify circulation yourself by using the Allen test with photoplethysmography.
- Position the arm so that the patient's wrist–hand angle is approximately 60º. A towel roll should be placed under the wrist and tape placed across the palm to secure the position. I prefer to use a short needle for radial puncture because it affords more control.
- As familiarity with available catheters increases, matching the catheter to the patient's needs ensures greater possibility of success.

## POSTPROCEDURE CONSIDERATIONS

Hemostasis and early ambulation are the primary goals of TRA. There are several devices available for radial artery compression including manual compression, such as the HemoBand (HemoBand Corporation, Portland, OR) and more recently the TR Band (Terumo Interventional Systems, Somerset, NJ). The most important aspect of this process is ensuring adequate hemostasis without compromising the integrity of radial artery circulation. Pancholy et al[4] recently completed two studies using conventional compression versus "patent hemostasis." This involves:

- Pulling the sheath out 4 to 5 cm and place HemoBand;
- Placing the pulse oximeter sensor on the index finger
- Tightening the HemoBand and removing the sheath;
- Occluding the ipsilateral ulnar artery via manual compression;
- Loosening the HemoBand until a plethysmographic signal returns (confirming radial artery patency) or bleeding occurs.

The results of this study clearly showed that this technique significantly reduces the incidence of radial artery occlusion at 24-hour and the 30-day follow-up. This study was followed by another that compared outcomes when using the two different bands (HemoBand vs TR Band). In this study, the TR Band proved to result in significantly fewer radial artery occlusions at 30 days in a group of 500 patients (250 in each group).[5] It is evident that improvements in hemostasis methods will decrease this rate further.

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## CONCLUSION

It is clear that the most important predictor of mortality from any interventional procedure is bleeding. TRA can prevent and decrease mortality from this catastrophic event. It has become the preferred access in many countries outside of the United States and has recently gained increasing visibility and interest as evidenced by the proliferation of courses and presentations on its advantages. The basic disadvantage for established interventionists is the learning curve; training and a commitment to its use for increasingly more challenging cases is the road to expertise. Industry is providing the tools, and some patients are requesting its use. The decreased length of stay and postprocedure complications lead to decreased costs. Starting a program just requires a committed interventionist. ■

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