Brachial and Axillary Arterial Access

An overview of when and how these approaches are used.

BY THOMAS A. SOS, MD

Due to the wide variety of lesion types, locations, and access-route challenges in patients with peripheral vascular disease, today's interventionists must know and understand a corresponding variety of access techniques. Each access location has benefits and drawbacks, many of which have been demonstrated in previous clinical studies, and these must be carefully weighed before selecting the appropriate access for each individual patient's presentation. Although not routinely used by many, there is an important role for vascular intervention via brachial and sometimes even axillary access techniques.

The indications for brachial and axillary access are quite similar to those of the radial approach. These include the presence of an occluded or severely diseased aortoiliac segment, operator preference in visceral artery interventions or when working with stent grafts requiring multiple accesses, infected/excoriated inguinal regions, and severely obese patients. The major drawback to using the upper extremity access sites is the length of the instruments required to reach even the visceral branches; generally, lesions below the popliteal artery are difficult to reach and treat. The primary advantage is the more direct line of entry into the usually caudally oriented proximal visceral arteries.

AXILLARY ACCESS

The axillary artery was the first upper extremity access site used by angiographers. Three decades ago, Hessel et al conducted a large survey regarding the complications of angiography.[1] This study showed that the incidence of complications using the transaxillary approach was much greater than those seen with the translumbar or transfemoral approaches. When the cases were analyzed in greater detail, the most frequent and severe complication of the transaxillary approach was shown to be hemorrhage, which could potentially produce brachial plexus compression syndrome injuring the median or ulnar nerves. Thereafter, investigators began to search for

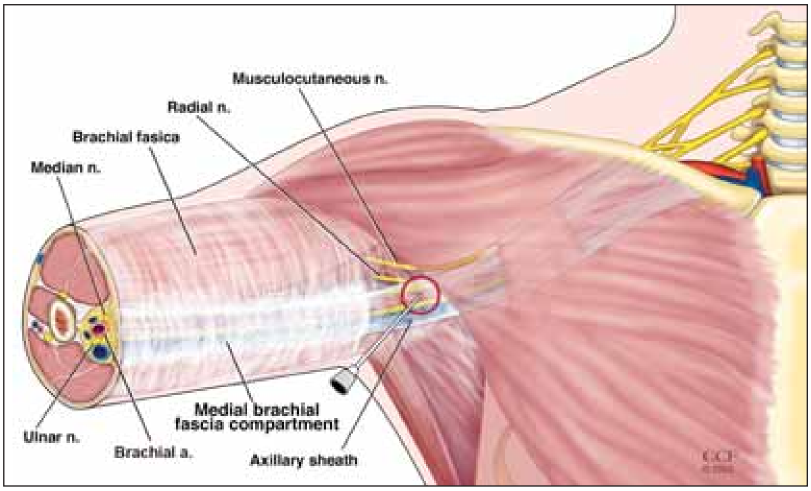

Figure 1. The medial brachial fascial compartment. Reprinted and modified with permission from Cleveland Clinic Center for Medical Art & Photography © 2003-2010. All Rights Reserved.

alternative upper extremity approaches as well as methods to reduce the complications of using this access site when it is necessary.

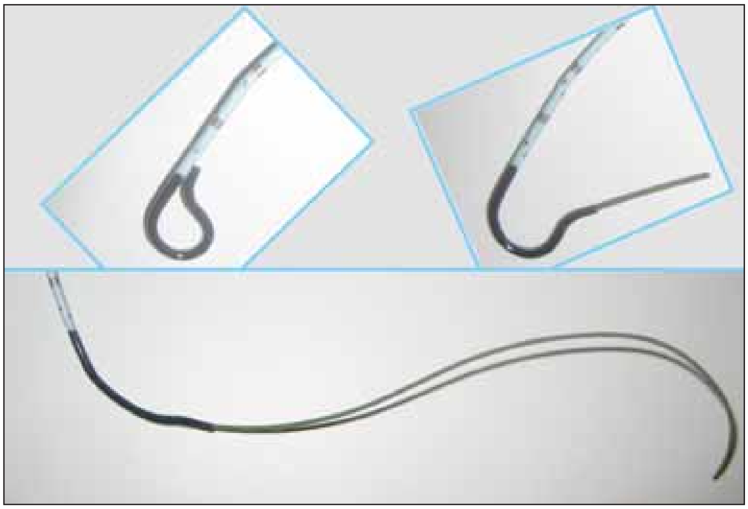

Figure 2. Omni Flush catheter (AngioDynamics, Queensbury, NY) for redirection of the wire from the left or right subclavian artery into the descending thoracic aorta.

UNIQUE ANATOMIC CONSIDERATIONS: THE MEDIAL BRACHIAL FASCIAL COMPARTMENT (MBFC)

The anatomy of the structures surrounding the axillary and brachial arteries and the nerves are considerably different than those of the radial artery and influence the complications due to accessing them. The MBFC, a tough fibrous sheath was first described by Smith et al, as extending along the axillary and brachial arteries starting "outside a thin axillary sheath to the elbow. The median and ulnar nerves are within the MBFC at an arterial puncture site just lateral to the anterior axillary fold. The radial and musculocutaneous nerves exit the MBFC more proximally. The different levels at which the major nerves of the brachial plexus exit the MBFC explain the anatomic distribution of the nerve injuries associated with compression by a hematoma after transaxillary arteriography."[2]

This anatomy is also the foundation for the compressive complications and the nerves affected that can occur as a result of puncturing the brachial artery; blood escaping from puncture at any part of these arteries can spread within the MBFC to compress the nerves.

THE BRACHIAL APPROACH

It was originally hoped that the high brachial puncture, initially described by Lipchik et al, would eliminate the relatively high risk of nerve compression when puncturing the axillary artery.[3] Lipchik stated that the brachial artery is a better access choice because it is more easy to puncture than the axillary, which rolls considerably more. Therefore, brachial puncture and post-procedure compression are easier, and should one occur, a hematoma will be recognized earlier and therefore be less likely to compress the nerves. As described previously, there are also fewer nerves surrounding the brachial artery than the axillary artery. These nerves spare the ventral surface of the brachial artery, so there is less chance of a direct needle injury during puncture.

However, it is now recognized that the risks of the axillary, high brachial, and even the low brachial approaches are somewhat "equalized" because hematomas can spread very easily within the medial brachial fascial compartment, thus the median and ulnar nerves within the same fascia at both the axillary and brachial locations are potentially vulnerable to nerve injury.[2] This realization was disappointing because the most compelling reason to use the high brachial technique was the hope that nerve compression would be less frequent.

Investigators then began to look at the low brachial approach as an option. Chatziioannou et al reported that in 2,250 patients, a relatively low incidence of major complications occurred with this technique.[4] In this study, the right-sided approach was used, presumably for reasons similar to why the right radial approach is favored (eg, ease of operator access).

UNDERSTANDING POTENTIAL AXILLARY AND BRACHIAL ACCESS COMPLICATIONS

The axillary access approach began to lose favor because of its known complications related to the puncture, and interventionists began to use as an alternative the high[3] and low[4] brachial entries. However, for the reasons discussed previously, regardless of the entry site, patients must be carefully monitored after these punctures and made aware of the importance of self-monitoring for the following signs and symptoms after discharge:

(1) Swelling and discoloration (hematoma) in axilla or arm.

(2) Motor and sensory symptoms in hand with the following important caveats:[5]

- These may be delayed, even out to 15 days after the procedure.
- There is a misconception that nerve compression

syndrome also causes significantly diminished distal peripheral pulses. If operators wait for the distal pulses to disappear, nerve compression syndrome injuries will occur more frequently because arterial compromise is a very late and rare manifestation. This is because direct compression of the microneural blood supply can occur at pressures of as low as 30 mm Hg, but to affect the pulse, a much higher pressure is required.

TIPS AND TRICKS

It is my recommendation that high or low brachial, rather than axillary punctures, should be performed using micropuncture needles and with ultrasound guidance if the operator is comfortable with this modality. When puncturing the brachial artery, it is important to understand that, ventrally, the artery is relatively easy and less dangerous to access because there are no nerves located in the vicinity. Especially when using ultrasound guidance, the operator should be able to avoid all the major nerves by visualizing them.

The number of puncture attempts made has some influence on the occurrence of complications. For example, if an intervention including thrombolysis takes place after many unsuccessful attempts to enter the artery, the chances of bleeding and hemorrhage are much greater.

For the same reason, the lowest-profile devices and sheaths should be used with the least-possible amount of manipulation and exchange.

One of the technical tricks I employ involves using the Omni Flush catheter to redirect the wire into the descending thoracic aorta when entering the ascending aorta or transverse aortic arch from the left or right subclavian artery (Figure 1). This is similar to the technique used to cross the aortic bifurcation from a retrograde approach where the Omni Flush can be used to direct the wire into the contralateral iliac artery. These turns can sometimes be difficult in elderly patients, but the wire opens the tip of the Omni Flush predictably, and the wire can be safely and controllably directed into the descending thoracic aorta. This is a fairly simple way to navigate this corner.

CURRENT CLOSURE METHODS

The major cause of developing nerve compression is a large hematoma. Aftercare is one of the most important considerations when evaluating and deciding between access sites. With a wide variety of closure devices coming to market since the initial complications data were presented, there is the possibility that brachial and axillary access approaches can be made safer by using a closure device. In 2008, Lupattelli et al described a lower incidence of bleeding complications using closure devices after low brachial access.[6] The results showed that by using the Angio-Seal device (St. Jude Medical, Inc., St. Paul, MN), hematoma occurred 2.5 times less often than that observed using manual compression; unfortunately, the reverse was found to be true in terms of vessel occlusion or thrombosis. There is no inherent reason that a high brachial or even an axillary approach could not be closed in a similar fashion, of course also with similar potential complications.

I am not certain that closure devices are universally beneficial, but they may be an option, especially in patients with difficult anatomy and in whom continued anticoagulation is required or coagulopathy cannot be controlled. Medicated compression pads may also be useful for achieving faster clotting at the puncture site.

CONCLUSIONS

Meticulous techniques such as those detailed above must be followed for the brachial and axillary approaches. Finally and most importantly, the physician and patient must be aware of and vigilant regarding the early signs and symptoms of nerve compression. Motor deficits are more ominous than sensory ones, but both should be carefully looked for, and early decompression should be performed. Decompression within 4 hours of the onset of symptoms carries an 8.3 times greater chance for complete recovery than delayed treatment does.[5] ■

Thomas A. Sos, MD, is Professor and Vice Chair of Radiology at New York Presbyterian Hospital, Weill Medical College of Cornell University, and Director, Peripheral Arterial Disease at Weill Cornell Vascular in New York. He has disclosed that he holds a royalty agreement with AngioDynamics. Dr. Sos may be reached at (212) 746-2601; tas2003@med.cornell.edu.

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