Ischemic brachial artery entrapment syndrome by supracondylar humeral bony spur

Narendranadh Meda, MBBS, MS, DNB(Vasc), Himanshu Verma, MBBS, MS, FEVS, and **Ramesh K. Tripathi, MD, FRCS, FRACS,** *Bangalore, India*

Medial supracondylar spur from the humerus is a rare cause of neurovascular pain of the upper extremity. The spur typically entraps the brachial artery and median nerve, resulting in compression-related symptoms. In advance stages, compression could lead to endothelial damage and thrombotic occlusion of brachial artery. Spur is also associated with an anomalous higher insertion of the pronator teres muscle, which could result in multilevel entrapment of the brachial artery. We report a patient with acute upper limb ischemia secondary to brachial artery compression and distal embolization from a medial supracondylar spur and anomalous attachment of the pronator teres. The entrapped brachial artery and median nerve were released by resection of the spur and of the anomalous belly of the pronator teres with thrombectomy of brachial artery. (J Vasc Surg Cases 2015;1:116-9.)

A supracondylar spur is a hook-like, bony spine of variable size that may project distally from the anteromedial surface of the humerus. It is usually clinically silent but may become symptomatic if the neurovascular bundle of the median nerve and brachial artery are compressed. Published literature on the supracondylar spur is limited to case reports only. We report a case where acute-on-chronic upper limb ischemia of upper limb resulted from compression of the brachial artery by a supracondylar spur. Patient consent regarding publishing this case report was obtained.

CASE REPORT

A 35-year-old man presented to the emergency department with rest pain and bluish discoloration of tips of fingers of the left hand of 2 days' duration. He had a history of forearm and hand claudication for the past 3 months. He had no associated comorbidities. The examination revealed a weak left brachial artery pulse at the cubital fossa, which disappeared on elbow extension. Distal pulses were absent, and the left hand was cold, with bluish discoloration of the tips of the fingers. Neurologic examination revealed mild sensory deficit in tips of all fingers, without any motor deficit. A hard bony mass was palpable on the medial aspect of the arm just proximal to the medial humeral epicondyle.

A computed tomography angiogram of left upper limb showed a supracondylar spur of the humerus compressing the brachial artery and the median nerve along with distal eccentric thrombus in brachial artery extending into radial and ulnar arteries (Fig 1). Thromboembolic evidence in the form of occlusion of two digital vessels was seen as well. No other source of embolism was identified. The right upper limb was normal.

Surgical excision of supracondylar spur was planned along with brachial thrombectomy. The patient was started on therapeutic unfractionated heparin, which provided relief from rest pain. During surgery, the left brachial artery and median nerve were not in their usual anatomic positions in the cubital fossa. Normally, the brachial artery and median nerve lie laterally to the humeral head of pronator teres. After the bifurcation of the brachial artery, its medial branch, the ulnar artery, passes behind the pronator teres, and the median nerve exits between the two heads of the pronator teres (Fig 2, *a*).

In our patient, the humeral head of the pronator teres had an abnormally high attachment to the supracondylar spur with an accessory muscle belly in addition to its medial epicondylar origin. The lower humeral course of the brachial artery and the median nerve were "entrapped" posterior to the superior-most humeral head of the pronator teres (Fig 2, *b*). This abnormal muscle belly of the humeral head of the pronator teres muscle was dissected cranially up to its attachment to the supracondylar spur and excised at its insertion, exposing the underlying brachial artery and median nerve (Fig 2, *c*). The supracondylar spur was found encasing the median nerve and brachial artery like a hook (Fig 3). The brachial artery had periarterial dense inflammatory thickening.

The artery and nerve were released, and the spur was excised with a bone cutter. After adequate dissection, the brachial artery was thoroughly inspected. Only the brachial artery at the bifurcation had a focal chronic eccentric thrombus, which was removed by thromboendarterectomy, resulting in excellent back bleed from the forearm arteries. The arteriotomy was closed with a vein patch. Postoperatively patient had palpable distal pulses, with pulse oximetry showing triphasic pulse wave form and 100% saturation.

The postoperative period was uneventful, and the patient was discharged on postoperative day 2 with palpable wrist pulses and complete resolution of the ischemic changes. The patient was started on low-molecular-weight heparin for 2 weeks, followed

From the Narayana Institute of Vascular Sciences.

Author conflict of interest: none.

Reprint requests: Ramesh K. Tripathi, MD, FRCS, FRACS, Narayana Institute of Vascular Sciences, Level I, B Block, NH-Mazumdar Shaw Medical Centre, Narayana Healthcare, 258-A, Bommasandra Industrial Area, Hosur Rd, Bangalore 560099, India (e-mail: ramesh.tripathi@vascularsurgeon.org).

The editors and reviewers of this article have no relevant financial relationships to disclose per the Journal policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2352-667X

http://dx.doi.org/10.1016/j.jvsc.2015.03.009

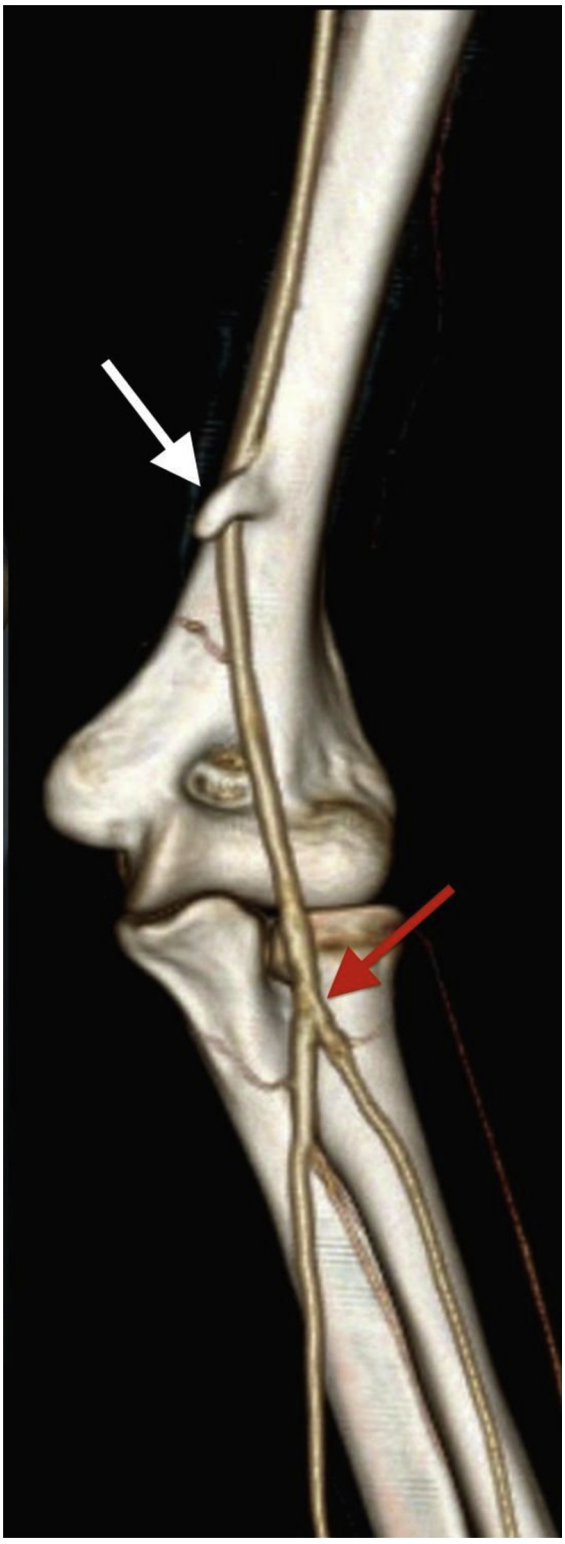

Fig 1. Three-dimensional reconstruction of a computed tomography angiogram of the left upper limb shows the hook-like supracondylar spur from humerus (*white arrow*). Distal thrombus in the brachial artery can be seen as irregularity in luminogram (*red arrow*).

by low-dose aspirin for 6 weeks. Considering the young age of the patient, the antiplatelet medications were stopped after 6 weeks.

At 1 year of clinical and Doppler follow-up, the arterial segment remained patent, without any new embolic episodes and no evidence of thrombus. Also there has been no recurrence of entrapment or regrowth at the spur area on X-ray imaging.

DISCUSSION

Supracondylar spur is a rare entity, with a reported incidence of 0.3% to 2.7% in the general population.[1,2] It is usually 2 to 20 mm long and about 5 cm proximal to the medial epicondyle of the humerus. It is unilateral in distribution, bilateral compression being extremely rare.[3] The spur may often be joined to the medial epicondyle by a fibrous band (ligament of Struthers) that may ossify and give attachment to a portion of the abnormally low fibers (the third head) of the coracobrachialis muscle and may also give origin to the pronator teres muscle.[4] The spur, band, and shaft of the humerus form a hook, ring, or canal through which the median nerve and brachial artery or their branches may be transmitted.[5]

Some anatomists believe that the spur is a vestigial structure found in climbing mammals that once served as the insertion of the muscle latissimo-condyloideus. This might explain why it may occasionally be found as an anatomic variant in humans.[6]

The spur is usually clinically silent. When symptomatic, it presents as a palpable bony mass about 2 inches above the medial epicondyle of humerus and forearm claudication, typically on extension of the forearm. This may be associated with the disappearance of the radial or ulnar pulse on full extension and supination of the forearm[3] or can be associated with symptoms of neurovascular compression.[7] Pressure from the ligament resulting in entrapment of the median nerve behind the pronator teres can rarely cause an irritative median nerve palsy that results in weakness of forearm pronation and wasting of lateral forearm muscles and thenar eminence. This condition is also known as "supracondylar process syndrome."[3]

In our patient, once the bony spur was palpable on clinical examination, diagnosis was evident as median nerve and brachial artery neurovascular compression due to the humeral spur. However, in line with the clinical diagnosis of microthomboembolic phenomenon, a cardiac workup was done to rule out a cardiac source of embolism, which was normal. Compression of the neurovascular bundle was found to be multisegmental by the bony spur as well as by an anomalous development of the pronator teres. Entrapment of the brachial artery between the muscle fibers of the pronator teres resulted in acute-on-chronic intraluminal arterial thrombosis that further resulted in acute distal embolization.

Rarely, ulnar nerve compression can also occur if the fibromuscular band from the process, instead of being attached to the medial epicondyle, extends downward as a band that blends with the fibrous arch between the two heads of the flexor carpi ulnaris.[8-10] Simultaneous description of anomalous pronator teres and humeral spur is very

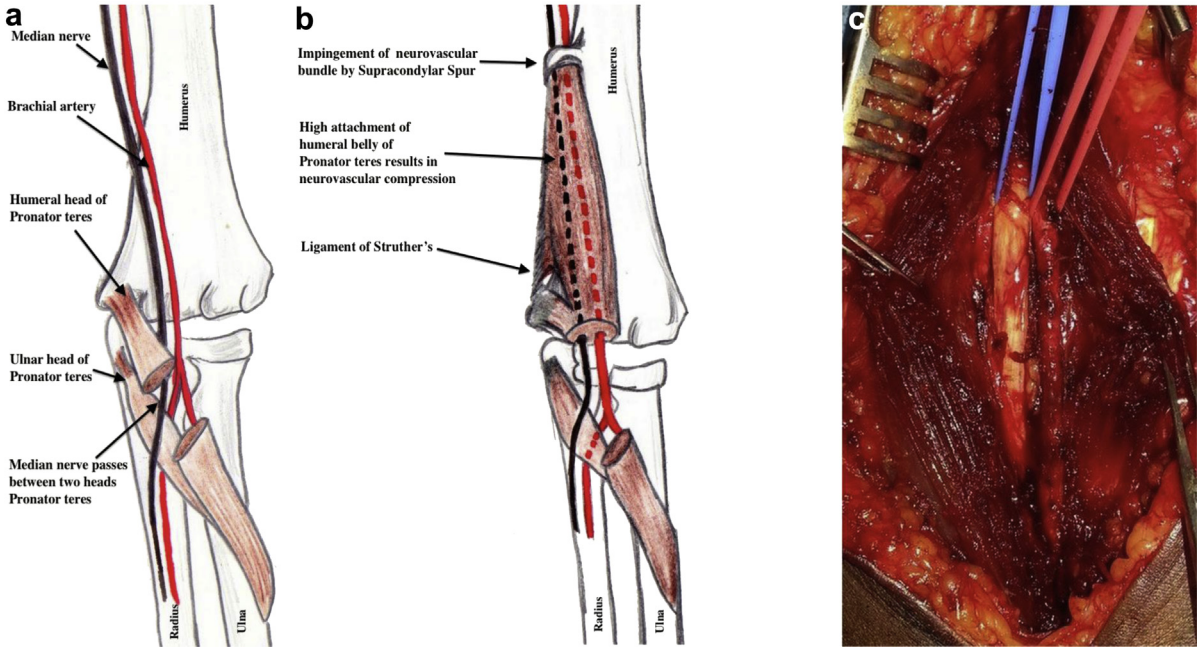

Fig 2. **a,** Normal anatomic relation of the brachial artery and the median nerve to the two heads of the pronator teres muscle. The artery and nerve lie lateral to the humeral head of the pronator teres in the cubital fossa. After bifurcation, the ulnar artery exits the fossa behind the ulnar head of the pronator teres, and the median nerve exits the cubital fossa between the two heads of the muscle. **b,** In our patient, the brachial artery and median nerve were entrapped cranially in the hook-shaped supracondylar spur. The abnormally high insertion of the pronator teres humeral head also caused long segment entrapment of the neurovascular bundle. **c,** Surgical dissection of the humeral head of the pronator teres muscle shows the entrapped brachial artery (*red loop*) and the median nerve (*blue loop*).

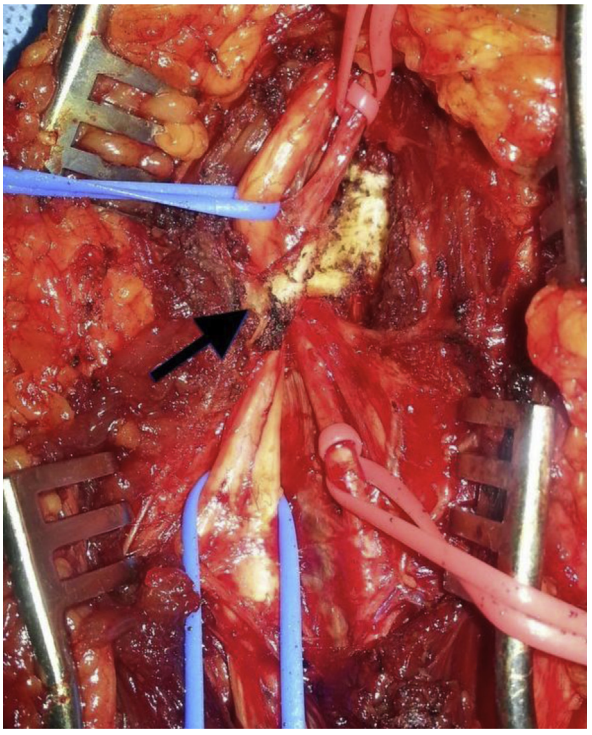

Fig 3. Operative steps. The hook-like bony spur (*black arrow*) encases the median nerve (*blue loops*) and the brachial artery (*red loops*).

rare, and to our best knowledge, has been described only in few case reports.[1,5,9] The exact incidence remains unknown.

The diagnosis of the spur is usually clinical and confirmed by X-ray imaging of the arm. Contrast-enhanced computed tomography/magnetic resonance angiography are useful to demonstrate the three-dimensional anatomic relationship of the brachial artery and the median nerve to the bony spur and also to the pronator teres muscle and to exclude other causes of upper limb ischemia. Nerve conduction velocity and electromyography have been rarely helpful in confirming the diagnosis but have been useful to rule out concomitant nerve compression at other sites in the limb.[11]

Resection of the spur and release of the neurovascular entrapment is the treatment of choice. As in this patient, removal of the periosteum of the spur and the attached fibers of the pronator teres during resection is essential to prevent regeneration of the spur and recurrence.[12] Symptoms of distal microembolization usually improve with low-molecular-weight heparin. However, thrombotic occlusion necessitates thrombectomy and patchplasty of the brachial artery.

CONCLUSIONS

A supracondylar humeral spur causing limb ischemia is a rare cause of neurovascular compression syndrome. It

should be considered in the differential diagnosis of upper limb ischemia, especially in young patients with a palpable bony spur and weak or absent pulses. Excision of the spur provides complete relief of symptoms.

REFERENCES

1. Kumar GR, Mehta CD. A study of the incidence of supracondylar process of the humerus. J Anat Soc India 2008;57:111-5.
2. Ivins GK, Fulton MO. Supracondylar process syndrome: a case report. J Hand Surg Am 1996;21A:279-81.
3. Kessel L, Rang M. Supracondylar spur of the humerus. J Bone Joint Surg Br 1966;48:765-9.
4. Last RJ. Anatomy, regional and applied. 7th ed. Edinburgh, U.K: ELBS/Churchill Livingstone; 1984. p. 73-4.
5. Soames RW, editor. Gray's anatomy, the anatomical basis of medicine and surgery, section 6: skeletal system. 38th ed. New York: ELBS/Churchill Livingstone; 1995. p. 626.
6. al-Naib I. Humeral supracondylar spur and Struthers' ligament. A rare cause of neurovascular entrapment in the upper limb. Int Orthop 1994;18:393-4.
7. Subasi M, Kesemenli C, Necmioqlu S, Kapukaya A, Demirtas M. Supracondylar process of the humerus. Acta Orthop Belg 2002;68:72-5.
8. Struthers J. On the processus supracondyloideus humeri of man. Trans Int Med Congr London 1881;1:148-51.
9. Solieri S. Nervalgia del nervo mediano da processo sopraepitrocleare. Chir Organi Mov 1929;14:71.
10. Aydinlioglu A, Cirak B, Akpinar F, Tosun N, Dogan A. Bilateral median nerve compression at the level of Struthers' ligament. J Neurosurg 2000;92:693-6.
11. Shivaleela C, Suresh BS, Lakshmiprabha S. Morphological study of the supracondylar process of the humerus and its clinical implications. J Clin Diagn Res 2014;8:1-3.
12. Barnard LB, McCoy SM. The supracondyloid process of the humerus. J Bone Joint Surg Am 1946;28:845-50.

Submitted Dec 21, 2014; accepted Mar 1, 2015.