Radiologic Characterization of Thoracic Outlet Syndrome in Two Patients with a Rare Anatomic Variant: Fused Cervical Rib

William Shelton, OMS-III[1] · *Duncan Tanner, OMS-III*[1] · *Brett Broussard, MD*[2]

[1]Midwestern University, Glendale, AZ, USA | [2]Banner Health, Sun City, AZ, USA

OBJECTIVES

The purpose of this report is to highlight the role of diagnostic imaging in the evaluation of suspected neurogenic thoracic outlet syndrome (nTOS) in two patients with a rare anatomic variant of cervical ribs exhibiting **complete bony fusion to the first rib**, and to review the associated clinical, osteopathic, and surgical implications.

INTRODUCTION / BACKGROUND

Thoracic outlet syndrome results from compression of the neurovascular bundle within the thoracic outlet, producing neurologic and vascular upper extremity symptoms. Neurogenic thoracic outlet syndrome is a clinical diagnosis supported by multimodality imaging, including radiography, CT and ultrasound with thoracic outlet protocols, and MRI.

- Cervical ribs occur in approximately **1.1%** of healthy individuals but in up to **29.5%** of patients with thoracic outlet syndrome.
- Despite this association, cervical ribs may go **unreported in up to 75% of CT studies**.
- Both cases included prior imaging in which fused cervical ribs were present but **not explicitly described** in the original radiology reports.

CASE DESCRIPTIONS

Patient A — 28-Year-Old Female

History of repetitive overhead activity and progressive left upper extremity fatigue, paresthesias with overhead activity, and shoulder pain refractory to conservative management. Examination reproduced left hand paresthesia with mild intrinsic hand weakness and medial forearm sensory deficit.

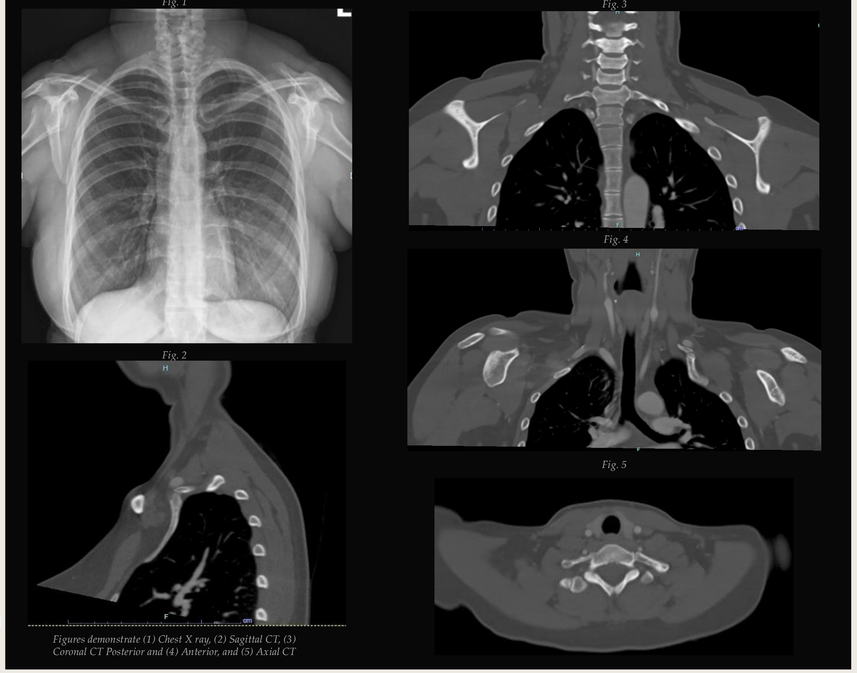
CTA demonstrated bilateral cervical ribs, with **complete fusion of the left cervical rib to the first rib** causing superior displacement and flattening of the left subclavian artery; right-sided narrowing occurred only with abduction. Vascular ultrasound showed a decrease of left subclavian arterial flow with abduction.

Patient B — 41-Year-Old Male (AFAB)

Presented with worsening chronic third through fifth digit pain and swelling with progressive arm pain refractory to prior cubital tunnel surgeries, worsened with provocative testing. CTA revealed a **calcified left cervical rib fused to the first rib** with persistent mild compression of the left subclavian artery in both abduction and adduction. MRI of the cervical spine showed only mild degenerative changes.

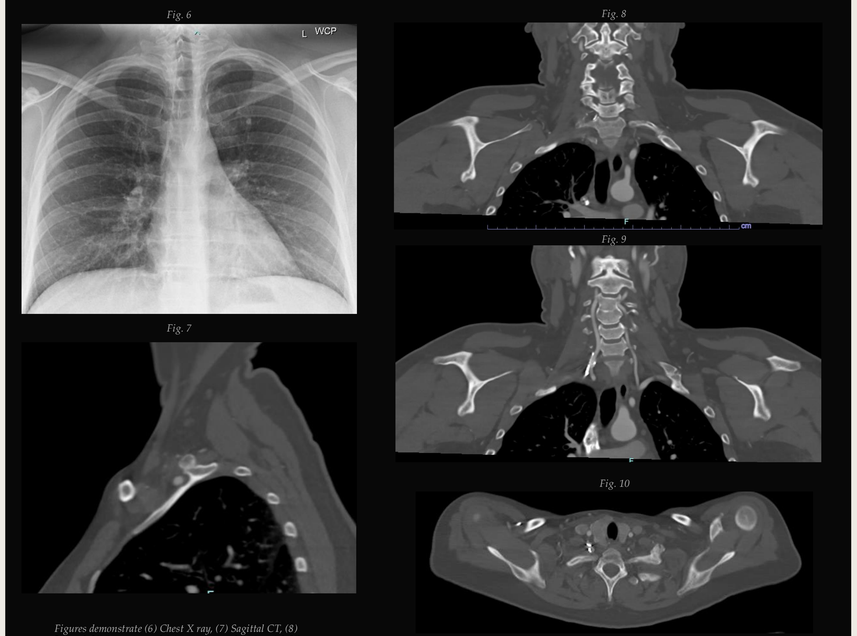
Evaluation included provocative physical examinations, CT and ultrasound with TOS protocols, MRI of the cervical spine and/or brachial plexus, and EMG studies.

Patient A — Pre-Operative Imaging (Figs. 1–5)



Figures demonstrate (1) Chest X ray, (2) Sagittal CT, (3) Coronal CT Posterior and (4) Anterior, and (5) Axial CT

Patient B — Pre-Operative Imaging (Figs. 6–10)



Figures demonstrate (6) Chest X ray, (7) Sagittal CT, (8) Coronal CT Posterior and (9) Anterior, and (10) Axial CT

DISCUSSION

Alternative diagnoses, including vascular TOS, cervical radiculopathy, and complex regional pain syndrome, were considered less likely following comprehensive evaluation. CT and ultrasound with TOS protocols were critical in identifying these rare bony abnormalities and assessing neurovascular involvement, while MRI aided anatomic delineation and surgical planning.

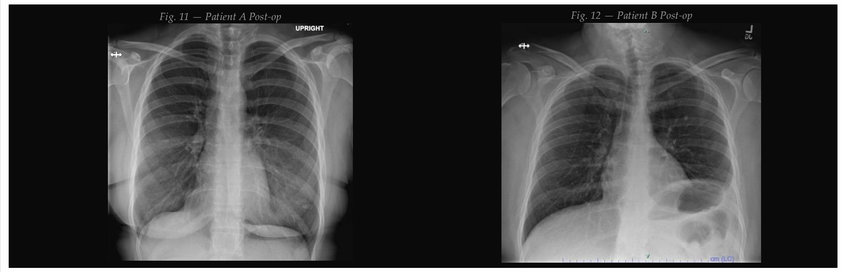
Regional somatic dysfunction may exacerbate symptoms and should be assessed as part of a comprehensive, multidisciplinary approach.

OUTCOMES / CONCLUSIONS

Both patients underwent **left supraclavicular cervical and first rib resection with anterior scalenectomy and brachial plexus neurolysis**. Surgical findings included dense fibrous bands in the brachial plexus with fusion of the cervical rib to the first rib, increasing technical complexity.

Patient A experienced marked postoperative improvement, while **Patient B** reported early partial symptom relief.

Cervical ribs may be overlooked on routine imaging. **Dynamic CT and vascular ultrasound** should be considered high-value studies in persistent upper extremity symptoms suggestive of TOS.



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