What Is Your Radial Access Cocktail, and Why?

Preferred strategies for mitigating risk of radial artery spasm.

With Dejah R. Judelson, MD; Brian M. Snelling, MD; and Sabeen Dhand, MD

Radial access for arterial intervention is a necessary adjunct in diagnostic imaging and intervention of peripheral artery disease. Radial artery access was first published in 1948 with a cutdown by Dr. Stig Radner to image the thoracic aorta. In the late 1980s, a series of 100 cases was published on percutaneous radial access for percutaneous coronary intervention. It has well been established in the cardiology literature that there are several benefits to percutaneous radial access over femoral access, including a reduction in access site complications, reduced bed rest and earlier ambulation, and improved patient experience. Vascular surgeons have been understandably slow to adopt radial access for peripheral interventions. Unlike coronary angiography where all lesions can be accessed by a radial approach, one cannot reliably treat the tibial and pedal vessels from a radial approach. Additionally, sheaths > 6 or 7 F are unlikely to be accommodated in a radial artery without running the risk of “radial artery on a stick.” Adequate sheath support or purchase for a mesenteric intervention may be limited with a radial approach. However, with appropriate patient and case selection, radial access can be an excellent adjunct to an interventionalist’s toolkit. I prefer to use radial access if I’m performing diagnostic imaging or possible intervention for patients with a previous aortobifemoral bypass graft or kissing iliac stents. Navigating the raised aortic bifurcation in these patients can be difficult from a retrograde approach, and selection from above is very straightforward. I also prefer radial access for mesenteric angiography as the downward angle is favorable.

When planning a radial access, I perform an Allen test to confirm the patient is ulnar dominant or codominant. I prefer to access the left radial because the right radial has often been previously accessed by my cardiology colleagues, and crossing the aortic arch unnecessarily increases the stroke risk and length to treatment. Under ultrasound, I assess the course of the radial artery and find a location where it is healthy and large enough in the distal third of the forearm (minimum, 2.5 mm). Radial arteries, especially in younger female patients, have a propensity to go into spasm. Injecting lidocaine with a small needle (27 or 25 g) in a superficial wheal avoids trauma to the vessel and allows for a more precise angle for access. I always use a 4-F micropuncture kit for access—I’m comfortable with visualizing the needle and wire, and the sheath is atraumatic. When I have confirmed access, the patient gets systemically heparinized for a goal activated clotting time (ACT) > 230 to 250 seconds. Additionally, I will give at least 100 µg of nitroglycerin through my micropuncture sheath (more if the blood pressure will tolerate it) and chase it with an additional 10 to 20 mL of heparinized saline. This reduces vasospasm when I upsize my sheath, and I can then proceed with my intervention. At the end of the case,
before I remove my sheath, I give an additional 100 to 200 µg of nitroglycerin to avoid radial artery spasm (RAS) in the forearm because this is often where sheaths get stuck and hematomas can occur. I find the most helpful “cocktail” for radial artery access is nitroglycerin because the blood pressure tolerates it. I keep my ACT > 230 seconds while the sheath is in place and redose frequently. With appropriate patient and case selection, thoughtful planning, and plenty of heparin and nitroglycerin, radial artery access is an excellent option for mesenteric, renal, and peripheral intervention.

The radial cocktail classically comprises a combination of antispasmodic and anticoagulant medications administered intra-arterially to mitigate the risk of RAS and radial artery occlusion (RAO), which are known risks of transradial access. Using a narrow definition of “radial cocktail,” I administer 5 mg of verapamil and 200 µg of nitroglycerin intra-arterially for every transradial access procedure after placement of the sheath. The medications are mixed into 20 mL of the patient’s blood, aspirated from the radial sheath, to reduce discomfort on administration. The specific choice of medications and their doses are based upon a meta-analysis of 22 prospective trials demonstrating the lowest risk of RAS with this specific regimen.1 Theoretical concerns of hypotension after administration have not been borne out in my practice, and these medications are administered without systemic effect, even in cases when hypotension is to be strictly avoided, such as intracranial mechanical thrombectomy or in patients with concerns for elevated intracranial pressure.

Anticoagulation is administered in the form of intravenous (IV) unfractionated heparin at a dose of 50 µg/kg or 5,000 IU, whichever is greater. The literature has shown no difference in RAO rates when comparing IV and intra-arterial bolus administration.2

During cerebral angiography and elective neurovascular interventions, IV heparin is administered when the Simmons 2 diagnostic catheter is shaped in the aortic arch and able to select a supra-aortic vessel of interest. This temporal delay between intra-arterial antispasmodic and IV heparin administration is performed to ensure there is no anatomic variant (such as an arteria lusoria) that would preclude the completion of the cerebral angiogram via transradial access. Thus, one can avoid the scenario of crossing over to transfemoral access in a patient who has just been administered a heparin bolus, which would increase the risk of transfemoral access site complications. For both ischemic and hemorrhagic stroke cases, heparin administration should be tailored to the clinical situation. For example, with ruptured cerebral aneurysms, heparin administration is delayed until the aneurysm has been secured with coil placement into the aneurysm to prevent rerupture. I do not routinely administer heparin during mechanical thrombectomy given the risk of hemorrhagic transformation of infarcted brain, as well as the fact that patients are frequently administered tissue plasminogen activator prior to the procedure.

If one takes a broader view of radial cocktail to encompass all RAS and RAO risk mitigation strategies performed at the beginning of the procedure, I also judiciously use procedural sedation and employ the use of 23-cm radial sheaths to reduce the risk of RAS. Cerebral angiography requires frequent catheter manipulation for vessel selection, which may increase the risk of RAS. Procedural sedation has been shown to reduce RAS, and 23-cm sheaths prevent or limit radial artery exposure to catheter manipulation.3

RAS can be an aggravating nightmare that can really discourage operators from using this access in their careers. My “radial artery cocktail” has been adopted from the interventional team of radial pioneers at Mount Sinai Medical Center in New York, New York: 200 µg of nitroglycerin, 2.5 mg of verapamil, and 3,000 IU of heparin. Both nitroglycerin and verapamil are included to reduce spasm, and heparin is used to avoid thrombosis. I slowly administer this solution (hemodiluted to 20 mL) through the sidearm of the sheath as soon as it’s placed into the radial artery. As it has been described extensively in the past, the hemodilution and slow administration will decrease the burning sensation that many patients typically feel in their hand. In my experience, when attempting to hemodilute to lower volumes (eg, 10 mL if that is the syringe you have the solution in), the majority of patients will feel a painful burning sensation that lasts a few seconds.

The radial access cocktail above is solely a guideline, and in some clinical situations, I will hold the heparin. These include conditions that the patient is either actively bleeding or at a high risk of bleeding: ruptured intracranial aneurysms, acute ischemic strokes, and visceral bleeding (unless performing provocative mesenteric angiography). I am very reluctant to hold the nitroglycerin and verapamil, even in cases where the patient’s blood pressure is labile, because severe spasm can result in a horrific access, terrible access complications, and severe patient discomfort. Other very important tips to avoid spasm include ultrasound-guided, single-wall access, early identification of a radial loop, use of hydrophilic devices, and gentle advancement of various large-bore catheters.

Sabeen Dhand, MD
Interventional Radiologist
Los Angeles Imaging and Interventional Consultants at PIH Health
Los Angeles, California
sabeen.dhand@pihhealth.org
Disclosures: None.