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First Rib Excision for Neurogenic Thoracic Outlet Syndrome: A Successful Outcome in a Case Report of an 18-Year-old

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ABSTRACT

Background: Neurogenic thoracic outlet syndrome (NTOS) is a rare condition caused by compression of the brachial plexus, often requiring surgical intervention in refractory cases. This report describes a successful outcome following first rib excision in a young patient with NTOS.

Case Presentation: An 18-year-old female presented with an 8-year history of left upper extremity pain, weakness, and numbness, aggravated by activity. Imaging revealed a bilateral elongated C7 transverse process and segmental attenuation of the left subclavian artery. Electromyography confirmed chronic left lower trunk brachial plexopathy and a median nerve conduction block, with autoimmune etiology ruled out. After unsuccessful conservative management (physical therapy, supraclavicular nerve block), left thoracic outlet decompression with first rib excision was performed on 22 May 2024. Post-operatively, the patient experienced complete symptom resolution and restored limb function.

Conclusion: This case underscores the role of surgical decompression in refractory NTOS, highlighting the importance of comprehensive diagnostic evaluation and surgical expertise for optimal outcomes.

Keywords: Neurogenic Thoracic Outlet Syndrome; Cervical rib; Brachial plexopathy; Segmental attenuation of Left Subclavian artery; Case Report

INTRODUCTION

Neurogenic Thoracic Outlet Syndrome (NTOS) is a rare condition caused by compression of the brachial plexus in the thoracic outlet, first described by Peet et al. in 1956 [1]. NTOS, a subtype of thoracic outlet syndrome, affects approximately 2–3 per 100,000 individuals annually, with true NTOS occurring in 1 per million [2]. Symptoms include upper extremity pain, weakness, numbness, and occasionally sympathetic nervous system dysfunction, often triggered by anatomical anomalies such as cervical ribs or elongated transverse processes [3]. The brachial plexus is most susceptible to compression in the interscalene and costoclavicular triangles, with less than 1% of the population having cervical ribs, a common cause [4]. Diagnosis is challenging due to nonspecific symptoms, often requiring multimodal imaging and electromyography [5]. While conservative treatments (e.g., physical therapy, nerve blocks) are first-line, refractory cases may necessitate surgical decompression, such as first rib excision, though its efficacy is debated [6,7]. This report presents a rare case of NTOS in an 18-year-old female with an elongated C7 transverse process, successfully treated with first rib excision, highlighting the role of surgical intervention in refractory NTOS and contributing to the ongoing debate on its effectiveness. This case report adheres to the SCARE 2025 guidelines [8].

ILLUSTRATIVE CASE

Patient Information (History)

An 18-year-old female presented to outpatient on 22 May 2024, with an 8-year history of left upper extremity pain, weakness, and numbness. Symptoms began at age 10, with progressive worsening over time, particularly aggravated by activities such as writing or cooking. The pain was sharp, severe in winter, and associated with burning and numbness in the left hand. Past medical and surgical history was not significant. She reported no trauma, systemic illness, or relevant family history. The patient was a non-smoker with no comorbidities.

Clinical Findings

Examination revealed left-sided neck tenderness and pain on arm and neck flexion. Wasting of the thenar and hypothenar eminences was noted, with impaired fine motor movements. Distal pulses were intact, and no sensory deficits were observed in the lower limbs.

Diagnostic Assessment

Electromyography (EMG) confirmed chronic left lower trunk brachial plexopathy and a median nerve conduction block, suggestive of NTOS. Autoimmune etiology was ruled out by negative ANCA and anti-dsDNA tests. Cervical spine X-ray revealed bilateral elongation of the C7 transverse process **(Figure 1).** CT angiography demonstrated segmental attenuation of the left subclavian artery in the costoclavicular space **(Figure 2).** MRI showed no evidence of brachial plexus injury or compression, supporting a diagnosis of NTOS secondary to anatomical compression.

Therapeutic Intervention

After unsuccessful conservative management, left thoracic outlet decompression with first rib excision was performed under general anesthesia. A transverse incision was made 1 cm above the clavicle in the supraclavicular space. The subcutaneous tissue and platysma were dissected, and the sternocleidomastoid muscle was retracted medially. The fat pad behind the sternocleidomastoid was lifted, exposing the phrenic nerve, internal jugular vein, and subclavian artery, which were preserved. The middle scalene muscle was divided, and the brachial plexus was identified and protected. The first rib, located posterior to the brachial plexus and subclavian artery, was partially excised after careful dissection

of the pleura. Hemostasis was secured, and a 10 Fr redivac drain was placed. The wound was closed in layers (muscle and platysma with Vicryl 3.0, skin with Vicryl 4.0).

At age 10 (2016), the patient experienced the onset of left arm pain and numbness. From 2016 to 2022, there were intermittent consultations with physicians; the patient was diagnosed with NTOS, followed by conservative treatment (physical therapy, analgesics) for 2 years. The patient received a supraclavicular nerve block (0.25% ropivacaine 10 mg, dexamethasone 8 mg) that provided temporary relief on May 7, 2024. The patient presented to the outpatient department of the hospital and underwent surgical management on May 22, 2024.

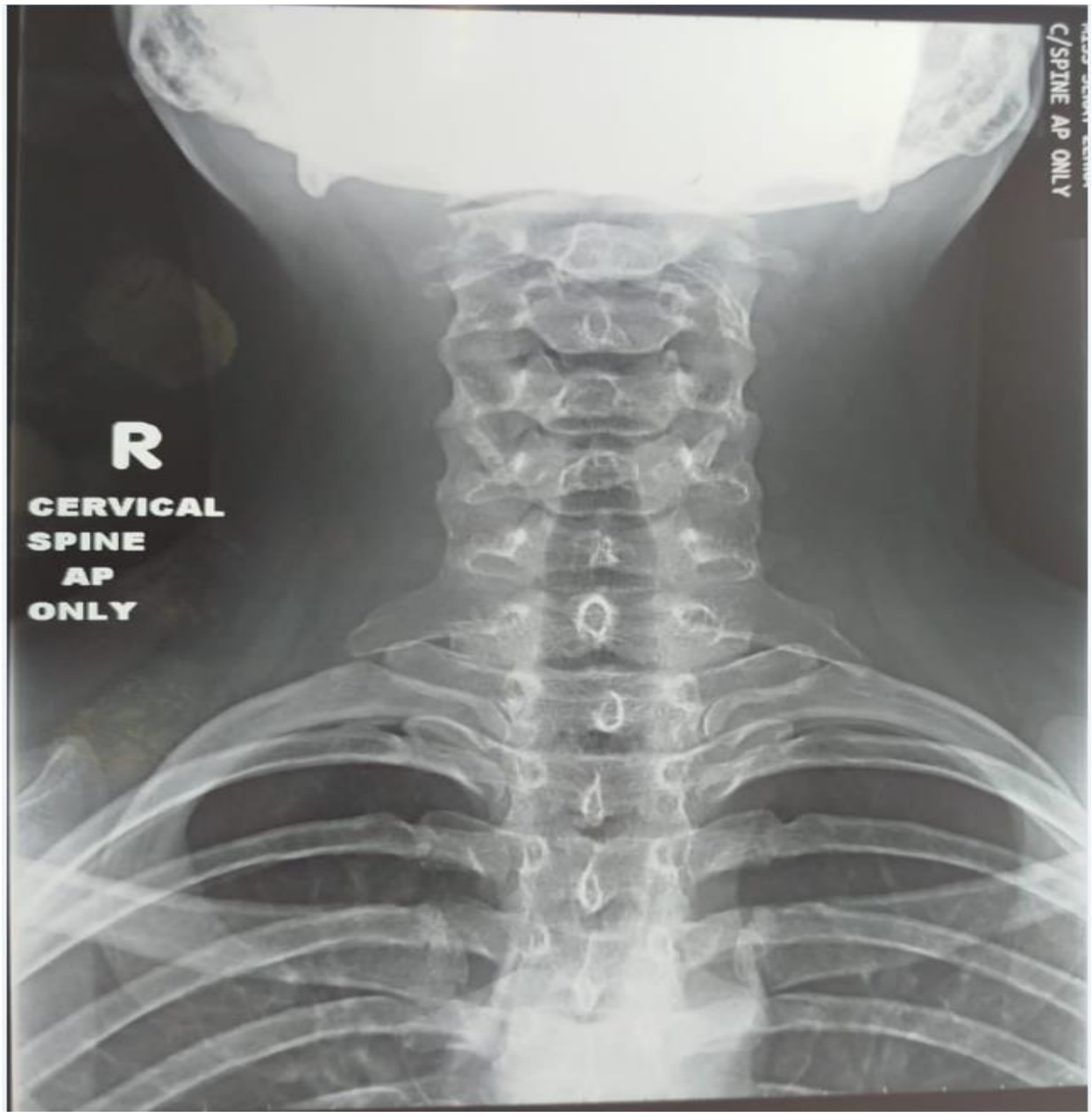

Figure 1

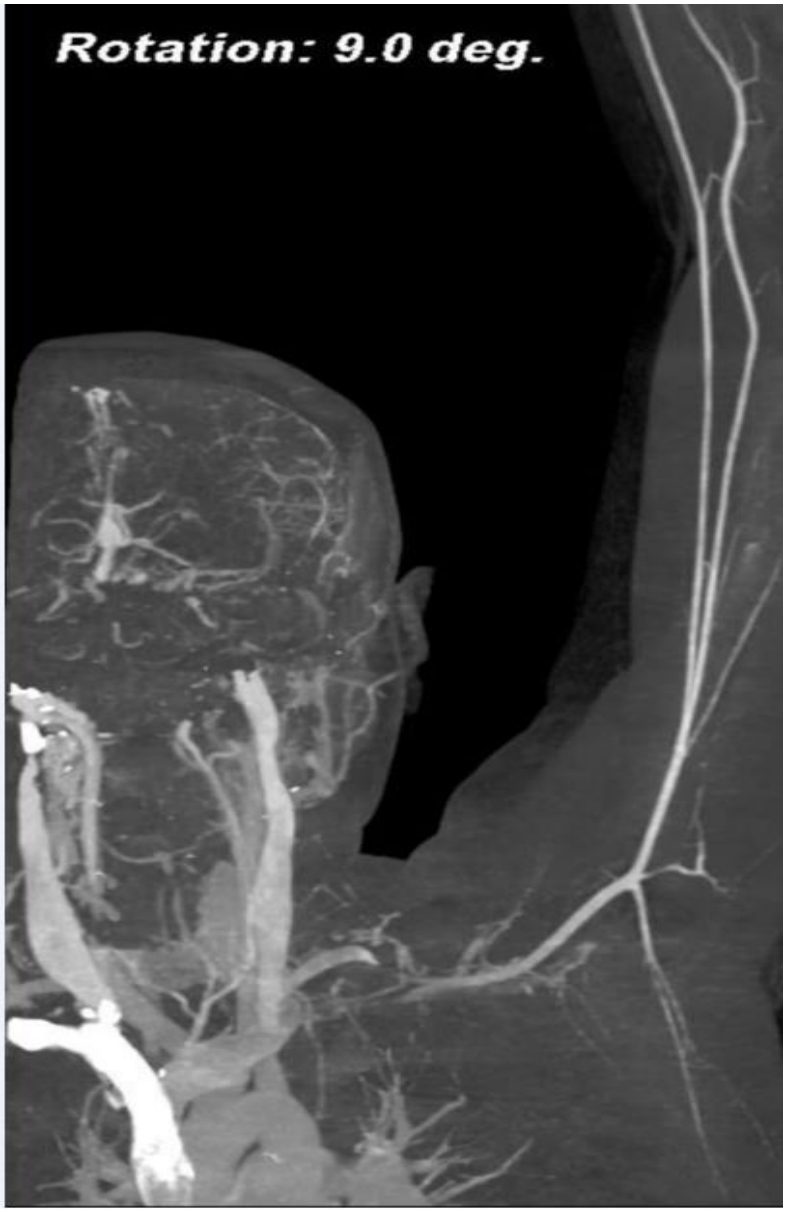

Figure 2:

Follow-up and Outcomes

Post-operatively, the patient received paracetamol (1 g every 8 hours) and cefazolin (1 g IV every 8 hours for 24 hours). She was mobilized on day 1 with physiotherapy. At 6 weeks, she reported complete resolution of pain and numbness, with restored arm function and normal fine motor movements. Distal pulses remained palpable, and no brachial plexus injury was noted. Follow-up at 3 months confirmed sustained symptom relief with no recurrence. Regular follow-ups are planned to monitor long-term outcomes. The patient expressed relief at the resolution of her symptoms, stating, “After years of pain and difficulty using my hand, I can now write and cook without discomfort. The surgery has given me my life back.

DISCUSSION

This case of an eighteen-year-old girl with longstanding unilateral upper extremity weakness and pain demonstrates the difficulties in diagnosing neurogenic thoracic outlet syndrome (TOS). A comprehensive evaluation led to the recognition of 7th cervical spine transverse process elongation, which worsened neurovascular congestion in the thoracic outlet. These findings support the literature indicating a diagnostic link between cervical rib abnormalities and the TOS-causing neurogenic type of thoracic outlet syndrome [9].

CT imaging was critical for detecting anatomical anomalies that contributed to neurogenic TOS. Additionally, the vascular component of TOS was underlined by CT angiography observations of segmental attenuation of the left subclavian artery in the costoclavicular area, emphasizing the significance of full vascular imaging in suspected patients. Alternate explanations, such as injury to the brachial plexus, were ruled out by MRI; nonetheless, electromyography revealed a persisting brachial plexopathy in the left lower trunk, consistent with neurogenic TOS. Notably, a conduction block in the median nerve suggested an autoimmune origin that needed to be ruled out via serologic tests [10].

Proper diagnosis and therapy plans were made possible by a careful review of the electromyographic results, imaging studies, and clinical history. Surgical intervention in the form of first rib resection and left thoracic outlet decompression was pursued when conservative therapy failed. This method, which aims to relieve neurovascular compression and restore upper limb function, aligns with accepted treatment guidelines for refractory cases of neurogenic TOS [11]. The supremacy of surgical treatment over conservative management has been established by the clinical trial as well [12]. This case demonstrates the importance of multimodal imaging and surgical expertise in managing rare NTOS presentations. The anatomical finding of bilateral C7 transverse process elongation adds novelty. As a single case, generalizability is limited. Long-term follow-up data are not yet available, and the role of autoimmune factors in median nerve conduction block remains unclear.

CONCLUSION/ LESSON

This case emphasizes the need to consider NTOS in young patients with chronic upper extremity symptoms refractory to conservative treatment. Comprehensive diagnostic evaluation, including imaging and EMG, is crucial for identifying anatomical causes. First rib excision is an effective surgical option for relieving neurovascular compression in NTOS, offering significant symptom relief and functional restoration.

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