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Case Report

Supraclavius muscle observed during anterior scalenectomy for thoracic outlet syndrome: A report of two cases and review of the literature

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ABSTRACT

Background: Thoracic outlet syndrome (TOS) is a clinical diagnosis caused by compression of neurovascular structures in the thoracic outlet. There are a variety of structures that cause compression implicated in TOS. TOS patients frequently require surgical decompression. Various structural anomalies encountered during decompression have been reported in the literature.

Case Description: We present two females (ages 42 and 45) that each underwent anterior scalenectomy for thoracic outlet decompression through a supraclavicular approach. A supraclavius muscle anomaly was observed in both patients. Analogous to the two reports previously described in the literature, the muscle inserted, along the medial superior undersurface of the clavicle and originated dorsally along the trapezius muscle. This is not to be confused with the subclavius posticus muscle, which originates from the first rib and inserts on the upper border of the scapula.

Conclusion: These two cases represent just the third and fourth ever descriptions of a supraclavius muscle anomaly encountered during TOS surgery. Due to the wide variety of anatomical variations encountered during TOS surgery, it is not only crucial for continued reporting of such anatomical variations to be reported in the literature but equally important for clinicians that treat TOS to be aware of such variations.

Keywords: Anterior scalenectomy, Muscle anomaly, Supraclavius, Thoracic outlet syndrome

INTRODUCTION

Thoracic outlet syndrome (TOS) was first described by Peet *et al.* as a clinical diagnosis in 1956.[12] TOS is a constellation of signs and symptoms caused by extrinsic compression of neurovascular structures as they pass through the thoracic outlet. To date, a wide variety of structural etiologies causing neurovascular compression of the thoracic outlet have been reported in the scientific literature. Common causes of neurovascular compression in TOS patients are scalene muscle hypertrophy, a cervical rib, and a prominent C7 transverse process, among others. While osseous structures can often be the cause of extrinsic compression in TOS patients, it is thought that as high as 70% of cases of TOS may actually arise from soft-tissue compression.[1]

Conservative management, such as physical therapy, is the first line of therapy in patients presenting with TOS. However, surgery is often indicated in patients that fail conservative

management. The surgical approach in patients with TOS depends on what structure causes compression and where compression of the neurovascular structures occurs. At our institution, we routinely perform anterior scalenectomy through a supraclavicular approach in patients that present with signs and symptoms consistent with TOS and fail conservative management.

There have been multiple reports in the literature of anomalous muscles and other connective tissue structures described anatomically when performing surgical approaches for thoracic outlet syndrome.[2-4,6,7,9-11,13,14,16] Salehi *et al*. have described two cases of a supraclavius muscle anomaly and its anatomical relation to the thoracic outlet.[15] Here, we report two additional cases of a supraclavius muscle anomaly encountered when performing an anterior scalenectomy through a supraclavicular approach for TOS.

CASE REPORTS

Case 1

A 42-year-old female with an unremarkable medical history presented to the neurosurgery clinic with complaints of the left arm weakness and numbness. She also reported a perception of the left arm heaviness exacerbated with arm elevation. Physical examination revealed positive thoracic outlet maneuvers in the left upper limb. A Tinel sign was positive over the left supraclavicular area. The patient demonstrated a positive scratch collapse test in the left supraclavicular region. She manifested a Medical Research Council grade 4/5 of the left triceps, handgrip, interossei, and thenar eminence. There was evidence of decreased light touch sensation over the fourth and fifth digits of the left hand, the ulnar aspect of the left hand, and the ulnar aspect of the left distal forearm both anteriorly and posteriorly. Deep tendon reflexes were 2+ and symmetric in the bilateral upper limbs.

Electromyography (EMG)/nerve conduction studies were unremarkable. A computerized tomography (CT) scan of the cervical spine did not reveal a cervical rib but did demonstrate a mildly elongated left C7 transverse process. Vascular ultrasound studies revealed arterial impingement with thoracic outlet maneuvers in the left subclavian artery with her left arm positioned at 90°, hyperextended, and head hyperextended to both the right and left. Given the patient's reported signs and symptoms, physical examination findings, and diagnostic imaging findings, she was clinically diagnosed with TOS. Due to her persistent symptoms despite nonoperative management, she was offered a left anterior scalenectomy through a supraclavicular approach for thoracic outlet decompression.

The patient was taken to the operating room and positioned supine. A curvilinear incision was planned two finger breadths superior to the left clavicle, lateral to the posterior border of the sternocleidomastoid muscle, and anterior to the anterior border of the trapezius muscle. From here, a standard dissection was performed down to the level of the superficial fat pad. An anomalous muscle, distinct from the sternocleidomastoid muscle, was immediately identified traversing the supraclavicular space [Figure 1]. The muscle inserted along the upper part of the undersurface of the medial clavicle and its origin appeared to be somewhere deep to the anterior border of the trapezius muscle. An effort to find its exact origin was not pursued as it would have required further aggressive dissection beyond the intended surgical approach. A substantial segment of the muscle was resected and sent to pathology, which later revealed findings consistent with normal skeletal muscle. Attention was then diverted to further brachial plexus exposure and routine anterior scalenectomy. The patient tolerated the procedure well without any complications. At 1 year follow-up, the patient reported at least 90% improvement in her preoperative complaints and denied any new signs or symptoms.

Case 2

A 45-year-old female with an unremarkable medical history presented to the neurosurgery clinic complaining of a 15-year history of progressively worsening right arm weakness and numbness, exacerbated by activities that required her to elevate her arm. Of note, roughly 1 year before presentation, she underwent a diagnostic workup under the direction of a vascular surgeon and was diagnosed with the right-sided TOS. Vascular ultrasound studies at that time revealed right subclavian arterial impingement with one provoking maneuver, compression of the subclavian vein in four

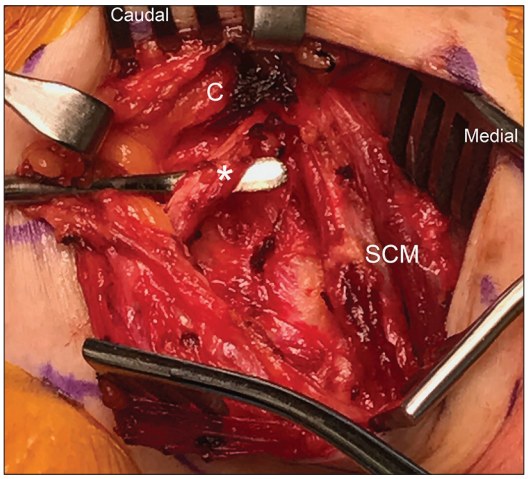

Figure 1: *Case 1*. Intraoperative photograph showing a supraclavius muscle (*) encountered during left anterior scalenectomy for thoracic outlet syndrome through a supraclavicular approach. C: clavicle, SCM: Sternocleidomastoid.

positions, and a nonocclusive deep vein thrombosis of the right subclavian vein. EMG performed at that time was unremarkable. CT of the cervical spine was unremarkable for a cervical rib. An initial procedure at that time was performed by vascular surgery for rib resection and pectoralis minor release through an infraclavicular approach. The patient did not get symptomatic relief from this and was, therefore, offered an anterior scalenectomy by neurosurgery.

The patient was taken to the operating room and positioned supine with her head turned to the left. A curvilinear incision was planned superior to the left clavicle and lateral to the sternocleidomastoid muscle. Incision was made and the subcutaneous and superficial tissues were dissected in a standard fashion. On mobilization of the supraclavicular fat pad, an anomalous muscle was identified in the supraclavicular space. This muscle was itself distinct from the sternocleidomastoid, inserted on the superior aspect of the medial clavicle, and tracked posteriorly across the supraclavicular space before diving deep to the trapezius muscle [Figure 2]. The muscle's origin appeared to be somewhere along the trapezius muscle. Effort was not taken to perform further exploration of the muscle's exact origin as it would have required additional aggressive dissection unrelated to the procedure. The muscle was transected to allow for further dissection into the thoracic outlet. Attention was, then, diverted to performing the remaining aspects of the thoracic outlet decompression through a right anterior scalenectomy. The remainder of the procedure was uneventful, and the patient tolerated the procedure well without complication.

At her 6-week follow-up, she reported at least a 50% improvement in her numbness and complete resolution of pain.

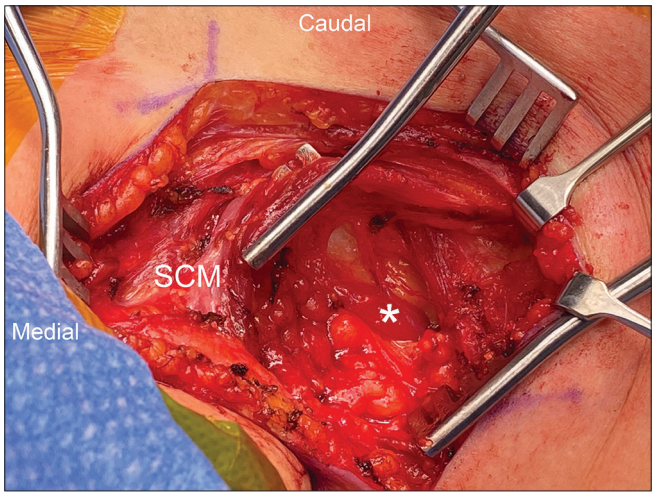

Figure 2: *Case 2.* Intraoperative photograph showing a supraclavius muscle (*) encountered during right anterior scalenectomy for thoracic outlet syndrome through a supraclavicular approach. SCM: Sternocleidomastoid.

DISCUSSION

TOS is a rare clinical diagnosis with an incidence most recently reported to range between 0.5 and 3/100,000 people/year.[8] TOS is largely defined by extrinsic compression and manifests in a spectrum of signs and symptoms that occur at the level of the thoracic outlet. Over the years, there have been a wide variety of structural etiologies identified in the literature thought to be the culprit of TOS. However, TOS is most often caused by compression from the first rib or the anterior scalene muscle.[5] While a first rib and anterior scalene muscle may be the most common structural causes of TOS, there are many less frequently encountered structures described in the literature that are thought to contribute as well. It is crucial that TOS surgeons be cognizant of as many of these culprit structures as possible to provide the best surgical care for the patients that they evaluate and treat.

This report describes a supraclavicular muscle anomaly encountered during thoracic outlet decompression through anterior scalenectomy. Before our report, there have been just two reports of this supraclavicular muscle anomaly encountered during thoracic outlet decompression.[15] The muscle anomaly we describe here has previously been classified as the *supraclavius muscle*.[15]

In our cases and the cases previously identified in the literature, the supraclavius muscle anomaly appears to have a rather consistent relationship with its surrounding anatomical structures. Salehi *et al*., initially, described this muscle as attaching obliquely to the medial superior undersurface of the clavicle and just lateral to the clavicular portion of the sternocleidomastoid muscle. In their description of the muscle, they note the muscle traversing deep to the scalene fat pad, yet just anterior to the brachial plexus, where the nerves emerge from the scalene triangle. The origin of the supraclavius muscle in their report was described as lateral along the trapezius muscle. Likewise, an analogous anatomical relationship of the supraclavius muscle and its surrounding structures was appreciated in the two cases that we present [Figure 3]. Not only is it pertinent for TOS surgeons to be aware of this anatomy but it is also crucial for radiologists to have similar knowledge so that they can accurately identify the muscle's presence or lack thereof when interpreting magnetic resonance imaging (MRI) studies. Unfortunately, though, MRI descriptions of the muscle are lacking in the literature. Whether the muscle contributed to the TOS symptoms or was an incidental finding remains to be ascertained. The muscle did not appear compressive when the patient's arm was in an adducted surgical position intraoperatively. However, the muscle could demonstrate compressive tendencies when the arm is abducted or in other anatomical positions clinically.

Furthermore, the supraclavius muscle is not to be confused with the subclavius posticus muscle described in other

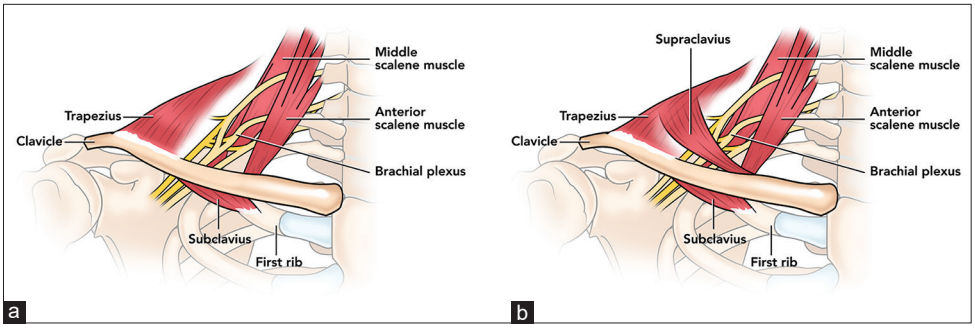

Figure 3: Diagrammatic illustration demonstrating (a) normal anatomy and (b) supraclavius muscle variant anatomy encountered during right anterior scalenectomy for thoracic outlet syndrome through a supraclavicular approach.

Table 1: Literature review describing four adult cases of a supraclavius muscle encountered during thoracic outlet decompression.

Case	Age at diagnosis (years)	Gender	Presenting symptom (s)	Surgical procedure (s)	Side of muscle
Salehi *et al.*, 2015[15]	19	Male	Arm swelling and cyanosis	Scalenectomy, first rib resection, and subclavian vein reconstruction	Right
Salehi *et al.*, 2015[15]	60	Female	Neck pain, arm/hand numbness and tingling	Scalenectomy, first rib resection, pectoralis minor tenotomy	Right
Our case report, 2022	42	Female	Arm weakness and numbness	Anterior scalenectomy	Left
Our case report, 2022	45	Female	Arm weakness and numbness, venous thrombosis	Anterior scalenectomy	Right

reports.[3,4,11] The latter muscle originates from the first rib and inserts along the upper border of the scapula near the suprascapular notch.

Among the now four cases of a supraclavius muscle anomaly reported in the literature, three out of four have been identified in a female [Table 1]. The age range of patients found to have a supraclavius muscle during TOS decompressive surgery ranges from 19 to 60 years of age, with the average age being 41.5 years of age. Of the four cases, one presented with arm swelling and cyanosis, one with neck pain, three with arm numbness, and two with arm weakness. Three of the four cases reported in the literature have identified the supraclavius muscle on the right side of the patient while only one has identified it on the left.

In addition to reporting the third and fourth ever cases of the supraclavius muscle in the literature, we describe the second and third ever cases of a female found to have a supraclavius muscle. We also present the youngest female, 42 years of age, to date in which a supraclavius muscle was identified. We, additionally, report the first two patients to present with arm weakness as their manifesting symptom, in which a supraclavius muscle was identified. Moreover, we present the first case to date of a supraclavius muscle found on the left side of the body.

CONCLUSION

TOS is a rare clinically diagnosed entity resulting from a wide variety of compressive pathologies. Numerous structural anomalies encountered during TOS surgery have been described in the literature. Here, we present the third and fourth cases ever of a supraclavius muscle anomaly encountered during an anterior scalenectomy through a supraclavicular approach for thoracic outlet syndrome. It is vital for clinicians who diagnose and treat TOS to possess knowledge of such anatomical anomalies so that they can provide the best possible care for their patients.

Declaration of patient consent

Patients' consent not required as patients' identities were not disclosed or compromised.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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