A wasted hand

Case with uncommon neurological and radiological features caused by a cervical band

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SYNOPSIS The symptomatology in the thoracic outlet syndrome is well known. A patient is reported in whom the finding of a unilateral pulse deficit was the alerting sign that led to the correct diagnosis. Angiography, performed with injections during different respiratory phases, visualized the pathogenetic mechanism underlying some of the clinical findings.

The neurological and vascular symptoms and signs in thoracic outlet obstruction, caused by a cervical rib or band, are now well recognized (for review see Gilliatt *et al.*, 1970 and Lord and Rosati, 1971). We are reporting a case for the unique nature of the 'clue sign'—unilateral pulse deficit. Furthermore we describe a modification of a well-known radiological technique.

CASE REPORT

A 20 year old man had noticed progressive weakness of the left hand since the age of 18 years. He had also noticed wasting of the small muscles of the same hand. He had had no numbness or paraesthesias in the hand, but he reported that he regularly felt numbness along the ulnar border of the left arm when lying on his back. He had been operated upon twice—once for supposed compression of the median nerve in the carpal tunnel, once for supposed compression of the ulnar nerve at the wrist. Neither operation had had any effect whatsoever on his symptoms.

On examination the left hand was found to be slightly but definitely smaller than the right hand. There was gross wasting of the thenar muscles and of the interossei and slight wasting of the hypothenar muscles and the ulnar flexors in the forearm, with corresponding weakness. There was pronounced sensory loss around the ulnar epicondyle and along the inside of the upper arm. The tendon reflexes were normal.

On palpation of both radial arteries at the wrist, (Accepted 8 August 1974).

the pulse on the left side was intermittently absent. On closer examination it was found to disappear with every inspiration even on normal breathing.

Auscultation over a restricted area in the left supraclavicular fossa revealed an intermittent bruit over the subclavian artery. The bruit was heard only in the mid-respiratory phase; it was absent in both

FIG. 1 *Cervical spine. Plain radiographs. Rudimentary cervical rib (arrow) on C7 on the left (a) and right (b) side.*

the inspiratory and expiratory phases. The blood pressure measured in the right arm was 100/70 and in the left arm 100/80 mmHg on expiration but not measurable on inspiration.

An electromyographic examination revealed signs of denervation in the first dorsal interosseous muscle, the abductor digiti quinti, opponens pollicis, and flexor carpi ulnaris on the left side.

From the clinical findings, it was obvious that there was an intermittent respiration-synchronous compression of the left subclavian artery.

RADIOGRAPHIC EXAMINATION *Cervical spine* A rudimentary cervical rib on C7 vertebra was present on both sides (Fig. 1).

Arch aortography The examinations were performed with the patient in the supine position with his arms resting alongside his body. A grey Ödman catheter with a side hole was introduced trans-femorally and advanced until its tip lay in the ascending aorta. On angiograms exposed during quiet breathing and on maximal expiration the contrast medium passed freely through the right and left subclavian arteries. However, when contrast medium was injected during maximal inspiration the passage of the contrast medium was almost completely obstructed in the left subclavian artery at the level of the tip of the rudimentary cervical rib, where the lumen of the artery was markedly narrowed, and there was only faint contrast filling of the axillary artery. On the right side the contrast medium passed freely through the right subclavian artery.

Selective left subclavian angiography During maximal expiration this revealed normal conditions (Fig. 2a); during maximal inspiration the subclavian artery was again markedly narrowed at the level of the tip of the rudimentary cervical rib. However, probably owing to the injection pressure (3.5 kp/cm²), contrast medium was able to pass through the narrowed part of the artery but remained peripheral to this part longer than normally, indicating a reduced blood flow (Fig. 2b).

Selective right subclavian angiography This revealed no pathological conditions during maximal expiration and inspiration.

OPERATION On exploration (by R.H.) of the left supraclavicular fossa a short cervical rib was found.

From the tip of it a very tense fibrous band, 3–4 mm wide, could be followed anteriorly. It could not be followed in its entire length, but obviously it had its distal insertion on the anterior end of the first rib. A small part of the fibrous band was resected together with the cervical rib. Immediately the brachial plexus and the subclavian artery sank down and disappeared in the thoracic aperture, which showed that these structures had been elevated and angulated by the fibrous band.

DISCUSSION

CLINICAL ASPECTS From the fact that the affected left hand was slightly smaller than the right it may be concluded that some sort of

FIG. 2 (a) *Selective left subclavian angiography during maximal expiration. Normal conditions.* (b) *Selective left subclavian angiography during maximal inspiration. The subclavian artery is narrowed at the tip of the cervical rib; owing to the injection pressure some contrast medium has passed through the narrowed part.*

disturbance—neural or vascular—had been present for a long time, at least before completion of skeletal growth. As the weakness and muscular atrophy had been noted for only about two years, it is probable that the hypoplasia was caused by relative vascular insufficiency. It must be supposed that the blood flow to the left arm had been severely impeded during every inspiration for an unknown number of years.

The explanation for the unilateral pulse deficit, as proved radiologically, was obviously periodic obstruction of the blood flow through the left subclavian artery.

The subclavian murmur could be heard only in the mid-respiratory phase. This is easily understood in view of the radiographic findings—during inspiration the artery was closed, and during expiration it was normal.

The distribution of the muscular wasting and sensory loss is compatible with a partial lesion of the brachial plexus (Gilliatt *et al.*, 1970). It thus seemed reasonable to suppose that the brachial plexus was compressed together with the subclavian artery in the thoracic outlet.

RADIOLOGICAL ASPECTS The angiographic examination was performed with the patient supine in a neutral position with his arms resting alongside his body as the patient experienced symptoms when lying on his back. No provoking manoeuvres such as those suggested by Lang (1962, 1971) and Weibel and Fields (1967), with the arms and head in various positions, were necessary. Injections of contrast medium were given in different respiratory phases, and, as the radial pulse was absent on maximal inspiration, examination in this phase was of special interest. On maximal inspiration narrowing of the left

subclavian artery was demonstrated. As the passage of contrast medium was free in both subclavian arteries during quiet breathing and maximal expiration, the narrowing of the left subclavian artery during maximal inspiration must have been a compression effect; thrombosis and other causes of intra-arterial occlusion could thus be excluded. As radiographic examination had demonstrated a rudimentary rib on C7 vertebra on both sides and as the left subclavian artery was compressed at the level of the tip of the rudimentary rib the presence of a fibrous band from this rib to the first thoracic rib seemed highly possible. The correctness of this assumption was verified at operation.

Compression of the subclavian artery during maximal inspiration in the supine posture has not been demonstrated radiologically before. The mechanism of compression is that during inspiration, when the first thoracic rib is elevated, the fibrous band pushes the brachial plexus and the subclavian artery forwards. As the costoclavicular space then is diminished, the plexus and the artery will be compressed by the subclavius muscle, which is situated above them.

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