

Cervical Rib: A Hidden Culprit in Arterial Thoracic Outlet Compression Syndrome

Case Report

Poornima GB, Madhu Shankar K, Sindhu K, Naveen D, Vishwapremraj, and Mallikarjunappa B

Department of Radiodiagnosis, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India

*Corresponding author: Naveen D, Department of Radiodiagnosis, Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India, Email Id: dmnaveen4@yahoo.com

Copyright: © 2024 Poornima GB, et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Article Information: Submission: 11/03/2024; Accepted: 02/04/2024; Published: 08/04/2024

Abstract

Thoracic outlet syndrome (TOS) is a rare condition caused by compression of the neurovascular structures as they pass through the thoracic outlet. One uncommon but potentially serious cause of TOS is compression of the subclavian artery by a cervical rib. We present a case of a 65-year-old female patient who presented with symptoms of arm pain, burning sensation, and discolouration of right hand. Imaging studies revealed a cervical rib causing significant compression of the proximal subclavian artery, leading to arterial type of thoracic outlet syndrome. The patient underwent emergency brachial embolectomy with successful resolution of symptoms. This case highlights the importance of considering cervical rib compression in the differential diagnosis of TOS and the effectiveness of surgical intervention in such cases.

Keywords: Thoracic Outlet Syndrome; Subclavian Artery Compression; Cervical Rib; Brachial Embolectomy

Introduction

A group of disorders associated with thoracic outlet syndrome (TOS) are brought on by compression of the neurovascular structures that passes via the thoracic outlet. Thoracic outlet serves as the passage that contains the brachial plexus, subclavian artery, and subclavian vein. The compression of any of these structures by any means can cause symptoms in the upper-extremity [1]. Compression of the neurovascular bundle at the thoracic outlet is hypothesized to be the cause of a cluster of symptoms that includes paraesthesia, weakness, and arm pain [2]. Atheromas can develop from persistent compression of the subclavian artery, harming the intima and potentially triggering anterograde or retrograde thromboembolic episodes [1].

This report describes a case of arterial type TOS that resulted in anterograde thromboembolic episode-induced thrombus in the brachial artery.

Case Report

A 65-year-old female patient was referred to the surgical department from another hospital with complaints of right upper limb pain for two months that had gotten worse in the last week. She has also complained of a burning sensation in her right hand with discolouration for the past three days. She underwent an outside Doppler scan of her right limb, which showed full occlusion of the brachial artery distal to the mid arm and extending to the cubital fossa, with no flow seen in the radial and ulnar arteries. The patient appeared to be normal two months ago until he had pain in his right upper limb, which is insidious in onset and gradually progressing. There was no aggravating or relieving factor, and no substantial medical, surgical, or familial history. On clinical examination, the right upper limb was cold from the upper arm to the forearm, with no palpable radial artery pulse and no sensation or capillary filling in the fingertips. The patient was clinically diagnosed with peripheral arterial disease of the right upper limb and advised to get a chest radiograph

and a CT angiogram of the right upper limb arteries in order to assess the extent of occlusion. On a routine chest radiograph, there was a right-sided cervical rib [Figure 1]. A CT angiography revealed a right-sided cervical rib causing compression of the proximal subclavian artery [Figure 2] [Figure3]. The proximal portion of the right subclavian artery is substantially compressed (>90% luminal stenosis) between the tip of the cervical rib and the clavicle, with extensive post-stenotic dilatation of the subclavian artery. Complete luminal occlusion of the brachial artery from the midarm to the elbow area was caused by thrombus, and the ulnar and radial arteries showed a marked decrease in calibre with non-opacification. With these imaging results, the final diagnosis of subclavian artery compression thoracic outlet syndrome caused by cervical rib was made. Later, the patient underwent an emergency right brachial embolectomy and recovered well after the embolectomy. The patient was recommended to undergo resection of the cervical rib and first rib, but she chose not to proceed with the surgery. Subsequently, we lost contact with the patient and were unable to continue her follow-up.

Discussion

Thoracic outlet syndrome (TOS) is categorized into three primary types: neurogenic, venous, and arterial. Neurogenic TOS is by far the most common, that is, accounting for around 95% of documented cases, whereas vascular causes are far less common, with 4% attributed to venous and 1% arising from an arterial etiology [2]. The costoclavicular space is the most common location for vascular compressions, while the retropectoralis minor space is rarely a site of compression. In cases where vascular involvement is suspected, further investigation is necessary since treating the vascular compression and related problems early on is crucial to averting infrequent but disastrous clinical outcomes. These include pulmonary embolism and venous gangrene of the hand due to venous TOS or digital ischemia, as well as stroke caused by emboli from the injured Subclavian artery [3]. Arterial TOS comprises of two components: damage to the subclavian artery at the first rib level and distant embolic events. Arterial TOS is nearly invariably accompanied with underlying bone

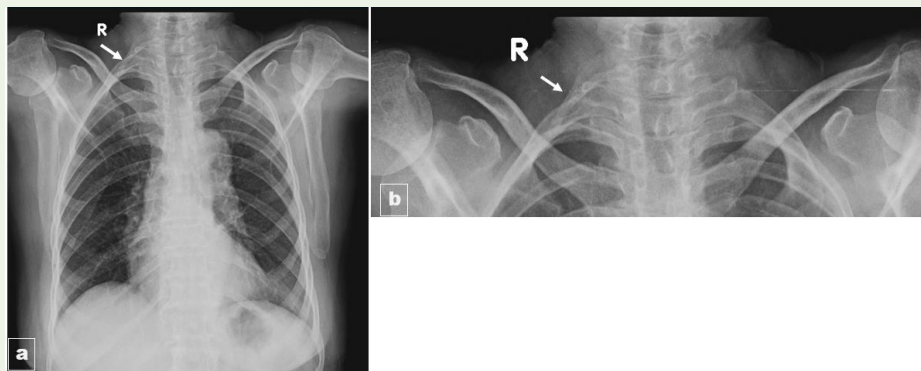


Figure 1: a) Full size Chest Radiograph, b) Magnified cropped image: Showing right sided cervical rib, which is seen extending till the medial third of clavicle. White arrow pointing at the right sided cervical rib.



Figure 2: (a & b): Axial section of CT angiogram showing significant compression of proximal portion of right subclavian artery between clavicle and cervical rib. (c): Coronal section of CT angiogram showing significantly compressed right subclavian artery between clavicle and cervical rib with post stenotic dilatation of subclavian artery. White arrow depicting the stenosis of SCA, Elbow arrow depicting cervical rib, curved arrow depicting the post stenotic dilatation of SCA, CL – clavicle and SCA – Subclavian artery.

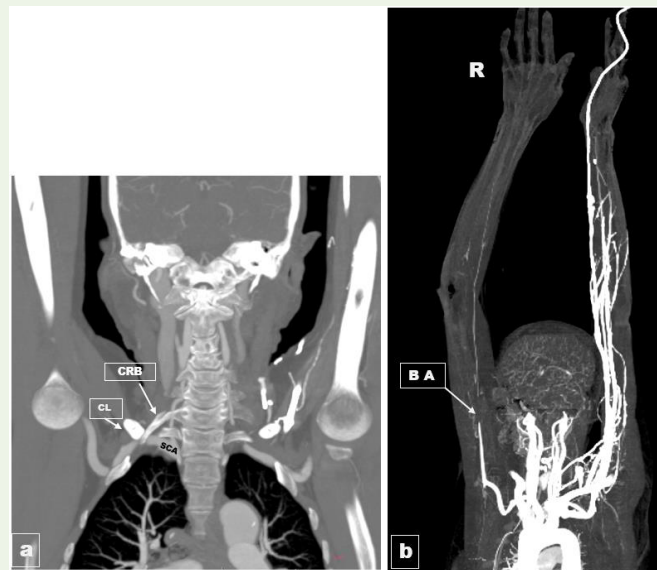


Figure 3: a) MIP Coronal section showing significantly compressed right subclavian artery between clavicle and cervical rib with post stenotic dilatation of subclavian artery. b) Coronal MIP image showing complete occlusion of right brachial artery from mid arm region with non-visualization of right radial and ulnar arteries. MIP – maximum intensity projection, CRB – Cervical rib, CL – Clavicle and BA – Brachial artery.

anomalies, either a cervical rib, anomalous first rib, or the first rib or clavicle fracture [4].

Thoracic outlet syndrome is most commonly caused by cervical ribs, especially the arterial type, which affects 85% of patients. Patients with arterial TOS have no symptoms until a thromboembolic event occurs. Anterograde or retrograde thromboembolism can result from post-stenotic dilatation-induced thrombus and pseudoaneurysm formation. Patients with thoracic outlet syndrome of the arterial type frequently exhibit signs of artery stenosis and limb ischemia, including pain, weakness, and cold limb [1]. Arterial TOS can present clinically as palpable supraclavicular pulse, abnormal skin colour changes, absent or diminished pulses, and digit ischemia. Retrograde embolism can potentially lead to cerebrovascular accident, albeit this is not common [1].

A thorough history, physical examination (including provocative tests), radiography, electrodiagnostic testing, and brachial plexus neurography are often used in the diagnosis of TOS. Nonetheless, imaging modalities may help in the diagnosis of patients if there is a suspected vascular component [3]. CT scans and MRIs are often regarded as the best diagnostic tools for thoracic outlet syndrome. Finding the pathological or anatomical root cause of TOS is the aim of imaging techniques. Vascular TOS is diagnosed when the subclavian artery or vein narrows by more than 30% or 50%, respectively. Imaging findings associated with arterial TOS include localized fixed stenosis of the subclavian artery on the compression side, arterial thrombosis, and the development of aneurysms or pseudoaneurysms in the axillo-subclavian artery [1,4,5].

The management of a TOS is not uniform and is mostly

determined on the underlying cause. Conservative management or surgery, such as surgical bypass, rib resection, scalene resection, as well as endovascular repair, are available options [2,6].

Conclusion

Arterial thoracic outlet syndrome (TOS) is often associated with bone anomalies like a cervical rib, an anomalous first rib, or fractures of the first rib or clavicle. When vascular involvement is suspected, radiological examinations play a crucial role in identifying the cause of arterial TOS and planning appropriate treatment to relieve vascular compression and its potential complications, thereby preventing rare but serious clinical outcomes.

Consent: The patient has given her consent for her cross-sectional images and other clinical information to be reported in the journal. The patient is aware that her name and initials won't be revealed in the publication.

References

1. Farzam F, Barakzai Y, Foladi N (2023, September). Arterial thoracic outlet syndrome by a commonly overlooked anomaly, the cervical rib: A case report. *Radiology Case Reports*, 18: 3351-3356.
2. Huang J, Lauer J, Zurkiya O (2021) Arterial thoracic outlet syndrome. *Cardiovascular Diagnosis and Therapy* 11: 1118–1124.
3. Ersoy H, Steigner ML, Coyner KB, Gerhard-Herman MD, Rybicki FJ, et al. (2012) Vascular Thoracic Outlet Syndrome: Protocol Design and Diagnostic Value of Contrast-Enhanced 3D MR Angiography and Equilibrium Phase Imaging on 1.5- and 3-T MRI Scanners. *American Journal of Roentgenology* 198: 1180–1187.
4. Raptis CA, Sridhar S, Thompson RW, Fowler KJ, Bhalla S (2016) Imaging of the Patient with Thoracic Outlet Syndrome. *RadioGraphics* 36: 984-1000.

5. Poyyamoli S, Swamiappan E, Gandhi J, Ranasingh RK, Cherian MP, et al. (2019) non-aortic vascular findings on chest CT angiogram: including arch vessels and bronchial arteries. *Cardiovascular Diagnosis and Therapy* 9: S59-S73.
6. Jones MR, Prabhakar A, Viswanath O, Urits I, Green JB, et al. (2019) Thoracic Outlet Syndrome: A Comprehensive Review of Pathophysiology, Diagnosis, and Treatment. *Pain and Therapy* 8:5-18.