Transradial Access: When to Lay Down Arms and Fall Back to Femoral

A tutorial on how to optimize transradial success by avoiding obstacles.

BY AMISH PATEL, MD; KEVIN "CHAIM" HERMAN, MD; VIVEK V. PATIL, MD; AND AARON M. FISCHMAN, MD

In recent years, many interventionists have taken up arms to join the so-called radial revolution. Potentially offering decreased bleeding complications, increased patient preference, improved quality of life, and decreased hospital costs, transradial access is an attractive alternative to transfemoral access.[1-4] However, transradial access does carry some unique challenges. By highlighting these obstacles to transradial access and potentials for failure, we hope to provide insight on how to succeed at transradial interventions.

So, when should you not use transradial access?

WHEN YOU DON'T HAVE THE RIGHT TOOLS

The tools needed for transradial access and intervention are not likely to be part of the average practice's toolbox. Having the right tools may mean the difference between success and failure. Although the 7-cm, 21-gauge, echogenic-tipped needle included in most micropuncture kits will suffice in achieving transradial access, a shorter 2.5-cm, 21-gauge needle allows for better control when accessing the relatively superficial radial artery. Once needle access is obtained, standard 0.018-inch guidewires are often sufficient for wiring the artery. When it cannot be passed, try changing the angle of the bevel by rotating the needle while probing the artery with the wire. Alternatively, using a specialty wire with an atraumatic tip and hydrophilic, stiff shaft like the Nitrex guidewire (Covidien) may help.

Once wire access is obtained, using a hydrophilic-coated sheath will ease insertion, minimize spasm, and prevent damage to the artery. In fact, using only hydrophilic catheters and sheaths for transradial intervention will avoid spasm, and worse, avulsion of any of the traversed arteries.

Additionally, almost all transradial visceral interventions will require longer catheters compared to transfemoral interventions. For most abdominal interventions involving the renal, mesenteric, or celiac branch arteries, a 110-cm catheter will suffice (Optitorque Sarah, Terumo Interventional Systems). For pelvic interventions (uterine fibroid embolization or iliac intervention), ≥ 125-cm catheters are usually necessary (Tempo Aqua, Cordis Corporation). However, some long catheters, such as the Glidecath (Terumo Interventional Systems) may be too soft for controlled torqueability around the bend of the aortic arch.

For certain interventions, the necessary tools may not yet exist. Long catheters are not available for infrainguinal interventions. Further, the radial artery is not of sufficient size to accommodate the large-bore access needed for deploying large stents or multiple stents simultaneously (multiple snorkeled stents during endovascular aneurysm repair, for example).

Upon completion of the procedure, nonocclusive, patent hemostasis has been shown to be superior to occlusive pressure in maintaining arterial patency while achieving hemostasis.[5] Although this can be performed manually, there are several devices designed for this specific purpose. In our labs, the TR Band (Terumo Interventional Systems) is the most commonly used. Alternatively, nonocclusive hemostasis can be achieved with manual pressure and a compassion bandage (TipStop, Baxter International Inc.).

WHEN WORKING NEAR THE ARCH

Catheterization of small vessels originating near the aortic arch will likely require a significant amount

Figure 1. Digital subtraction angiogram (DSA) of the proximal descending aorta shows the origin of the right bronchial artery (arrow). Note the acute angulations needed to catheterize it via a transradial approach (dashed line).

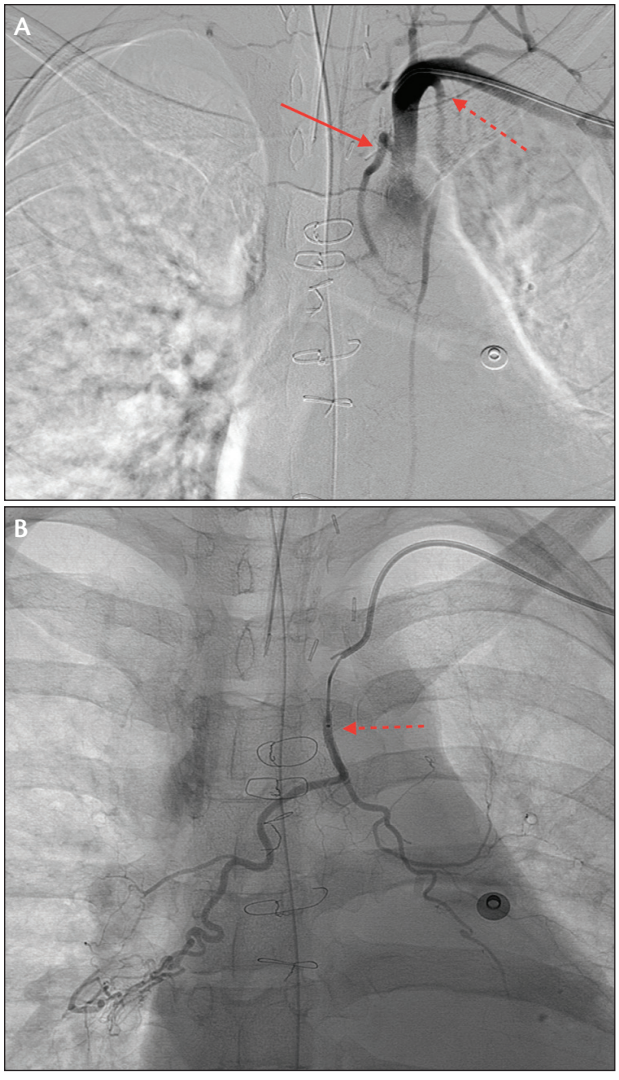

Figure 2. DSA (A) of the left subclavian artery demonstrates aberrant origin of the bronchial artery from the left subclavian artery. Note the usual origin of the left internal thoracic artery, which can be easily catheterized via a transradial approach. Selective bronchial arteriogram (B) after easy catheterization and prior to embolization.

of catheter manipulation from a transradial approach, increasing the risk of a neurologic complication. This is the case during bronchial artery embolization in which two acute and adjacent turns are necessary to catheterize the bronchial arteries successfully (Figure 1). In the majority of cases, this is more easily and safely achieved via transfemoral access. In the rare case of an aberrant origin of a bronchial artery from the subclavian artery, transradial access allows the most direct access to the target vessel (Figure 2). Similarly, catheterizing the ipsilateral or contralateral internal thoracic arteries may also be made simpler by utilizing a transradial approach (Figure 2).

WHEN YOUR PATIENT DOESN'T WANT IT

Although complication rates are reported to be lower for coronary intervention via a transradial approach compared to a transfemoral approach, the data for visceral interventions are lacking.[4,6] Further, the coronary intervention data may not be transferrable to visceral intervention given the absence of strong anticoagulants during most visceral interventions. As such, the strongest support for transradial approach for visceral interventions is patient preference. By using a transradial approach, patients are able to ambulate immediately after procedures. Patients who rely on their fine motor skills for work, however, (eg, classical pianists or endovascular physicians), may prefer a transfemoral approach. Although diligent patient selection and evaluation of ulnopalmar patency can reduce the likelihood of a clinically relevant complication, it may still be a possibility that some patients are not willing to accept.

WHEN THE PATIENT CANNOT PHYSICALLY COOPERATE

Patients with physical impairments from previous cerebrovascular accidents or debilitating arthritides may

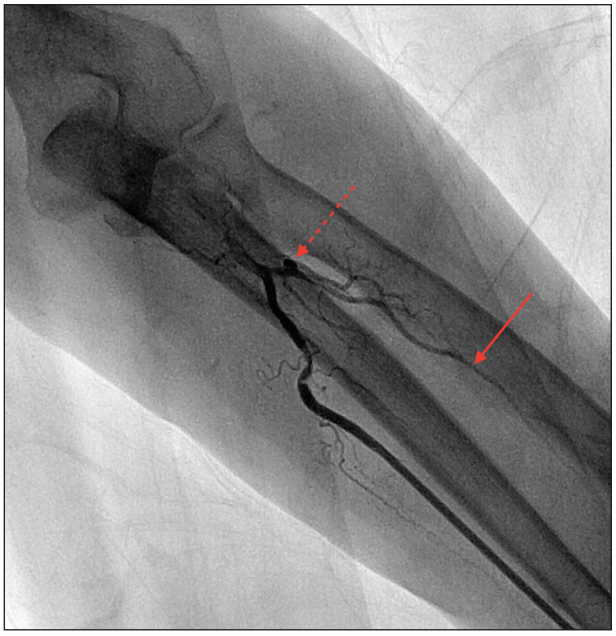

Figure 3. Left ulnar arteriogram after transulnar access shows a prohibitively small left radial artery (solid arrow) becoming diminutive immediately distal to a radial loop (dashed arrow).

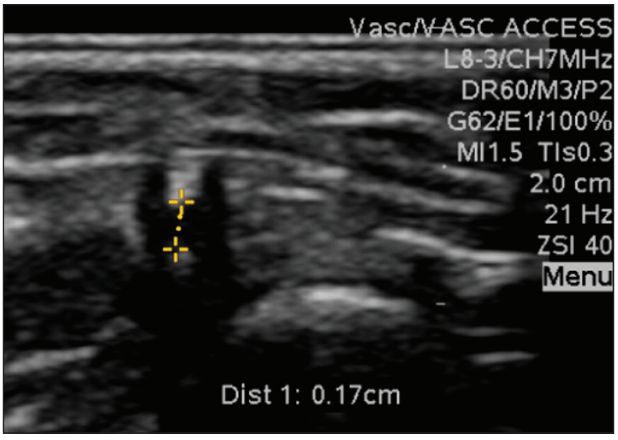

Figure 4. Grayscale ultrasound of the arm shows a left radial artery (dashed line) less than the 2-mm threshold.

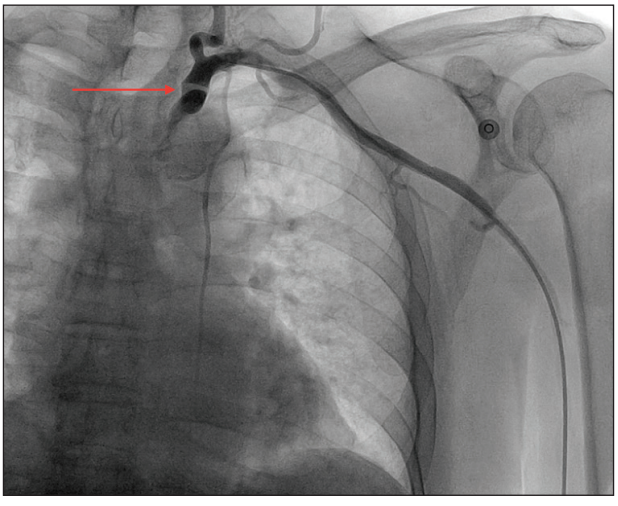

Figure 5. Left subclavian arteriogram shows the characteristic changing density of contrast in a tortuous vessel en face (arrow).

have upper extremities that make it difficult or impossible to access the radial artery. The operator's tolerance and persistence will determine the access in these patients.

WHEN THE PATIENT DOESN'T HAVE ADEQUATE COLLATERAL CIRCULATION

If the patient does not have ulnopalmar arch patency (Barbeau type D), transradial access is contraindicated because thrombosis of the radial artery would result in ischemia to the hand. In these patients, however, transulnar access may be used if the ulnar artery is of sufficient size (> 2 mm, Figure 3). Likewise, if the radial artery is of insufficient size on preprocedure ultrasound evaluation (Figure 4), transulnar access may be used if radiopalmar arch patency is present.[7]

WHEN THE PATIENT MAY NEED THE ARTERY FOR DIALYSIS ACCESS OR BYPASS GRAFT

If during transradial intervention, the sheath or catheter crosses an anastomosis of an arteriovenous dialysis fistula, the access could become occluded and unknowingly thrombose. Although transradial access for dialysis intervention has been shown to be safe and effective,[8] inadvertent occlusion during visceral intervention may be more likely since the operator's attention is not on the dialysis access itself.[9] This complication may be avoided by periodically monitoring flow through the dialysis access by simple physical examination for the usual thrill.

Similarly, transradial access should be avoided in patients with chronic stage 4 kidney disease, defined as glomerular filtration rate (GFR) > 30. Although a formal recommendation is absent from the KDOQI guidelines,[10] these patients may nevertheless rely on the forearm arteries for future hemodialysis access creation. Likewise, foreseeable harvesting of the radial artery as an arterial conduit for coronary artery bypass grafting would serve as a relative contraindication to transradial intervention.

WHEN THERE IS SOMETHING IN YOUR WAY

The anatomy of upper extremity arteries may provide obstacles to passage of the catheter. Patients may have tortuous central arteries (Figure 5) that are difficult to

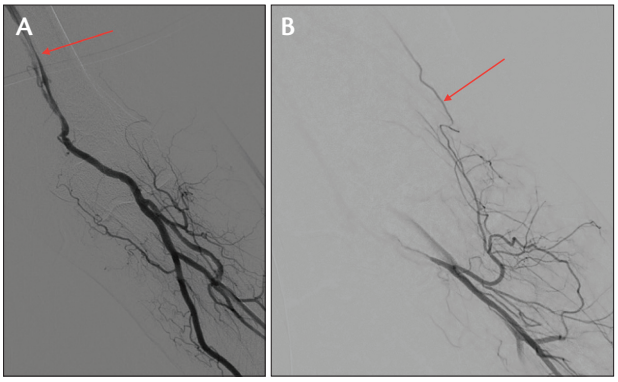

Figure 6. Left brachial arteriogram (A) shows a stenosis (arrow) in the left brachial artery in a patient with a previous transbrachial access. Reflux left radial angiogram (B) in a different patient shows complete occlusion of the left brachial artery with collateral formation (arrow) in a patient with previous transbrachial access.

cross. More commonly, a tortuous aorta makes catheter steering difficult below the diaphragm. Patients who have had previous brachial interventions may present with brachial artery stenoses or occlusions (Figure 6). Additionally, radial, ulnar, and brachial arteries may have loops that obstruct catheter passage (Figure 7). Passing a floppy wire through the loop, then quickly retracting it stresses the wire into a straight orientation, thereby reducing the loop. Intervention across a straightened loop may cause spasm and significant discomfort to the patient, requiring additional intra-arterial vasodilator medication and sedative medications. However, just as transfemoral access may be preferable in patients with tortuous upper extremity arteries, transradial access may be preferable in patients with tortuous pelvic arteries, diseased common femoral arteries, or abdominal aortic aneurysms.

Patients who undergo multiple transradial interventions (dialysis access or hepatic transcatheter therapy) may present with thrombosed radial arteries, seemingly prohibiting further transradial access. However, transradial access and intervention may still be performed by accessing the vessel using ultrasound guidance and using a specialty guidewire such as those previously described to gain entry to a more proximal patent vessel. Patients undergoing repeat transradial intervention may present with other complications such as hematomas or pseudoaneurysms (Figure 8). In these cases, transfemoral access may be preferred for arterial interventions or transvenous access for dialysis access interventions.

WHEN YOUR EVALUATION IS INCOMPLETE

Successful transradial intervention will occur most frequently for the diligent interventionist. This includes

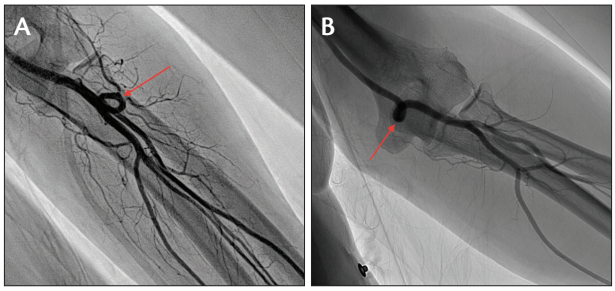

Figure 7. Left brachial arteriograms in different patients show arterial loops (arrows) in the radial (A) and brachial (B) arteries.

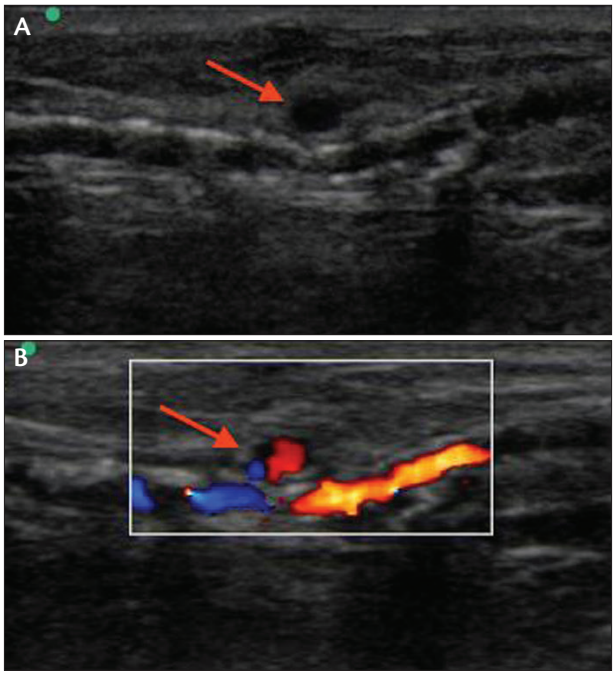

Figure 8. Grayscale (A) and color Doppler (B) ultrasound images show the typical "yin-yang" appearance of a radial pseudoaneurysm. This was successfully treated with ultrasound-guided percutaneous thrombin injection.

simple measures like evaluating the tortuosity of the aorta on a chest radiograph, assessing for ovarian supply on an MRI before fibroid embolization, and considering the angulation of the target vessel for catheterization. Unfavorable visceral artery anatomy such as tortuosity or cranial angulation may require the use of specialty guide catheters for support that may not be designed for transradial use.

Further, ultrasound evaluation of the upper extremity may allow for identification of arterial loops, stenoses, and occlusions that are otherwise clinically silent. Similarly, using ultrasound during access will likely mini-

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mize your passes during initial puncture, increase your chances of obtaining access, and minimize your likelihood of complications.

CONCLUSION

Although the skill set needed to be a proficient transradial interventionist is often described as having a steep learning curve, success may ultimately lie in the use of due diligence to avoid failures. Nevertheless, early failures should not serve to dissuade the transradial access novice. ■

Amish Patel, MD, is with the Interventional Institute at Holy Name Medical Center in Teaneck, New Jersey. He has disclosed that he has no financial interests related to this article. Dr. Patel may be reached at amishpatelmd@gmail.com.

Kevin "Chaim" Herman, MD, is with the Interventional Institute at Holy Name Medical Center in Teaneck, New Jersey. He has disclosed that he has no financial interests related to this article. Dr. Herman may be reached at (201) 227-6210; hermankc@gmail.com.

Vivek V. Patil, MD, is with the Division of Interventional Radiology, Icahn School of Medicine at Mount Sinai in New York, New York. He has disclosed that he has no financial interests related to this article.

Aaron M. Fischman, MD, is Assistant Professor of Radiology and Surgery, Division of Interventional Radiology, Icahn School of Medicine at Mount Sinai in New York, New York. He has disclosed that he is a paid consultant for Terumo Interventional Systems. Dr. Fischman may be reached at (212) 241-7409; aaron.fischman@mountsinai.org.

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