

Thoracic Outlet Syndrome with Positional Symptoms Diagnosed by Dynamic Ultrasonography: A Case Report

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Abstract

Case Report

Thoracic outlet syndrome (TOS) is a dynamic neurovascular compression disorder, and non-traumatic, posture-related forms may be overlooked on static imaging. We report a 45-year-old female anesthesiologist who developed intermittent numbness and weakness of the left arm exclusively during arm abduction in the sitting or standing position. Computed tomographic angiography showed no fixed structural or vascular abnormality; however, dynamic ultrasonography demonstrated marked narrowing of the costoclavicular space with compression of the brachial plexus and subclavian artery during provocative positioning, reproducing the patient's symptoms and supporting a diagnosis of functional TOS. Conservative management, including postural correction, scapular stabilization exercises, targeted physical therapy, ultrasound-guided fascial release, and ergonomic modification, resulted in partial symptomatic improvement. Follow-up dynamic ultrasonography showed reduced but persistent positional compression. This case highlights that normal static imaging does not exclude thoracic outlet syndrome and supports the clinical value of dynamic ultrasonography for identifying posture-dependent neurovascular compression.

Keywords: thoracic outlet syndrome, dynamic ultrasonography, positional symptoms, neurovascular compression, case report.

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INTRODUCTION

Thoracic outlet syndrome (TOS) comprises disorders caused by compression of the brachial plexus or subclavian vessels in the thoracic outlet region. It is commonly classified as neurogenic, arterial, or venous TOS; neurogenic TOS accounts for most cases, whereas vascular forms are less common [1]. Although TOS has traditionally been associated with fixed anatomical abnormalities such as cervical ribs, fibrous bands, or trauma, non-traumatic and posture-related forms are increasingly recognized in association with prolonged poor posture, repetitive arm use, and occupational strain [2,3].

Chronic tension involving the anterior scalene, subclavius, and pectoralis minor muscles can narrow the thoracic outlet and produce dynamic compression even without structural lesions. This mechanism may explain functional or posture-related TOS in patients without fixed anatomical abnormalities. Diagnosis is often challenging because static imaging may appear normal

when compression occurs only during specific positions. Dynamic ultrasonography enables real-time assessment of the brachial plexus and subclavian vessels during provocative maneuvers and may reveal clinically relevant compression that is absent on static images [4]. Recent consensus recommendations also emphasize careful history taking, postural examination, and dynamic assessment in suspected TOS [5,6]. This case illustrates an occupational, non-traumatic form of TOS in which neurovascular compression manifested only in provocative positions despite normal static imaging.

CASE REPORT

This case report was approved by our Institutional Review Board, and written informed consent for publication was obtained from the patient. A 45-year-old female anesthesiologist presented with a 2- to 3-month history of intermittent numbness and weakness in the left arm. The symptoms were initially mild but progressively increased in both frequency and intensity. She denied trauma or systemic illness. Because

the symptoms involved the neck and arm, cervical disc disease was initially suspected.

The patient had more than 20 years of clinical experience and frequently performed airway management requiring repeated and sustained use of the left arm. On further questioning, she reported that she had unconsciously avoided raising her left arm overhead for several years because this position often caused sudden weakness or dropping of objects. This long-standing avoidance suggested chronic, gradually compensated compression that had recently become clinically apparent.

On examination, the symptoms were clearly position-dependent. She was largely asymptomatic in the supine position; however, when sitting or standing with

the left arm elevated above the head or forcefully extended backward, paresthesia and weakness developed within seconds and resolved promptly after returning the arm to neutral. Postural assessment showed a forward head and rounded shoulder posture, with the left scapula depressed. Neurological examination showed no definite sensory loss and normal strength on manual testing. Spurling's test was negative, whereas Adson's test and the Roos maneuver immediately reproduced her typical numbness and weakness, suggesting TOS rather than cervical radiculopathy.

Dynamic ultrasonography was performed. In the neutral arm position, no significant compression of the subclavian vessels or brachial plexus was observed, and flow dynamics were preserved (Figure 1).

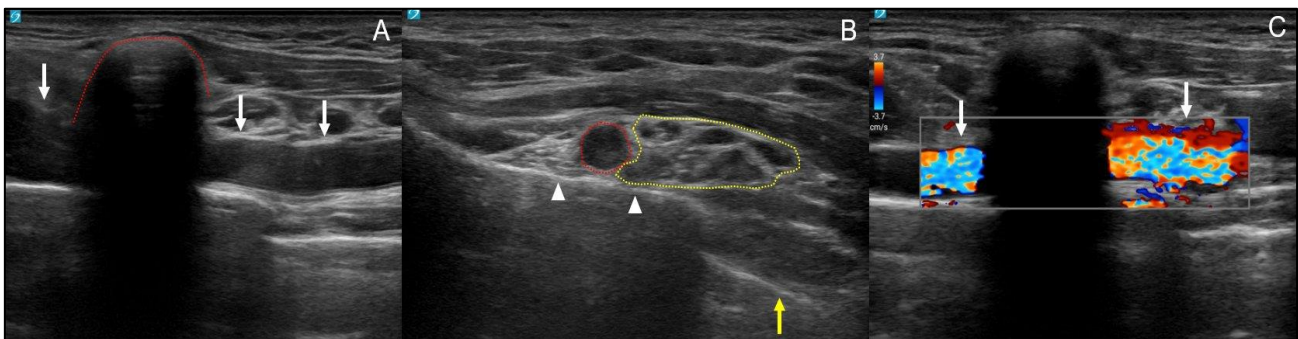


Figure 1. Ultrasonographic evaluation in the neutral arm position.
 (A) Long-axis view shows preserved subclavian artery caliber without compression. (B) Short-axis view demonstrates the subclavian artery and brachial plexus within the costoclavicular space without structural compression. (C) Color Doppler image shows preserved arterial flow

When the left arm was elevated and abducted, the costoclavicular space between the clavicle and first rib markedly narrowed, and the subclavius muscle visibly impinged on the brachial plexus and subclavian

artery (Figure 2A, B). Doppler imaging showed reduced subclavian artery flow during this provocative position (Figure 2C), and the patient immediately reported hand numbness and pallor.

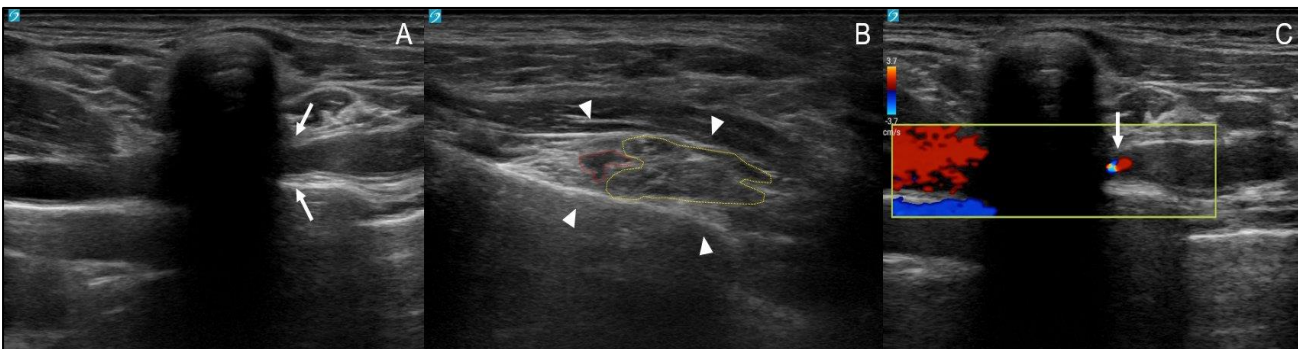


Figure 2. Ultrasonographic findings during the compression-provoking position.
 With the left arm elevated and abducted, ultrasonography shows positional narrowing of the subclavian artery and compression of the adjacent neurovascular structures. Color Doppler demonstrates reduced arterial flow during positional compression.

Computed tomographic angiography showed no cervical rib, anomalous band, thrombosis, aneurysm, or other fixed vascular abnormality (Figure 3). These

findings supported positional neurovascular compression at the thoracic outlet.

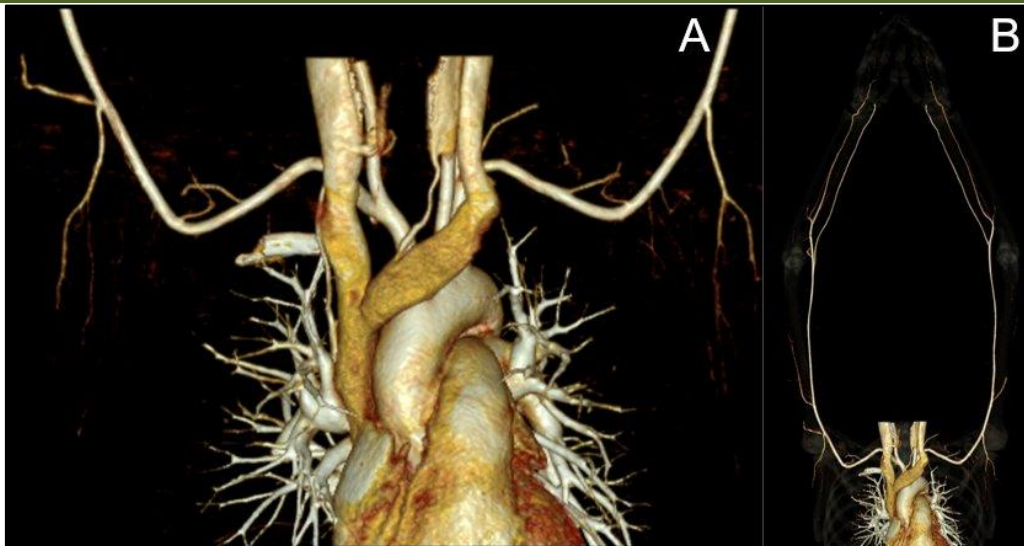


Figure 3. Computed tomographic angiography.

Computed tomographic angiography shows no fixed vascular abnormality or structural vascular lesion

The patient was diagnosed with functional TOS precipitated by occupational repetitive strain and poor posture. Conservative treatment was initiated, including scapular stabilization, postural retraining, stretching of the pectoralis minor and scalene muscles, strengthening of the periscapular musculature, ultrasound-guided fascial release, and ergonomic modification at work. Botulinum toxin injection was considered but not performed because of the patient's need for ongoing left arm function during clinical work. After several months, her symptoms partially improved. Follow-up dynamic ultrasonography showed slightly reduced but persistent positional compression, consistent with her clinical course.

DISCUSSION

This case demonstrates that non-traumatic, functional TOS can develop from chronic occupational and postural strain in the absence of structural anomalies. Repetitive arm elevation and sustained shoulder girdle effort can increase tightness of the scalene, subclavius, and pectoralis minor muscles, progressively narrowing the costoclavicular space. Similar work-related mechanisms have been described in occupations requiring prolonged arm elevation or awkward postures, including dentists, surgeons, veterinarians, and hairdressers [7].

The patient's symptoms were strongly position-dependent and were reproduced by arm elevation rather than by neck movement. This pattern helped distinguish TOS from cervical radiculopathy. Electrophysiological studies may demonstrate lower brachial plexus involvement, particularly C8-T1 fibers, whereas paraspinal muscle abnormalities suggest cervical root disease; however, electrodiagnostic findings in

intermittent or disputed TOS may be subtle or negative [8]. Therefore, clinical assessment remains essential.

The key diagnostic feature in this case was the discrepancy between normal static imaging and abnormal dynamic ultrasonography. Computed tomographic angiography excluded fixed lesions, but it could not demonstrate transient compression during arm elevation. In contrast, dynamic ultrasonography reproduced the patient's symptoms while showing narrowing of the costoclavicular space, deformation of the brachial plexus and subclavian artery, and reduced arterial flow. This finding supports the concept that normal anatomy at rest does not necessarily indicate normal function during movement [4].

Recent EANS and INTOS recommendations emphasize that TOS diagnosis should be based on history, physical examination, provocative maneuvers, and dynamic assessment rather than static imaging alone [5,6]. The present case is consistent with these recommendations and highlights the usefulness of dynamic ultrasonography as a practical diagnostic tool for posture-dependent compression. Recognition of this functional subtype is important because symptoms may improve with postural correction, physical therapy, myofascial treatment, and workplace ergonomic adjustment.

CONCLUSION

Normal static imaging does not exclude thoracic outlet syndrome when symptoms are clearly position-dependent. Dynamic ultrasonography provides real-time functional assessment during provocative positioning and may help guide diagnosis and conservative management in functional or posture-related TOS.

Ethics statement: This study was approved by the Institutional Review Board of Presbyterian Medical Center (IRB No. 2025-10-005). Written informed consent for publication was obtained from the patient.

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Conflict of interest: The authors declare no conflicts of interest.

Patient consent: Written informed consent for publication was obtained from the patient.

Data availability statement: Data sharing is not applicable to this article, as no datasets were generated or analyzed during the current study.

REFERENCES

1. Sanders, R. J., Hammond, S. L., & Rao, N. M. (2007). Diagnosis of thoracic outlet syndrome. *Journal of Vascular Surgery*, 46(3), 601-604.
2. Abraham, P., Lecoq, S., Mechenin, M., *et al.*, (2024). Role of lifestyle in thoracic outlet syndrome: a narrative review. *Journal of Clinical Medicine*, 13(2), 417.
3. Levine, N. A., & Rigby, B. R. (2018). Thoracic outlet syndrome: biomechanical and exercise considerations. *Healthcare*, 6(2), 68.
4. Dollinger, P., Bohm, J., & Aranyi, Z. (2022). Combined nerve and vascular ultrasound in thoracic outlet syndrome: a sensitive method in identifying the site of neurovascular compression. *PLoS One*, 17(5), e0268842.
5. Dengler, N. F., Ferraresi, S., Rochkind, S., *et al.*, (2022). Thoracic outlet syndrome Part I: consensus on anatomy, diagnosis, and classification by the EANS Section of Peripheral Nerve Surgery. *Neurosurgery*, 90(6), 653-667.
6. Chim, H., Hagan, R. R., Barnett, A. J., *et al.*, (2024). Consensus recommendations for neurogenic thoracic outlet syndrome from the INTOS workgroup. *Plastic and Reconstructive Surgery Global Open*, 12(8), e6107.
7. Laulan, J., Fouquet, B., Rodaix, C., *et al.*, (2011). Thoracic outlet syndrome: definition, aetiological factors, diagnosis, management and occupational impact. *Journal of Occupational Rehabilitation*, 21(3), 366-373.
8. Khadilkar, S. V., Yadav, R. S., Soni, G., Dhonde, S., & Chaudhari, C. R. (2013). Brachial and lumbosacral plexopathies: a review. *Annals of Indian Academy of Neurology*, 16(1), 12-18.