A floating first rib causing vascular thoracic outlet syndrome

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Introduction

Anomalous first rib is a rare cause of thoracic outlet syndrome (TOS) [1]. The incidence is 0.34% with equal gender distribution [1]. We present a case of a floating first rib causing dynamic obstruction of subclavian artery and vein.

Case Report

A 19-year-old male presented with insidious onset left arm and hand pain for three months. Pain aggravated during hyper-abduction and excessive manoeuvring of the limb. He denied of any past trauma or paraesthesia. Examination revealed fullness, thrill and a bruit over the left supra-clavicular region. Pitting oedema was present with no embolic phenomena or neurological manifestations. Radial and brachial pulses disappeared with Adson's test. X-rays of his chest and cervical spine were initially reported to be normal. Triplex Doppler scan of the left upper limb vessels was normal. There was segmental narrowing in the left subclavian artery at the costoclavicular space during abduction manoeuvre in Computed Tomography angiogram (Figure 1).

The luminal diameter of the subclavian artery in adducted and abducted positions was 8.5 mm and 1.5 mm respectively with a reduction of 46%. The subclavian vein was compressed with no visible flow during the abducted position. Rest of the subclavian vessels had no filling defects. The first rib on the left was short and ended halfway close to the mid-clavicle. It failed to articulate with the manubrium sterni. The left middle scalene muscle appeared larger in anteroposterior diameter than the right side. Retrospective examination revealed a short rib on the chest X-ray (Figure 2). The patient was explored using a supraclavicular approach. Intra-operatively compression of subclavian vessels by tight bands of scalenous anterior and medius was observed. The first rib was resected lateral to the sympathetic trunk with scalenectomy. Postoperative period was unremarkable.

Discussion

TOS occurs due to a cervical rib, anomalous first rib and ligamentous or fibrous bands of scalene muscles [2]. An anomalous first rib arises from the transverse process of the first thoracic vertebra. It is attached to the superior surface of the second rib with osseous or fibroligamentous connections [1]. If not, the anterior end of the first rib may remain free,

Figure 1. Computed Tomography angiogram showing segmental narrowing in the left subclavian artery at the costoclavicular space during abduction manoeuvre (marked with an arrow)

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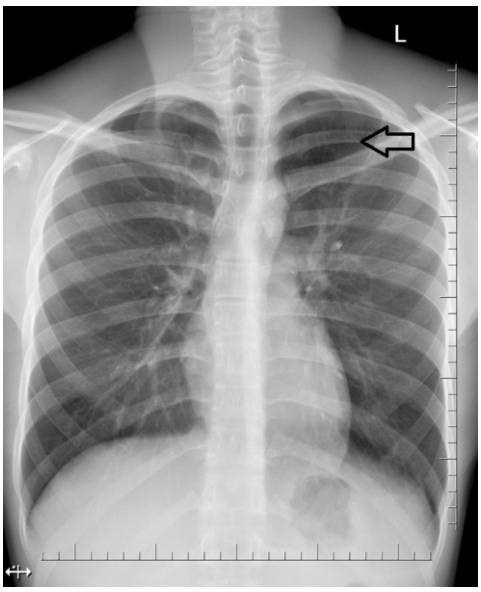

Figure 2. Chest X-ray showing a short rib on the left side. The anterior end is marked with an arrow.

termed a "floating first rib". Subclavian artery and trunks of brachial plexus run between anterior and middle scalene muscles. Subclavian vein arches over the first rib anterior to scalenous anterior. During forced inspiration or lateral flexion of the neck to the opposite side, traction of the scalenous muscles causes a floating rib to move upwards and compress these neurovascular structures. Similarly, when the ipsilateral upper limb is hyper-abducted, the available space within the posterior triangle is reduced.

Pete described the TOS for the first time in 1956[3]. In 80% of the times, TOS is caused by trauma [1]. TOS can be neurogenic, arterial, and venous or mixed, the commonest being neurogenic [2]. Arterial TOS can be due to dynamic obstruction, fixed stenosis or post-stenotic aneurysm of the subclavian artery [1]. Dynamic obstruction presents as pain, paraesthesia and Raynaud's phenomenon during hyper-abduction. The examination may reveal a thrill and a bruit in the supraclavicular region over the stenotic subclavian artery. Adson described the disappearance of the radial pulse on inspiration and turning of the neck towards the ipsilateral upper limb in arterial TOS in 1927 [4].

Arterial TOS can also be asymptomatic until thrombosis or embolism occurs. The latter might present with the cardinal features of acute arterial insufficiency. Venous TOS presents with transient oedema, pain, pallor markedly on hyper-abduction and prolonged working. If deep venous thrombosis occurs, rapidly progressing and persistent oedema accompanied by the severe throbbing type of pain will be noted [5]. Our patient had both components of arterial and venous insufficiency.

Unlike cervical ribs, anomalous first ribs are difficult to diagnoses in chest radiographs, because they arise from the transverse processes of first thoracic vertebrae [1]. It was missed initially in our case. Careful comparisons of both hemithoraces may reveal a thin, superiorly placed rib which does not articulate with the manubrium [1]. Doppler ultrasound and angiogram with provocative manoeuvres are sensitive in diagnosing both arterial and venous TOS [6]. The normal triplex study in our case may be due to the avoidance of provocative manoeuvres during imaging.

Vascular TOS can be managed by surgical excision of the anomalous rib. Murphy conducted the first successful surgical excision of an anomalous first rib [7]. DeBakey incorporated resection of anterior scalene muscle with improved surgical outcomes [8]. Supraclavicular and trans-axillary approaches are described for excision of anomalous first ribs [1]. We used the supraclavicular approach in our patient as it provided a better exposure of the subclavian artery and to excise the anomalous rib.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Learning Points:

- The anomalous first rib is a rare cause of vascular thoracic outlet syndrome
- Presence of thrills, bruits and positive Adson's test are indicative of arterial thoracic outlet syndrome
- Imaging studies such as Doppler ultrasound and angiograms need to be done with provocative manoeuvres
- Excision of the anomalous first rib with scalenotomy is the treatment of choice