

## Arterial thoracic outlet syndrome

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**Abstract** Arterial thoracic outlet syndrome (TOS) causes ischemic symptoms; it is the rarest type, occurring in 1-2% of all TOS cases. This paper is a case report of a 33-year-old male patient diagnosed with arterial TOS, displaying symptoms of acute critical limb ischemia caused by thromboembolism. Clinical examination revealed absent brachial, radial and ulnar pulse on the left arm. Colour Duplex Scan (CDS) was performed that showed brachial artery thrombosis and no evident flow in the radial artery. Surgical treatment was performed along with resection of dilated part of the subclavian artery that was reconstructed by interposition of Dacron tubular graft 8mm. We review the literature and elaborate on the anatomy, etiology, symptoms, diagnostic criteria and treatment modalities of arterial TOS. Arterial TOS usually remains unrecognized until a thromboembolic complication occurs. Persistent compression may cause an aneurysm in the subclavian artery.

**Key words** Thoracic aortic syndrome; acute limb ischemia

### Introduction

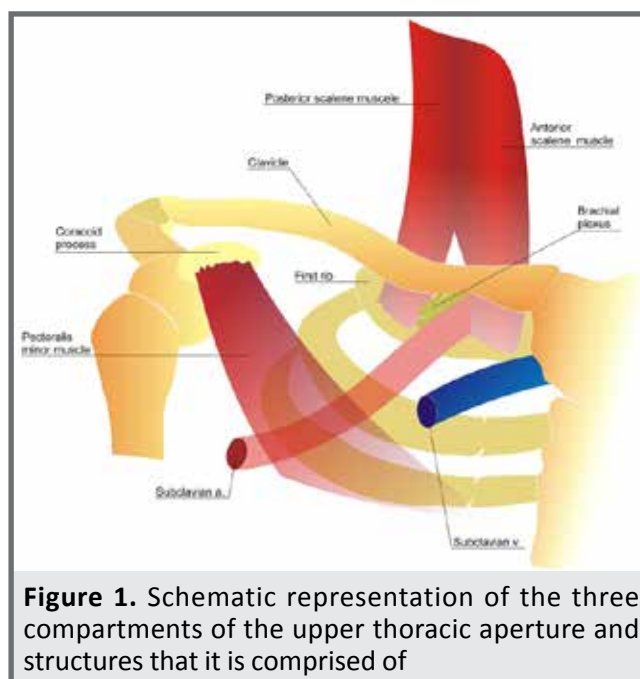
**T**horacic Outlet Syndrome (TOS) is a name for a group of disorders characterized by the compression of the nerves, arteries or veins (or all three structures simultaneously) at the level of the upper aperture of the chest<sup>1</sup>.

The title “Thoracic Outlet Syndrome” (TOS) was introduced by Peet in 1956<sup>2</sup>. In 1958 Charles Rob defined TOS as a collective name for the compressive neurovascular disorders in the shoulder area level<sup>1</sup>. The disorder used to be described by other names as well, depending whether the emphasis was placed on the affection of neurogenic or vascular component: a description of a disorder that would fit TOS was found in the writings of Galen (2nd century A.D), Harvey (1627) and Coote (1861) described the role of repeated traumatization of the arterial segments with the first rib, in the etiology of this disorder Clagett (1962) pointed out as a dominant the role of cervical rib, Adson and Coffey (1927) were the first to conduct scalenectomy in the treatment of TOS. Ochsner, Gage and DeBakey in 1935 named it the “scalenus anticus syndrome”, and made the first successful resection of the anterior scalene muscle<sup>3,4,5,6,7</sup>. Roos (1966) performed the first successful transaxillary resection of the first rib<sup>8</sup>. (Figure 1).

The aim of this case is to present interesting case of anomalous left cervical rib causing arterial TOS, subclavian artery aneurysm and brachial artery embolization.

### Case report

A 33-year old male patient was admitted to our Clinic for significant pain in the left arm that appeared sev-



**Figure 1.** Schematic representation of the three compartments of the upper thoracic aperture and structures that it is comprised of

eral months prior to admission. He denied any past medical history. Clinical examination revealed absent brachial, radial and ulnar pulse on the left arm. Colour Duplex Scan (CDS) was performed that showed brachial artery thrombosis and no evident flow in the radial artery and minimal flow in the ulnar artery, with significant flow reduction in the proximal brachial artery during provocative tests and arm abduction. (Figure 2).

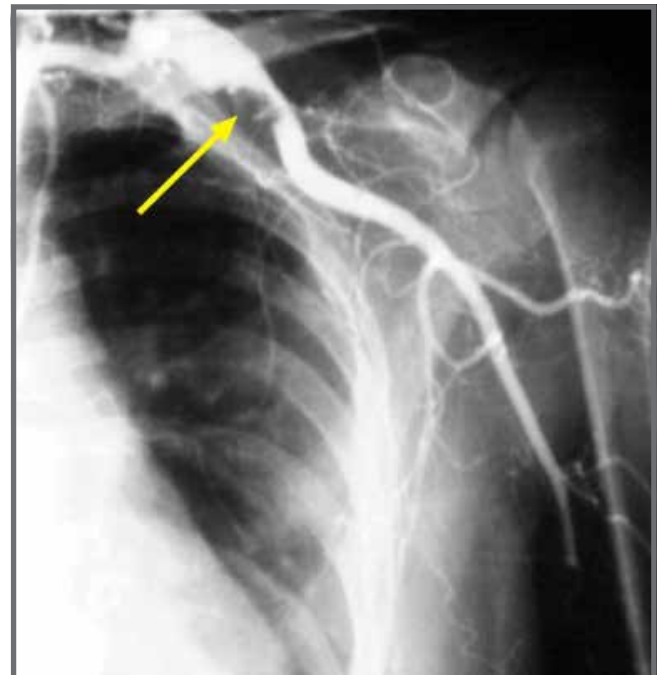
Invasive angiography was performed and showed aneurysm formation of the left subclavian artery 16 mm in diameter with thrombotic mass that caused distal embolization, while X-ray showed anomalous cervical



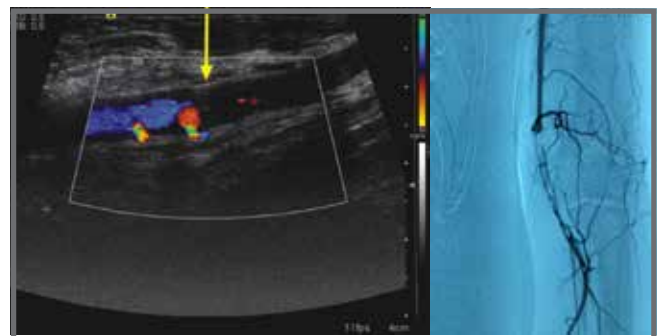
**Figure 2.** Shows reduction of flow in the proximal brachial artery during provocative tests and arm abduction



**Figure 4.** X-ray shows anomalous cervical first rib



**Figure 3.** Invasive angiography shows aneurysm formation of the left subclavian artery



**Figure 5.** Acute occlusion (embolism) of brachial artery. A. Ultrasonography; B. Angiography (arrows)

first rib with. (Figure 3, Figure 4) Thrombosis of the left brachial artery was also confirmed. (Figure 5).

Surgical treatment was indicated and resection of the anomalous left rib was performed along with resection of dilated part of the subclavian artery that was reconstructed by interposition of Dacron tubular graft 8mm. This procedure was followed by brachial artery thrombectomy with Fogarty catheter and reconstruction with autologous vein patch. Procedure went uneventfully, brachial, radial and ulnar pulsations were present. Control CDS showed regular flow after subclavian and brachial artery revascularisation. After six months follow up the patient was doing well with left arm vascularisation well preserved.

## Discussion

The exact incidence of thoracic outlet syndrome is unknown and the majority of cases are diagnosed between the ages of 20 and 50 years, estimates range from 3-80 cases per 1000 population<sup>9,10</sup>.

Women are three to four times more likely to develop neurogenic TOS, while the incidence of vascular

TOS is equal both among non-athletic men and women<sup>11,12</sup>.

In the vast majority of cases it is the matter of a neurogenic TOS (more than 95% of cases). Although the venous TOS (between 3 and 4%) and the arterial TOS (between 1 and 2% of cases) are significantly less frequent, their consequences are usually more serious and often require immediate surgical treatment<sup>13</sup>.

In the United States approximately 2,000 to 2,500 first rib resections are performed per year. In the last 10 years the total of 25,642 operations have been coded. 96.7% were done for neurogenic causes, 2.8% for venous issues, and 0.5% for arterial pathology<sup>14</sup>.

Morbidity and mortality is minimal, and the majority of operations are being performed by vascular surgeons<sup>15</sup>.

In the opinion of most authors, arterial TOS, occurs less frequently than venous TOS. Similarly to venous TOS it also occurs in both asymptomatic and symptomatic form. Symptomatic arterial TOS is manifested as acute or chronic. Chronic arterial TOS is manifested with pallor, cold and weakness of an arm or a hand during labor (arterial claudication). Arterial pulse is weakened

or absent. Furthermore, there is often in auscultation harsh systolic murmur over *a subclaviae*. Acute arterial TOS often has dramatic clinical picture: with the absence of pulses, there is pallor and coldness of arm (hands, fingers). The condition develops suddenly, progresses rapidly and often causes development of gangrene fingers.

## Conclusion

Thoracic outlet syndrome is a complex syndrome that requires thorough knowledge of the anatomy and anatomical variants and presents management challenges to the modern cardiovascular surgeon. Arterial TOS usually remains unrecognized until a thromboembolic complication occurs. Persistent compression may cause an aneurysm in the subclavian artery.

## Recommendation

The excellent clinical outcomes depends on the using standardized evaluation and protocol-driven treatment strategies for arterial TOS, which is emphasized in multidisciplinary approach to all forms of TOS (vascular surgeon, angiologist, interventional radiologist, and other specialists).

This case report suggests a distinct surgical protocol to achieve exceptional outcomes for patients with arterial thoracic outlet syndrome.

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## Sažetak

### Sindrom „arterial thoracic outlet“

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Arterijski sindrom gornje torakalne aperture (TOS) uzrokuje ishemijske simptome; to je najređi tip, koji se javlja u 1-2% svih TOS slučajeva. Ovaj rad je prikaz slučaja 33-godišnjeg muškog pacijenta sa dijagnozom arterijskog TOS-a, sa simptomima akutne kritične ishemije uzrokovane tromboembolijom. Klinički pregled otkrio je odsustvo brahijalnog, radijalnog i ulnarnog pulsa na levoj ruci. Izveden je Color Duplex Scan (CDS) koji pokazuje trombozu brahijalne arterije, bez evidentiranog protoka u radijalnoj arteriji. Hirurško lečenje je izvršeno uz resekciju dilatiranog dela potključne arterije, koja je rekonstruisana interpozicijom Dacron tubularnog grafta od 8mm. Pregledom literature detaljno je elaborirana anatomija, etiologija, simptomi, dijagnostički kriterijumi i modaliteti lečenja arterijskog TOS-a.

Arterijalni TOS obično je neprepoznat dok ne dođe do tromboembolijske komplikacije. Perzistentna kompresija može izazvati aneurizmu potključne arterije.

**Ključne reči:** "Thoracic aortic syndrome", ishemija donjih ekstremiteta