

Right Versus Left Radial Artery Access

Safe and effective methods for patient assessment and procedural setup from the right or left radial artery approach.

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The popularity of the transradial approach to coronary angiography and percutaneous coronary intervention (PCI) continues to grow with mounting evidence of its clinical benefits, particularly, the lower incidence of bleeding and vascular complications,¹ among others. Transradial cardiac catheterization can be effectively and safely performed using either right or left radial arteries for vascular access. However, unlike the transfemoral route, the patient preparation, equipment setup, and overall techniques vary depending on which radial artery is used. Ideally, the transradial operator should be proficient with both right and left radial access and, therefore, should be well versed on the subtle variation between the two approaches. The modern cardiac catheterization laboratory and its support staff should also be equipped to handle these differences efficiently in order to maximize the advantages gained from transradial procedures.

Historically, transradial catheterization was developed using the left radial artery as the primary access site. In the

original description of the technique by Lucien Campeau in 1989, the patient's left wrist was hyperextended to facilitate puncture of the left radial artery with an 18-gauge needle and subsequent cannulation using a 5-F sheath. Coronary angiography was successfully completed using 5-F catheters.²

The left radial approach was not widely adopted, however, perhaps because it relocated the operator to the left side of the patient and disrupted the traditional laboratory setup. The right radial approach was utilized in the first description of transradial PCI in 1993, as described by Ferdinand Kiemeneij.³ During this time, dedicated radial catheterization kits with 22-gauge access needles were already commercially available, as were the 6-F guiding catheters used for PCI.

The right radial approach has since become the vascular access site of choice by the majority of transradial operators. The familiarity and ease of catheter and equipment manipulation from the right side by both the opera-

TABLE 1. COMPARISON BETWEEN RIGHT AND LEFT RADIAL ACCESS

	Right Radial Access	Left Radial Access
Acceptability	Widely adopted	Less popular
Preparation and setup	More standardized	May be cumbersome
Comfort for the operator	++++	+
Learning curve	Longer	Shorter
Catheter manipulation	More technically challenging	Better control
Radiation	Similar to left radial access among expert operators	Shorter with trainees
Efficacy and safety	Similar	Similar

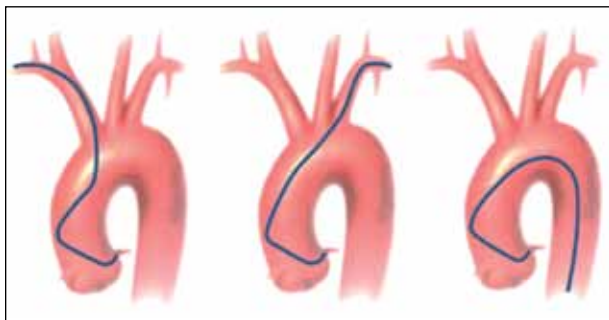


Figure 1. Anatomy of the aortic arch and its branches. In the right radial approach, the catheter has to traverse two bifurcations at the right subclavian and brachiocephalic arteries, making catheter manipulation more challenging. The vascular path followed by the catheter in the left radial approach is somewhat similar to that of transfemoral access.

tor and the ancillary staff, like that of the standard transfemoral route, has probably driven this trend. However, the left radial artery route offers a few advantages over the right radial approach, such that mastery of this technique has become almost compulsory for the modern transradial operator. Furthermore, modifications in patient preparation and equipment setup make it possible to perform left radial catheterization from the right side of the patient, providing convenience that is comparable to that of right radial or transfemoral access. Table 1 summarizes the differences and similarities between right and left transradial access.

The safety and efficacy of the right and left radial approaches were compared in a recent randomized

trial involving 1,000 patients who underwent transradial coronary angiography. The study found significantly shorter fluoroscopy times with the left radial approach. This may be partly explained by a three-fold higher incidence of subclavian tortuosity, as well as a higher incidence of radial loops with right radial access. Nevertheless, the overall procedural success rate, total procedure duration, number of catheters used to complete the procedure, and amount of contrast material used were the same between the two routes.⁴ A similar observation was seen in patients undergoing transradial PCI for acute myocardial infarction. In a retrospective series of 135 patients, no significant difference between right and left radial approaches was found in terms of procedure success rate, procedure duration, room-to-balloon time, and safety profile.⁵

In the hands of expert transradial operators, outcomes are comparable with either right or left radial access. During the learning phase, however, transradial catheterization is technically demanding and time-consuming. Data suggest that it may be advantageous to emphasize the left radial approach during the training period as it appears to allow novice operators to acquire the skills and confidence required for transradial procedures more quickly than the right radial route. This was demonstrated by the TALENT (Left Versus Right Transradial Approach for Percutaneous Coronary Procedures) trial, which randomized nearly 1,500 patients undergoing transradial coronary angiography with either right or left radial routes. The study found that among trainees, the left radial approach was associated with a significantly shorter learning curve, with progressive reductions in cannulation and fluoroscopy times as the operator volume increased, compared to right radial access.⁶

This difference may be explained by the anatomical variations between the right and left vasculature. In addition to the higher incidence of loops in the right radial artery, the right subclavian artery is often more tortuous than the left, especially in patients with short stature and those who are elderly.⁷ Additionally, in the right radial route, the catheter has to pass not only through the right subclavian artery, but also the brachiocephalic trunk before reaching the aortic root. Traversing these two areas of bifurcation increases the technical difficulty, especially if atherosclerosis is involved. Because the left subclavian artery arises directly from the aorta, the path followed by the catheter in the left radial

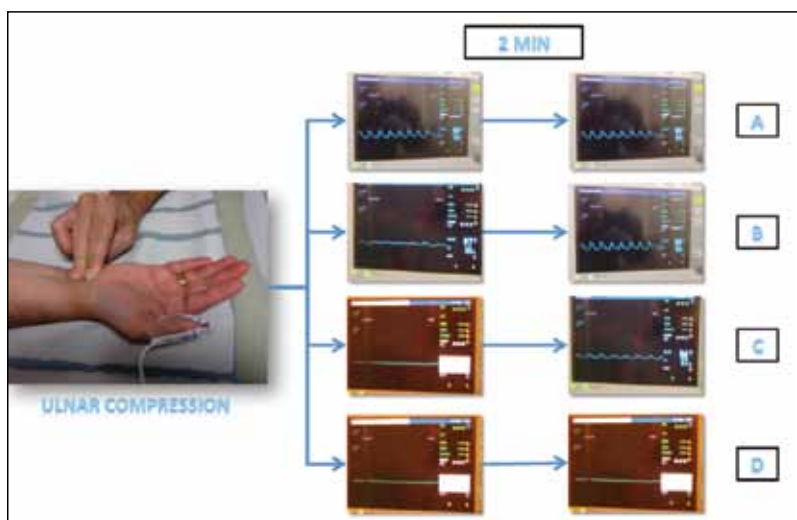


Figure 2. The Barbeau grading system for assessment of collateral circulation of the palmar arch. The presence of an arterial waveform on plethysmography (even if delayed or with reduced amplitude) and an oxygen saturation > 90% (grades A, B, and C) confirm the adequacy of collateral hand circulation.

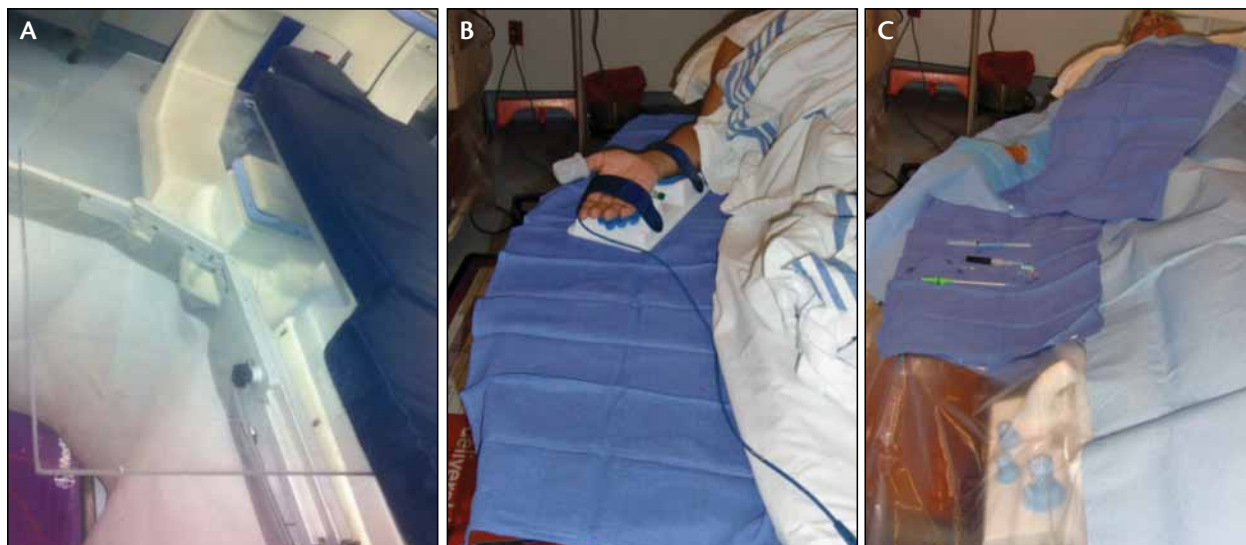


Figure 3. The right radial approach. An armboard is tucked securely underneath the mattress (A), oriented such that the narrow end is at the level of the patient's shoulder, and the broad end is at the patient's hip level. The patient's right arm rests on this board, and the operator performs the entire procedure at the right-hand side of the patient (B, C).

route is very similar to that of the transfemoral approach, resulting in less-complex catheter manipulation and greater control (Figure 1). Furthermore, the left radial approach provides direct access to the left internal mammary artery (LIMA), which is of special significance in patients who have undergone coronary artery bypass grafting. Certainly, the LIMA can also be cannulated from the right radial route, but it is significantly more challenging from a technical standpoint, and there is a potential risk of embolic stroke due to catheter manipulation in the aortic arch.

PREPROCEDURAL ASSESSMENT

Although major limb complications of transradial catheterization are exceedingly rare, postprocedure occlusion of the radial artery does occur in approximately 5% of the cases, but this problem can be further reduced with use of anticoagulation during the procedure and careful use of patent hemostats.⁸ Owing to the dual blood supply of the hand, loss of the radial pulse is, for the most part, of little clinical consequence as long as perfusion to the palmar arch is preserved by an intact ipsilateral ulnar artery. Thus, in addition to the routine precatheterization history and physical examination, patients undergoing transradial procedures through either right or left radial access require assessment of the adequacy of the ulnopalmar arch to avoid ischemic hand complications.

The classic Allen's test, however, is highly subjective and, at times, lacking reproducibility. The recommended method of formally documenting patency of the radioulnar vasculature is the Barbeau grading system (Figure 2), which is an objective, quantitative assessment of hand

circulation. With this method, finger pulse oximetry and plethysmography are recorded to increase the sensitivity of the examination. A patient is a candidate for transradial access only if Barbeau grade A to C is demonstrated in the ipsilateral hand.⁹

Transradial access is not recommended if Barbeau grade D is documented. The physician should also investigate other conditions that potentially preclude a transradial approach, including known or suspected severe upper extremity peripheral vascular disease (Buerger's disease, Raynaud's syndrome, vascular anomalies, extreme arterial tortuosity, severe atherosclerosis), dialysis access at the ipsilateral limb, and if the radial artery is to be harvested for bypass grafting and other surgical purposes. Procedures involving devices that require sheaths larger than 7 F are better served by using nonradial vascular access.

The choice of the laterality of radial access is largely dictated by operator preference and patient-related factors. The left radial approach may be preferred in patients with short stature or the elderly when the incidence of right-sided tortuosity is high, as well as in those requiring cannulation of the LIMA.

RIGHT RADIAL ACCESS

With transradial catheterization through the right radial approach, the patient is positioned supine on the table in the same manner as the transfemoral route. An arm board extension is attached to the right-hand side of the table. Arm boards are available in different shapes and designs. Perhaps best-suited for this purpose may be the trapezoid-shaped fiberglass board, with the narrow end



Figure 4. Positioning the left hand using armrest or padding for the left radial artery setup.

tucked under the mattress at shoulder level and the broad area at the wrist (Figure 3).

The patient's right arm is placed on the arm board and abducted at a 30° angle. The right wrist is secured to a soft wrist board in a supinated and hyperextended position. In our laboratory, a pulse oximeter probe is placed on the right index finger or thumb to allow for continuous monitoring of the circulation to the hand throughout the procedure.

The right wrist area, from the distal half of the forearm to the palm, is then prepped with standard chlorhexidine- or iodine-based antiseptic solution. Both groins may be prepped as well, depending on the anticipated need for femoral access. The patient is then covered with the standard long sterile drape from neck to toe. The drape segment covering the right arm may need to be cut or folded to expose the wrist. The right wrist is then covered with sterile drape (custom radial drapes are commercially available).

The operator achieves vascular access and performs the catheterization procedure on the right side of the patient at the level of the wrist or thigh. Because the right wrist is situated away from the patient's midline, it is recommended that an additional 12 inches of tubing be attached to the standard manifold setup to allow adequate slack in the system.

LEFT RADIAL ACCESS

There are more variations in patient preparation and equipment setup with the left compared to the right radial approach. Some operators prefer to achieve access and perform the catheterization procedure at the left-hand side of the patient. In this case, the patient is positioned, prepped, and draped in a similar fashion as that of right radial access, only the arm board is attached to the left side of the table, and the equipment is arranged as a mirror image of the right-sided approach.

However, a right-sided approach to left radial access is recommended to avoid disruption of the traditional laboratory setup and maximize the advantages of this route. In

this mode, the patient is positioned supine on the table in the typical manner as the transfemoral route. Instead of an arm board extension, a custom arm rest made of foam or pillow material is attached to the left side of the table to elevate the left upper arm and guide the forearm toward the midsection of the patient's body (Figure 4). The left wrist can be strapped to a soft wrist board, and a pulse oximeter probe is placed on the left index finger or thumb to allow continuous monitoring throughout the procedure.

Both groins are prepped, if desired, and the patient is covered with the standard long sterile drape. A sterile sheet or towel is placed underneath the left arm to preserve the sterility of the underlying long drape. The left hand is then placed on top of the left thigh area in a supinated position. The left wrist is prepped and draped in a sterile fashion. The operator achieves vascular access from the right side of the patient, as if performing a left femoral artery puncture. After the left radial sheath is inserted, the left forearm is pronated and adducted, such that the left wrist rests close to the right inguinal area. The operator then performs the catheterization procedure on the right side of the patient with a general setup that closely resembles the transfemoral approach (Figure 5).

Of note, there may be some variation in the choice of catheters, as catheter manipulation from the left radial artery may feel similar to the transfemoral approach, as shown in Figure 1. In fact, the inexperienced operator may feel more comfortable using left transradial access and Judkins catheters during the steep portion of the learning curve. In the TALENT trial, inexperienced operators had lower fluoroscopy times and less contrast use with left radial access compared to right radial access, indicating that left transradial access may be a good strategy for operators who want to initiate their learning process.⁶



Figure 5. In this left radial access setup, the wrist is positioned across the midline on top of the right groin. The operator performs the catheterization on the right side of the patient, as in right femoral access.

CONCLUSION

With appropriate patient assessment and preparation, the right and left routes to transradial catheterization are equally safe and effective. To be proficient with both approaches, the operator needs to understand the differences between these two routes in terms of patient preparation, procedural technique, catheter selection, and laboratory setup. It is recommended that each cardiac catheterization laboratory develop specific protocols for right and left radial access to enhance the efficiency and likelihood of successful outcomes from transradial procedures. ■

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