Brachial plexopathy secondary to anticoagulant-induced hematoma as a complication of axillary arteriography

DAVID W. SHOUP, DO
GILBERT J. TOFFOL, DO
THOMAS J. TRAHAN, DO

In the patient described, brachial plexopathy was caused by a large anticoagulant-induced hematoma and pseudoaneurysm. The patient was seen at the hospital 2 weeks postarteriography with weakness, numbness, and pain in the left arm, as well as diffuse left-sided ecchymosis. Noncontrast computed tomographic scans of the axilla confirmed the diagnosis by showing an organized hematoma in the axillary compartment. Color-flow Doppler ultrasound studies showed blood flow in a pseudoaneurysm. This is a rare complication of arteriography that requires surgical intervention to remove the hematoma, decompress the brachial plexus, and repair the puncture site responsible for the pseudoaneurysm. Even if there is a delayed diagnosis, surgery should be performed urgently. Prognosis is based on prompt recognition and timely surgical intervention.

(Key words: Brachial plexus, hematoma, pseudoaneurysm)

A hematoma leading to brachial plexopathy is an infrequent, yet serious, complication of arteriography of the axillary artery, subclavian artery, and jugular vein.¹⁻¹³ Several case reports have shown this complication rate to be from 0.2 to 1.7%.^{2,4,9} Pseudoaneurysm at the site of puncture can further compress the plexus.^{1,2,4,9,13,14} Hemorrhagic compression of the brachial plexus is not uncommon as a complication of axillary arteriography in patients on anticoagulant therapy.⁶ Previous case reports of brachial plexopathies required exploration of the axilla or a second arteriogram to confirm the diagnosis.

We report a unique case of a patient with brachial plexopathy associated with axillary arteriography in which the diagnosis of hematoma and pseudoaneurysm was confirmed by noncontrast computed tomographic (CT) scans and color-flow Doppler ultrasound of the axilla. The patient underwent subsequent surgical decompression. With current technology that allows more precise diagnosis, the need for an additional arteriogram, as well as surgical exploration, is obviated. This case report and our discussion emphasize the need for immediate diagnosis and surgical decompression to minimize permanent neurologic sequelae should a brachial plexopathy occur secondary to hematoma or pseudoaneurysm after axillary arteriography.

Report of case

A 78-year-old man was admitted to our hospital with progressive weakness, numbness, and pain in the left arm. Two

weeks before admission, the patient had emergent arteriography through the left axillary artery at a different healthcare center. He underwent a right above-the-knee amputation for gangrene of the leg. The patient had been taking sodium warfarin (Coumadin), alternating 2.5 mg/d with 5 mg/d at the time of the arteriogram, as well as one 325-mg aspirin daily. The patient had been off the warfarin therapy since the amputation. The patient's medical and surgical history included severe peripheral vascular disease with a previous left above-the-knee amputation in 1968.

On admission to our hospital, the patient complained of having constant agonizing pain in his left arm for the past 2 weeks. On physical examination, the left axilla was found to have ecchymosis that extended along the arm and forearm (Figure 1). The ecchymosis also gravitated along fascial planes from the chest to the left leg stump. The patient had a 7×8 cm indurated, nonfluctuant, mobile mass in the left axilla; no bruit or palpable pulsation was associated with the mass. Pulses were 2+ at the radial and ulnar arteries bilaterally. Neurologically, motor examination showed a strength of 5/5 at the biceps and 0/5 at the triceps, wrist flexors, and extensors, and intrinsic hand muscles of the left upper extremity. Sensation to light touch and pain was decreased in the C-5 through T-1 dermatomes of the left arm. Muscle stretch reflexes were absent for triceps and finger flexors.

The patient underwent noncontrast CT scanning, which revealed a large organized hematoma of the left axilla deep to the pectoral muscles extending superiorly to the clavicle (Figure 2). A color-flow Doppler ultrasound study showed flow in and out of a false aneurysm (Figure 3).

The patient was taken to surgery to evacuate the hematoma (Figure 4). Approximately 200 g of clotted blood (Figure 5) was removed from the axilla. A 3-mm puncture site with surrounding pseudoaneurysm was identified in the axillary artery. The pseudoaneurysm was removed and the puncture site was sutured. The patient was discharged pain

From the Department of Family Practice (Dr Shoup); Department of Internal Medicine, Division of Neurology (Dr Toffol); and Department of Surgery, Division of Vascular Surgery (Dr Trahan) at Mesa General Hospital Medical Center, Mesa, Ariz.

Correspondence to Gilbert J. Toffol, DO, Valley Neurology Associates, 4244 N 19th Ave, Phoenix, AZ 85015.

Figure 1. Patient as seen 2 weeks after arteriography. He had extensive ecchymosis on the left side and a palpable indurated, mobile, nonfluctuant mass in left axilla.

Figure 2. Computed tomographic scan shows homogeneous mass density deep to pectoral muscles bordered medially by the chest wall, laterally by the humerus, and posteriorly by the scapula. A 2-cm increased-density mass represents a pseudoaneurysm.

Figure 3. Ultrasound study shows an organized 7×8 cm thrombus of left axilla with a 2-cm pseudoaneurysm originating from axillary artery.

Figure 4. *Surgical evacuation of hematoma.*

free 3 days after surgery with no improvement in strength or sensation.

Discussion

Percutaneous puncture of the axillary artery is a useful approach for diagnostic angiography of the aorta and its branches if a femoral artery approach cannot be performed.^{1,2} The axillary artery continues from the subclavian artery at the lateral border of the first rib and becomes the brachial artery at the inferior border of the teres major muscle.¹⁴ The brachial plexus is in close proximity to the axillary artery. Together, they are surrounded by a neurovascular fascial sheath as they pass through the axilla.¹⁴ The three cords of the plexus surround the axillary artery.¹⁴ The median nerve lies on the anterior surface of the axillary artery, the ulnar nerve lies medial, and the radial and axillary nerves lie posterior to the artery.¹⁴ Bleeding from the axillary artery puncture site into the neurovascular sheath causes compression of the distal brachial plexus, particularly at the ulnar and median nerves as they arise from the medial and lateral cords of the plexus.¹¹

An axillary hematoma or small pseudoaneurysm may be difficult to palpate owing to the surrounding muscle framework.^{13,14} An injury to the axillary artery may be missed on physical examination because collateral blood supply to the

arm may allow normal distal pulses.^{13,14} Therefore, clinical suspicion of hematoma or pseudoaneurysm warrants immediate further investigation.

Permanent neurologic deficit is probable when diagnosis and treatment are delayed.^{1,2,6,7,9,11,12} Therefore, early recognition is essential. The patient will have progressive weakness or numbness and severe unrelenting pain after axillary arteriography.^{1,2,5,6,15} Delayed hemorrhage occurring several days after arteriotomy may indicate a slow leak within the brachial sheath.⁶ The amount of analgesics necessary to control the pain may seem excessive, and thus, should alert

the physician to search diligently for the cause of the pain. As the hematoma expands within the axillary compartment, blood is forced to dissect along the fascial investments, causing extensive skin ecchymosis, a useful physical sign.¹⁶

If axillary arteriography is necessary, certain precautions are recommended. The puncture site should be compressed for at least 15 minutes after arteriography.² Blood pressure measurements should be done only on the opposite arm. Patients should be instructed to report any pain, weakness, or numbness that persists for more than 2 hours postarteriography.⁷ Patients should have the affected arm placed in a sling after arteriography, and movement of the arm should be limited overnight.⁴ Hypertension should be controlled before the arteriography, and the anticoagulant profile should be normal if possible.⁴ The complication rate increases proportionally to the number of punctures required to gain access to the artery.⁴

Surgical decompression is the preferred treatment to minimize neuronal damage in cases of hematoma.^{1-3,5,6,8,9,11-13,16} Waiting for the natural absorption of a large hematoma may risk irreversible damage to the nerves.⁵ Repair of the arteriotomy site by suture is required to stop the bleeding that is causing the hematoma or the pseudoaneurysm.⁶ Early surgical decompression resulted in minimal motor and

Figure 5. *Approximately 200 g of clotted blood evacuated from hematoma.*

sensory deficits in many case studies.^{3,5,8,13,16} Surgical decompression delayed by as little as 1 to 2 days has consistently resulted in permanent, severe motor and sensory deficits.^{1,6-8,11-14} An inverse relationship exists between the duration of motor and sensory deficit and the probability of return of function.¹¹ Therefore, even if the surgeon is called to see the patient at a late stage, surgery should still be considered to remove the compression.⁸ Even with surgical decompression, the outcomes in many case studies have been poor.^{1,6,13,14}

With current available technology, CT scans and color-flow Doppler ultrasound studies of the axillary compartment in patients with pain, weakness, or numbness occurring subsequent to axillary arteriography provide rapid, noninvasive confirmatory diagnosis of a condition requiring prompt surgical decompression. This workup eliminates the need for a second arteriogram. The usefulness of magnetic resonance imaging and magnetic resonance angiography over computed tomography for detection of hematomas and pseudoaneurysms remains to be demonstrated.

Comment

A hematoma or pseudoaneurysm leading to a compressive brachial plexopathy is an uncommon, yet serious, complication after axillary arteriography. The incident rate increases if the patient is taking anticoagulants at the time of the procedure. The diagnosis of a hemorrhagic brachial plexopathy should always be considered in a patient with

pain, weakness, or numbness after axillary arteriography. The pain is typically severe and unrelenting. Computed tomographic scans of the axilla along with color-flow Doppler ultrasound studies of the axillary artery quickly confirm the diagnosis by showing a hematoma or pseudoaneurysm (or both). Surgical intervention should be done emergently, but also should be done if the diagnosis is delayed. Prognosis depends on the duration of compression, degree of palsy, and timing of surgical intervention.

References

1. Staal A, van Voorthuisen AE, van Dijk LM: Neurological complications following arterial catheterization by the axillary approach. *Br J Radiol* February 1966; 39:115-116.
2. Molnar W, Paul DJ: Complication of axillary arteriotomies. An analysis of 1,762 consecutive studies. *Radiology* 1972;104:269-276.
3. McCready RA, Procter CD, Hyde GL: Subclavian-axillary vascular trauma. *J Vasc Surg* 1986;3(1):24-31.
4. Mulligan B, Espinosa GA, Mafee M: Prevention of brachial plexus injury during transaxillary artery catheterization. *Mil Med* 1983;148:518-520.
5. Nash E, Soudry M, Abrahamson J, Mendes DG: Neuropraxis secondary to hemorrhage in a traumatic dislocation. *J Trauma* 1984;24:546-547.
6. Braun RM, Newman J, Thacher B: Injury to the brachial plexus as a result of diagnostic arteriography. *J Hand Surg* 1978;3(1):90-94.
7. Lyon BB, Hansen BA, Mygind T: Peripheral nerve injury as a complication of axillary arteriography. *Acta Neurol Scand* 1975;51(1):29-36.
8. Gierson ED, Kilpatrick W: Brachial plexus compression following peraxillary artery angiography. *Angiology* 1974;25:777-779.
9. Eriksson I, Jorulf H: Surgical complications associated with arterial catheterization. *Scand J Thorac Cardiovasc Surg* 1970;4:69-75.
10. Fuller GN, Dick JP, Colquhoun IR: Brachial plexus compression by hematoma following jugular puncture. *Neurology* 1994;44:775-776.
11. Dudrick S, Masland W, Mishkin M: Brachial plexus injury following axillary artery puncture. *Radiology* 1967;88:271-273.
12. Carroll SE, Wilkins WW: Two cases of brachial plexus injury following percutaneous arteriograms. *Can Med Assoc J* 1970;102:861-862.
13. Raju S, Carner D: Brachial plexus compression: Complication of delayed recognition of arterial injuries of the shoulder girdle. *Arch Surg* 1981;116:175-178.
14. Gallen J, Wiss DA, Cantelmo N, Menzoin JO: Traumatic pseudoaneurysm of the axillary artery: Report of three cases and literature review. *J Trauma* 1984;24:350-354.
15. Frangides C, Kounis NG: Anticoagulant-induced shoulder hematoma producing brachial plexus neuropathy. Case reports. *Angiology* 1992;43:701-705.
16. Salam AA: Brachial plexus paralysis: An unusual complication of anticoagulant therapy. *Am Surg* 1972; 38:454-455.
17. Schafer AI: The hypercoagulable states. *Ann Intern Med* 1985;102:814.
18. Dalen JE, Hirsh J: Third ACCP consensus conference on antithrombotic therapy. *Chest* 1992; 102(Suppl):305s-549s.