What We Learned After Starting a 'Radial First' Program

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Eight months ago, our lab took up the challenge that Olivier Bertrand of Laval Hospital in Quebec City laid down regarding becoming a predominantly radial access program for best patient outcomes. We re-read the articles in *Cath Lab Digest* by Drs Popma,[1] Rao,[2] and Coppola.[3] My partner, Dr. Pranav Patel, and I told the cath lab that the radial approach will be harder for us all at the start, but this should be a better way for the patients and ultimately, the lab. What did we learn from beginning a radial program from the ground up?

The Oximetric Allen Test

We learned that the traditional Allen's test was often subjective. The traditional Allen's test uses our observation of the time (usually about 8-10 seconds) to pink palm color return after releasing the compressed ulnar artery while continuing to compress the radial artery. The subjective nature of the Allen's test can be overcome by using a pulse oximeter. This objective and easier method starts with placing the pulse sensor on the index finger. Observe the pulse waveform. Compress the radial artery. A patent ulnar artery will be associated with a strong pulse waveform. Minimally reduced or partially limited ulnar flow will have blunted waveform, while a poor ulnar supply will have a flat pulse waveform. A normal pulse wave is type A, blunted waveform is type B, and flat waveform is type C. We will proceed with radial access for types A or B, but not C (Figure 1).

The Arm Prep

We recently found a way to use a glove to cover the hand and forego the cumbersome drapes and clips used to secure the sterile towels around the wrist (Figure 2. Also see, "The Armen Glove" in *CLD* May 2010). To use the glove method, the hand and forearm are shaved and bathed in sterile antiseptic solution, and placed on the sterile-draped arm board. Instead of several small blue towels with clips, we put a large sterile glove over the hand. Additionally instead of a stay suture, we secure the sheath after placement by a clear tegederm patch with a hole cut for access to the sheath valve. After the prep and radial sheath insertion, the arm is then moved to the patient's side. Do not forget

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Figure 1. Pulse oximeter and waveforms of Allen's Test. A) Full pulse wave displayed, B) Flat pulse wave, type C, shown when both radial and ulnar arteries compressed. C) patency of ulnar artery supply confirmed with release of ulnar compression and observation of type A waveform.

Disclosure: *Dr. Kern reports that he is a speaker for Volcano Therapeutics and St. Jude Medical, and is a consultant for Merit Medical and InfraReDx, Inc.*

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Figure 2. Armen Glove and tegederm securing dressing.

to prep the groin in case that radial access fails (<1 in 10 after the initial 25 cases).

The Wrist

Accessing the radial artery with a micropuncture needle and guide wire is the hardest part of radial access for our fellows and me. To facilitate needle entry, we learned to hyperextend the wrist by placing a rolled towel under the wrist. We use a small amount (a wheal the size of a dime) of subcutaneous lidocaine. Using light palpation, center the needle over the artery, and keeping the needle at 30 degrees from the horizontal plane, advance the needle slowly, observing for blood. While there are two schools of thought on the puncture technique, we favor the front-wall stick with 0.018-in guide wire over the "through-and-through" puncture. I think using a plastic cannula is an additional and unnecessary step, but it is subjective. Whatever works best for the operator is best for the patient in this case. After entering the artery, do not move the needle.

The second major point of difficulty is advancing the guide wire. When the wire does not advance smoothly, consider a few causes. Artery spasm, wire entry into a small branch, or the needle partly in the artery wall are all possible sites of resistance. When resistance to wire advancement is encountered, retract the wire, spin it gently and try again. Retract the wire and apply a small bend, and re-introduce it. Use of a coated wire can be tried. These maneuvers must be done relatively quickly, as clotting in the micropuncture needle will occur within 4 minutes without anticoagulation.

The Arterial Sheath

After guide wire is in the artery, we give more lidocaine on each side of the needle (with the wire still inside) then nick the skin at the needle. The needle is removed and the sheath inserted with a rotating movement over the wire as far as it will go. If no resistance is encountered, the sheath is fully advanced, and the obturator and wire are removed. If resistance is met, we stop and remove the guide wire, and give verapamil (2.5-5mg) and occasionally NTG (200mcg) through the sheath obturator. The verapamil is diluted in 10 ml of blood (if the obturator is removed, we will use the side arm of the sheath). Dilution of medication in blood reduces burning in the hand. Heparin is then given through an IV route rather than intra-arterial (IA), which can also be painful. After sheath advancement, the sheath is then secured as above and the arm moved back to the patient's side to begin catheter introduction.

Forearm Vasospasm

Vasospasm can prevent smooth catheter passage and grip the catheter to prevent torque or catheter removal without pain. When we have difficulty advancing the 0.035-in guide wire or catheter, we obtain an angiogram (Figure 3). We have seen spasm and its relief with more vasodilators (nitroglycerin 200-400mcg IA, verapamil 2.5-5.0 mg IA, and a tincture of time. Using a glide wire and downsizing from 6 to 5F has also been helpful.

The Tortuous Shoulder

We learned that there is large variation of pathways as the guide wire moves across the shoulder, through the right subclavian to the brachiocephalic trunk, and down to the ascending aortic position. The relation of the arch vessels to the transverse aorta can cause delay in central catheter positioning. It is not unusual to use a catheter with a sharply angled tip to direct the wire from the descending aorta across the transverse aorta to the ascending segment. A helpful maneuver is to have the patient take a deep breath, which elongates the aortic arch and facilitates catheter positioning. We found the most difficulty in getting to the central aorta in short, elderly patients (Figure 4).

Coronary Catheter Seating

We learned that a catheter that can perform both left and right coronary angiography saves time and reduces catheter exchanges. The Jacky catheter (Terumo Medical Corp., Somerset, NJ) works most of the time to engage both the right (RCA) and left coronary arteries (LCA), but requires some practice. Occasionally it will not successfully engage the LCA, but might get the right. Other times, it will get the left and not the right. For the LCA, the Judkins left (JL) 3.5 works as an alternative catheter for the Jacky, but other shapes can also work. For the RCA, the right Judkins catheter is a standard alternate. Operator experience with several catheters should be encouraged. Patience and practice will determine catheter selection after the standard shapes fail. Beware of deep seating with the Jacky, especially for the RCA.

Left Ventriculography

After coronary angiography, a 260-in exchange wire is used to position the pigtail and assist in crossing the aortic valve. After placing the pigtail, left ventriculography is performed in a standard fashion. The only note we add is that the left ventricular (LV)-aortic (Ao) pullback should be over a short distance, compared to the femoral LV-Ao pullback. We remove the pigtail catheter from the arm after straightening the curl with a guide wire in the central aorta to prevent scraping the subclavian or brachial artery on the way out.

The Wrist Band

We gravitated to the Terumo inflatable band, because the perception that

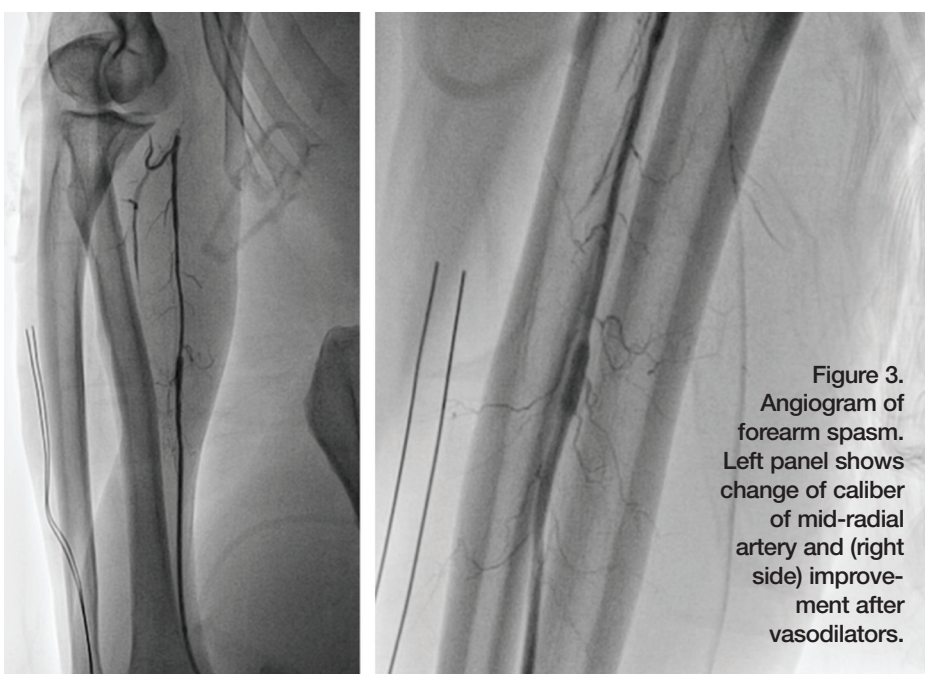
Figure 3. Angiogram of forearm spasm. Left panel shows change of caliber of mid-radial artery and (right side) improvement after vasodilators.

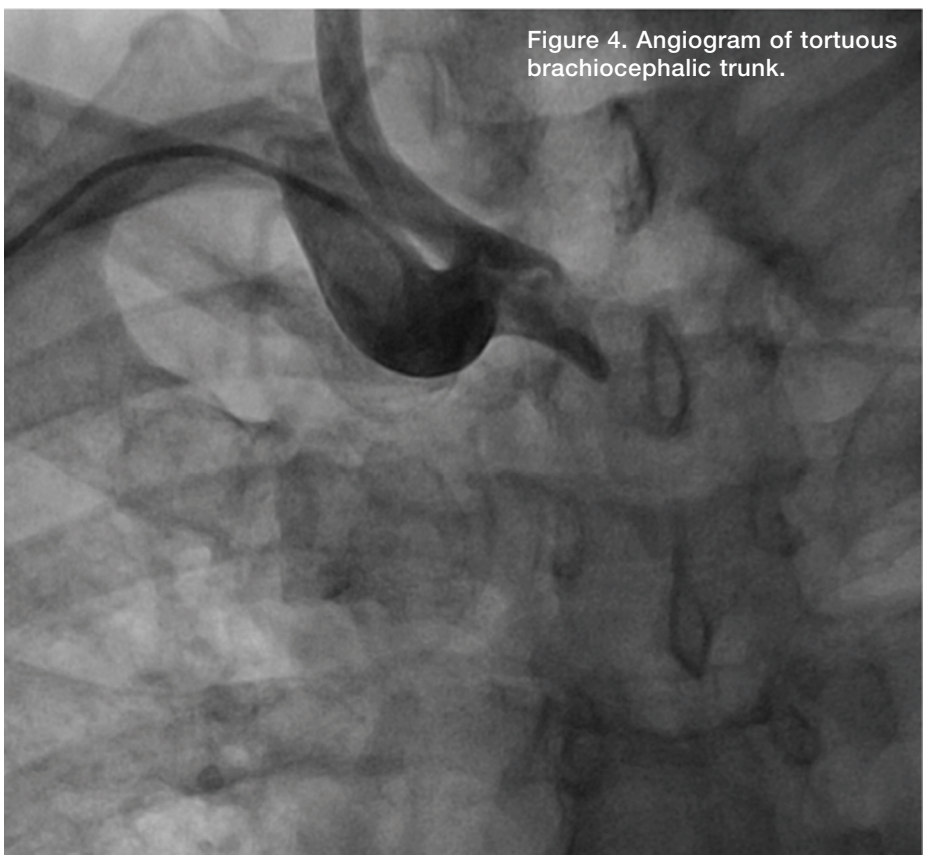
Figure 4. Angiogram of tortuous brachiocephalic trunk.

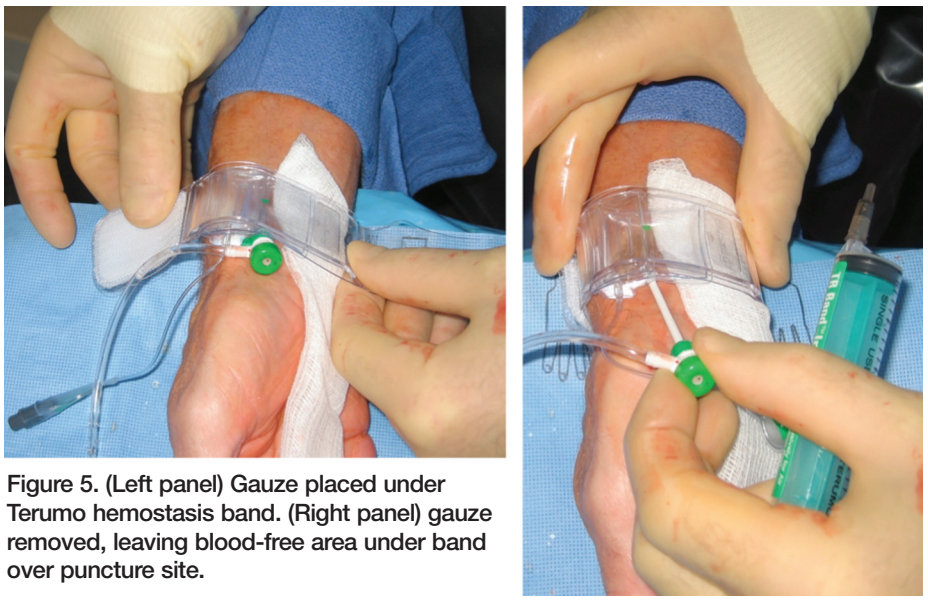

Figure 5. (Left panel) Gauze placed under Terumo hemostasis band. (Right panel) gauze removed, leaving blood-free area under band over puncture site.

Figure 6. (Left panel) 7F sheath is positioned in brachial vein. (Right panel) The right arm has both sheaths for right and left heart hemodynamics.

Figure 7. Got radial?

preserved radial flow with sufficient arterial compression to obtain hemostasis seems like a good idea. During band application, in order to keep the puncture site free of blood, we place a thin layer of gauze under the clear band parallel to the sheath. To help in positioning the band, we pull the sheath out of the artery about a centimeter, or far enough to have a good centering of the green dot (center of the pressure bulb) on the puncture site. As recommended, we inflate the band with 15 ml air, pull the sheath out of the artery, then slowly deflate the band until we see a flash of blood from the puncture site and then add 2 ml of air. Our final maneuver is to pull the gauze across the area near the puncture site, capturing remaining blood under the band and leaving a clean area around the puncture (Figure 5). This maneuver assists in recognizing future leaks, as well as prevents sticking of the band at the site on removal. After the band is placed, we let the patient use his arm for normal, but not excessive, activity. After 1 hour, we reduce air in the band and at 2 hours, we take the band off. Some labs keep a pulse oximeter on the hand, but with a normal Allen's, this should be unnecessary.

Right Heart Cath From the Arm

Right heart cath from the arm presents a real problem for the radial approach. We have successfully used a large brachial vein, but as many times been unsuccessful in gaining adequate venous access (Figure 6). The medially-oriented brachial vein is better than the lateral cephalic vein, because of the acute angle that the cephalic vein takes into the subclavian vein. We used a micropuncture guide wire and 6F sheath, or 16-gauge angiocath and 0.035-in short guide wire to insert a 7F sheath in the brachial vein. A 5F pediatric or 7F balloon-tipped pulmonary artery catheter was then easily positioned for right heart hemodynamics and cardiac outputs. A femoral vein can be used, but try not to hit the femoral artery when getting access.

A nice aspect of our radial access program is the satisfying reports from the radial patients having diagnostic procedures who also undergo femoral percutaneous coronary intervention at other institutions. They uniformly remark on the superiority, from their viewpoint, of the radial method. My wife heard me talking about this and thought it was such a good idea she wanted to remind everyone in my lab (Figure 7).

We hope these practical tips will be helpful for your radial program. Tell us about your good ideas for new approaches to better cath techniques. ■

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