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*AJNR Am J Neuroradiol* 2006, 27 (10) 2073-2074  
<http://www.ajnr.org/content/27/10/2073>

This information is current as  
of April 18, 2024.

## TECHNICAL NOTE

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# Use of the Ulnar Artery as an Alternative Access Site for Cerebral Angiography

**SUMMARY:** Although the common femoral artery is the easiest and most widely accepted access site for cerebral angiography, atherosclerotic, aortoiliac, or femoral artery disease can preclude this approach. We describe our experience using the ulnar artery access site in a patient with bilateral aortoiliac occlusive disease. This article may be useful to neuroradiologists who encounter difficulty with other arterial access sites. A description of the technique and a review of the pertinent literature are provided.

Although uncommon, occlusion of the abdominal aorta or the iliac or common femoral arteries can present a problem to neuroradiologists performing cerebral angiography. The cardiac literature contains numerous reports on the safety and feasibility of transradial access for coronary interventions.<sup>1-4</sup> Several cases series in the neuroradiology literature describe the use of the radial artery for cerebral angiography and intervention.<sup>5,6</sup> More recently, transulnar access for coronary angiography and coronary interventions has been described.<sup>7,8</sup> We describe our technique using transulnar cerebral angiography in a patient with occluded iliac arteries in whom a transradial approach was unsuccessful.

### Description of Technique

**Clinical History.** A 70-year-old woman presented to the emergency department with a severe headache. Subarachnoid hemorrhage was present on her head CT predominantly in the posterior fossa, and she was brought to the angiography suite for cerebral angiography. Although both common femoral arteries were successfully punctured, a 0.038-inch J-tipped guidewire could not be advanced beyond the external iliac arteries on either side secondary to vessel occlusion.

Three tests were performed to evaluate the patency of the palmar arch.<sup>6</sup> First, a standard Allen test was performed, in which both the radial and ulnar arteries are simultaneously compressed. Visual inspection is used to assure that normal color returns to the palm after release of the ulnar artery. Second, Doppler insonation was performed over the palm with occlusion of the ulnar and radial arteries sequentially, with good Doppler flow demonstrated in both cases. Last, a pulse oximeter was placed on the thumb, and the radial artery was occluded for several minutes, during which a normal waveform and normal oxygenation were maintained. A 4F sheath was then placed in the right radial artery by using a micropuncture set. Although the sheath was thought to be intravascular, there was no return of blood through the sheath, presumably secondary to severe spasm. We then performed a successful right brachial artery puncture and complete cerebral angiography, without complications. She was noted to have a multilobulated aneurysm of right posterior inferior cerebellar artery (PICA) origin, with the PICA originating from the neck of the aneurysm. Because the aneurysm was unfavorable for coiling, she underwent a successful suboccipital craniectomy and clipping of the aneurysm. Six days after surgery, repeat angiography

was ordered to assess the clipped aneurysm and to evaluate patency of the right PICA.

**Technical Description.** Our preference was to avoid another brachial artery puncture, because of its associated risks, so an ulnar artery approach to angiography was planned. We performed a reverse Allen test on the right wrist, which again confirmed adequate radial-ulnar collaterals to the hand. A reverse Allen test is performed by compressing both the radial and ulnar arteries and having the patient make a fist several times. In contrast to the Allen test in which pressure on the ulnar artery is released, for the reverse Allen test, occlusion of the ulnar artery is maintained while pressure on the radial artery is released. If there is return of blush to the palm within 10 seconds, the test is considered positive and indicates adequate collateral supply to the hand.<sup>7</sup> Further, we performed the Doppler evaluation and pulse oximetry test as described previously. For the Doppler test, the radial and ulnar arteries were compressed sequentially while we confirmed a normal audible signal intensity in the palmar arch. The pulse oximetry test was performed with occlusion of the ulnar artery, and a normal waveform and percentage oxygenation was confirmed.

Using a micropuncture needle, we entered the ulnar artery and placed a 4F sheath. After confirming pulsatile return of blood, we injected 3 mg of verapamil into the sheath.<sup>9</sup> Under fluoroscopic guidance, a 4F vertebral catheter was advanced over a 0.035-inch angled coated guidewire (Glidewire, Terumo Interventional Systems, Tokyo, Japan) into the right vertebral artery. Single-vessel cerebral angiography was then successfully performed. After the procedure, the catheter and sheath were removed. Light manual pressure was applied over the puncture site for 10 minutes, and hemostasis was achieved. No neurologic or access-site complications were encountered.

### Discussion

At our institution, we frequently use radial artery access for cerebral angiography and neurointerventional procedures.<sup>6</sup> Use of the radial artery access site has been widely documented in the cardiac and neuroradiology literature to be a safe alternative to the common femoral and brachial artery routes.<sup>1-6</sup> A 4-vessel cerebral angiogram is easily performed through the radial artery, and neurointerventional procedures can be performed in the right vertebral and carotid arteries by using sheaths up to 6F.<sup>5,6</sup> As demonstrated in our Technical Note, the ulnar artery provides an alternative approach to the radial, brachial, and axillary arteries when traditional transfemoral access is not possible.

In a prospective randomized trial comparing the radial and ulnar artery access routes for coronary procedures, Aptekar et al<sup>7</sup> demonstrated that the ulnar artery is an equally safe and feasible access site for performing angiography and interven-

Received April 14, 2006; accepted after revision May 28.

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tion in the coronary system. In the PCVI-CUBA study,<sup>7</sup> 93.1% of ulnar artery access attempts were successful. There was a 5.7% asymptomatic ulnar artery occlusion rate as demonstrated by follow-up forearm sonography. Of 216 transulnar cases, only 2 access-site complications (0.9%) were encountered, and neither required surgery or transfusion. One was a case of a large forearm hematoma (>10 cm) following ulnar artery access that resolved without consequence. The second ulnar artery access complication involved an asymptomatic small arteriovenous fistula discovered by routine Doppler evaluation that resolved after manual ulnar artery compression.

The ulnar artery may provide advantages over the radial artery as an access site for angiography. At some institutions, the radial artery is often used as a conduit for coronary artery bypass procedures. If use of the right radial artery is anticipated for coronary bypass, catheterization of this vessel is not recommended.<sup>10</sup> As experienced in our case, severe radial artery spasm can rarely prevent successful sheath placement before angiography. In both of these circumstances, the ulnar artery provides a viable alternative to radial artery access, and sheaths up to 6F can be placed in the ulnar artery in cases in which intervention is anticipated.

Compared with access to the radial artery, access to the ulnar artery can be difficult for the inexperienced operator. The ulnar artery is generally less pulsatile than the radial artery because of its deeper location. In the current case, the ulnar artery was easily palpated and was at least as bounding as the radial artery. Extending the wrist before puncture may facilitate arterial puncture. To palpate the ulnar artery, one must apply light manual pressure to the ulnar artery proximal and distal to the entry site; however, care must be taken not to occlude the vessel proximal to the puncture site because this can make access difficult. Access to the ulnar artery is generally performed by puncturing the artery 1–3 cm proximal to the pisiform bone. There is a theoretic potential for injury to the ulnar nerve, which runs just medial to the ulnar artery, and patients may experience a “lightning-flash” sensation in the hand if the ulnar nerve is contacted with the micropuncture needle.<sup>7</sup>

As with radial artery access, angiography by using ulnar artery access can be performed on anticoagulated patients and in patients who receive periprocedural antiplatelet and thrombolytic agents. Manual pressure is easily applied to the puncture site, and passive compression devices can be applied to the

wrist to provide hemostasis. Similar to the radial artery, the ulnar artery is not an end artery in most patients. If adequate collateral supply is documented with a reverse Allen test, inadvertent injury or occlusion of the ulnar artery is typically not a problem because the radial artery should provide sufficient perfusion to the hand. As with the radial artery route, ulnar artery access has a significant advantage over brachial artery access because the brachial artery is effectively an end artery, and occlusion can result in significant perfusion deficits in the distal arm. If radial artery access is initially unsuccessful, ipsilateral ulnar artery access is not recommended on the same day because of potential spasm incited in the radial artery that could result in hand ischemia if the ulnar artery becomes occluded or goes in to spasm.<sup>8</sup> Furthermore, ipsilateral ulnar artery access is relatively contraindicated in patients who have undergone radial artery harvest for coronary artery bypass grafting.

This article combined with the experiences in the cardiac literature may prove useful to neuroradiologists faced with difficult arterial access cases. If readily palpable, the ulnar artery can be accessed safely for cerebral angiography and is a promising alternative to the radial and brachial arteries for interventional neuroradiology procedures.

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