ASK THE EXPERTS

What Are the Most Common Obstacles to Success During Radial Access, and How Can They Be Avoided?

A multidisciplinary panel shares how experience, knowledge of anatomy and available equipment, and careful periprocedural planning can prepare operators for encountering challenges during radial access.

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Since the first use of radial access in the cardiology space in the late 1980s, it has been increasingly used for percutaneous interventions. The safety and technical feasibility, as well as its advantages over femoral access, have been well documented in the literature. Despite this, there are several obstacles precluding the incorporation of radial access into clinical practice.

One of the most common barriers for embarking on radial access is operator uncertainty. The specific technical steps required for accessing the radial artery and the need to build expertise when an operator is already comfortable with another site (eg, femoral) are frequent causes for hesitation. Furthermore, there may be inherent physical limitations regarding room setup. The most effective way to address these issues is to attend formal training courses aimed at supporting operators with little or no prior radial experience. In this environment, operators can receive invaluable information on the fundamentals of good practice, procedural steps, troubleshooting, and practical tips. For instance, in situations where space is limited, discussing newer alternative options such as the cross-body distal radial approach may provide a suitable solution because the suite layout can be maintained the same as for femoral access.

Another concern operators raise is case selection. A common error is when operators first begin to use the radial approach by starting with difficult cases. Usually, this is either because more than one site of access is required for an already complex procedure or their preferred route of access has previously failed. Understandably, this can lead to intraprocedural failure if the operator has not had the opportunity to gain enough familiarity or experience to apply problem-solving skills when required. In addition, not using the radial approach on a regular basis does not allow the operator or their team to build a solid case experience. If radial access is initially used for procedures the operator performs routinely and is then used regularly, this will enable a graduated exposure to transradial interventions

while maintaining operator reassurance. If any issues arise, they can revert to their usual practice and complete the procedure.

A further potential deterrent is inventory building and appropriate equipment selection. New products are being made available by industry; however, there is no standardized classification or nomenclature for sizing purposes. As a result, this may cause confusion and lead to unexpected equipment incompatibility during a procedure. To avoid such an event, detailed preprocedural planning is of utmost importance.

Radial access should be viewed as an opportunity to expand procedural possibilities and improve patient care. Whether operators wish to change their practice to predominantly radial or use this site of access as an adjunct, dedicated training from the outset, knowledge of equipment selection, and careful case planning can overcome barriers and facilitate success.

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For decades, transfemoral access was the default vascular approach for diagnostic and interventional neurovascular procedures. With it came closure device failure and access site complications that happened more often than we would like to admit, and some were unfortunately devastating. However, there was no alternative for neurointerventionalists—or so we thought.

Although we were more hesitant to change our traditional vascular access, our interventional cardiology colleagues started adopting the transradial approach in 1989.[1] Over the years, and with several randomized controlled trials and other studies, interventional cardiologists have shown the safety and feasibility of performing a variety of procedures with this approach, including via documentation of major advantages over the traditional femoral approach, such as faster patient recovery postprocedure, higher patient satisfaction, fewer access site complications, and even reduced cost.[2-7] The indisputable benefits of transradial access (TRA) did not go unnoticed and, thus, TRA for neurointerventions has gained more traction in recent years.[8-13]

PATIENT-RELATED OBSTACLES

When planning TRA, patient comorbidities need to be considered. Relative contraindications include vasospastic diseases such as Buerger disease and Raynaud phenomenon and inflammatory conditions such as systemic lupus erythematosus and scleroderma. Absolute contraindications for TRA include presence of an arteriovenous fistula for hemodialysis, vaso-occlusive disease, and coronary artery disease requiring radial artery harvesting for bypass surgery. Calcific peripheral artery disease and atherosclerosis can affect the radial artery and may warrant prior ultrasound evaluation of the vessel.

Anatomic variations of the radial, brachial, and axillary arteries are common.[14] Such variants include tortuosity, vessel loops, and high origin of the radial artery (above the antecubital fossa). Catheters may be safely navigated through most anatomic variants once the operator is familiar with the anatomy. Ultrasound evaluation may be useful to identify anatomic variants prior to vascular access. After successful access, angiography of the limb may be helpful to visualize the vessel anatomy and safely guide a wire and catheter through the vessel.

A patient with known complex radial or brachiocephalic anatomy and/or prior access failure or possible complication such as radial artery dissection or perforation may not be a good candidate for TRA.

Anatomy of the great vessels and aortic arch as well as laterality of the lesion to be treated is another important consideration. Angles of vessel origin, aberrant anatomy, and arch configuration may allow for easier or more difficult (if not impossible) catheter navigation into the target vessel and provide a stable or unstable basis for the procedure. TRA can be beneficial, but if extensive catheter manipulation is required, it may prolong a procedure and increase the risk of periprocedural stroke. It is known that TRA is associated with higher incidence of foci of diffusion restriction after angiography and minor neurologic symptoms after diagnostic procedures.[15,16]

Managing a patient's discomfort and anxiety prior to the procedure is very important. The radial artery is very sensitive to catecholamines and thus vasospasm. A nervous and uncomfortable patient will have an increased vascular tone, which can result in spasm that may preclude TRA and/or catheter manipulation. A topical anes-

thetic cream at the site of arterial puncture while the patient is being prepared for the procedure can reduce discomfort during subcutaneous injection of anesthetic medication.

PROCEDURAL OBSTACLES

First and foremost, considering the endovascular procedure to be performed and the necessary catheter and device setup are important because TRA may not be suitable for large-bore guide catheters. The radial artery is smaller than the femoral artery, with a mean size of about 3.2 mm (± 0.6 mm) in men and about 2.7 mm (± 0.5 mm) in women.[17] Additionally, there are geographic differences, with the mean internal diameter of the radial artery being about 3.67 mm (± 0.8 mm) in the Western population[18] compared with approximately 2.63 mm (± 0.35 mm) in the Asian population.[19]

Patient and hand positioning are also important factors. An uncomfortable patient will not hold still, and a hand that is not properly positioned and stabilized will complicate vascular access unnecessarily. Radial arm boards are designed to help position the patient and the arm/hand ergonomically for the procedure, assuring patient comfort and cooperation and preventing the hand or arm from drifting, which allows for safe vascular access. Radial arm boards come in different shapes and lengths and at prices suitable for all budgets.

Local subcutaneous anesthesia at the puncture site is not only more comfortable for the patient but will reduce pain associated with vascular access that could potentially result in increased vascular tone and a higher propensity for radial artery spasm on catheterization.

Ultrasound guidance for precise puncture can be considered as repeated attempts at vascular puncture are shown to be an independent predictor of radial artery spasm[20] and need for crossover to femoral access. Other factors associated with radial artery vasospasm include female sex and small radial artery diameter.[21,22]

After insertion of the needle, a rapid flash of blood should be observed in the needle hub, followed by quick dripping of blood or even a short squirt of blood with each heart pulsation. This is a good indicator of proper alignment of the needle tip with the orientation of the vessel, which is important because advancement of the access wire should be as smooth as possible to avoid vasospasm, vessel dissection, or perforation. While the needle is still in the artery, some interventionalists may choose to make a small skin incision over the needle to facilitate the insertion of the dilator and vascular sheath. A hydrophilic sheath is best tolerated, and it has been suggested that the size of the vascular sheath should only be as large as needed for the procedure.[23,24] It is also recommended that the access devices are 1 F size smaller than the radial artery diameter to prevent vasospasm and future radial artery occlusion.

After inserting the vascular sheath, some operators opt to administer an intra-arterial "radial cocktail" consisting of vasodilator(s) and heparin to prevent catheter-induced vasospasm and radial artery occlusion. However, experienced operators have reported successful TRA procedures without the routine administration of intra-arterial spasmolytic medication.[20] Heparin can always be given intravenously if no intra-arterial medication is given, and administration can be via bolus doses or weight based.

If desired, a long sheath that terminates at the level of the brachial artery, rather than the radial artery along the forearm, may further reduce the risk of catheter-induced vasospasm if several catheter exchanges are anticipated.

Dedicated guide catheters for TRA are now available and offer support and trackability customized for this vascular access:

- Armadillo (0.072-inch inner diameter [ID]) (Q'Apel Medical)
- Rist (0.071-inch ID, 6-F catheter; 0.079-inch ID, 7-F catheter) (Medtronic)
- Zoom RDL (0.088-inch ID) (Imperative Care)

SUMMARY

TRA has its role in the neurointerventional practice and, with some considerations, can be performed safely and successfully. The individual patient, vascular anatomy, and procedure to be performed should be taken into account when planning the vascular approach.

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The transradial approach for peripheral endovascular interventions has grown in popularity over the past several years due to improvements in adjunctive device availability and the inherent safety of avoiding femoral artery access in high-risk patients. Longer low-profile hydrophilic sheaths, wire lengths, and balloon and stent delivery systems have made this possible. Historically, the medical literature suggests an improved safety profile of TRA compared to femoral artery access in coronary applications.[1,2] The recent advent of peripheral interventions is a less clear comparison because there are no current randomized comparisons of radial versus femoral artery access in this setting. However, there are many scenarios where radial access can provide an advantage for the interventionalist.

I prefer TRA in scenarios where the patient is at high risk for femoral access complications or the anatomy dictates an easier approach from above the diaphragm. This includes patients with previous endovascular or open aortic surgery, previous lower extremity bypass or femoral artery cutdown, calcified femoral vessels, or morbid obesity, or a restless patient. For mesenteric and renal interventions, I favor TRA in patients with steep downward angulated vessels. Success during TRA for peripheral interventions requires proper patient selection, pharmacologic therapy to prevent radial artery spasm, and long-length device availability.

When selecting patients for radial intervention, preprocedural evaluation of the radial artery by ultrasound and an Allen test are helpful steps to take. In a patient with a positive Allen test, ulnar collateral flow may not be sufficient to prevent hand ischemia in the event radial artery thrombosis occurs. Bedside ultrasound evaluation of the forearm can be used to assess radial artery diameter, presence of calcification, and whether significant vessel tortuosity is present. Because most peripheral interventions require a 6-F sheath, a radial artery diameter ≥ 2.5 mm is recommended to accommodate a 6-F hydrophilic sheath with a 2.54-mm outer diameter.

Setting up the procedural room for radial intervention and obtaining sufficient equipment are also essential components of a successful case. The room should be configured to allow enough space for longer wires and catheters, and the arm needs to be stabilized in an arm board with the wrist hyperextended. I usually also prep a secondary access site, such as the femoral vessels, in case there is an unanticipated need for additional vessel access. I prefer ultrasound-guided access with a low-profile, hydrophilic, 11-cm radial sheath to avoid spasm and multiple punctures of the vessel. When access is obtained, a radial "cocktail" should be administered that includes intra-arterial administration of heparin with verapamil and nitroglycerin to prevent spasm and vessel occlusion.[3] For lower extremity interventions, approximately 350- or 400-cm-long guidewires and 200-cm–working length balloons and stents are needed to reach the femoral popliteal arteries.

Another potential obstacle can occur when advancing and removing the guide sheath. I highly recommend using a hydrophilic, low-profile guide sheath designed for transradial delivery. These sheaths typically have a smaller outer diameter, while preserving a 6-F working ID, and should be advanced and removed over a stiff guidewire with the inner dilator still in place. With the right equipment and a carefully selected patient, radial access can provide a safe and advantageous approach for endovascular treatment of peripheral vessels. ■

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