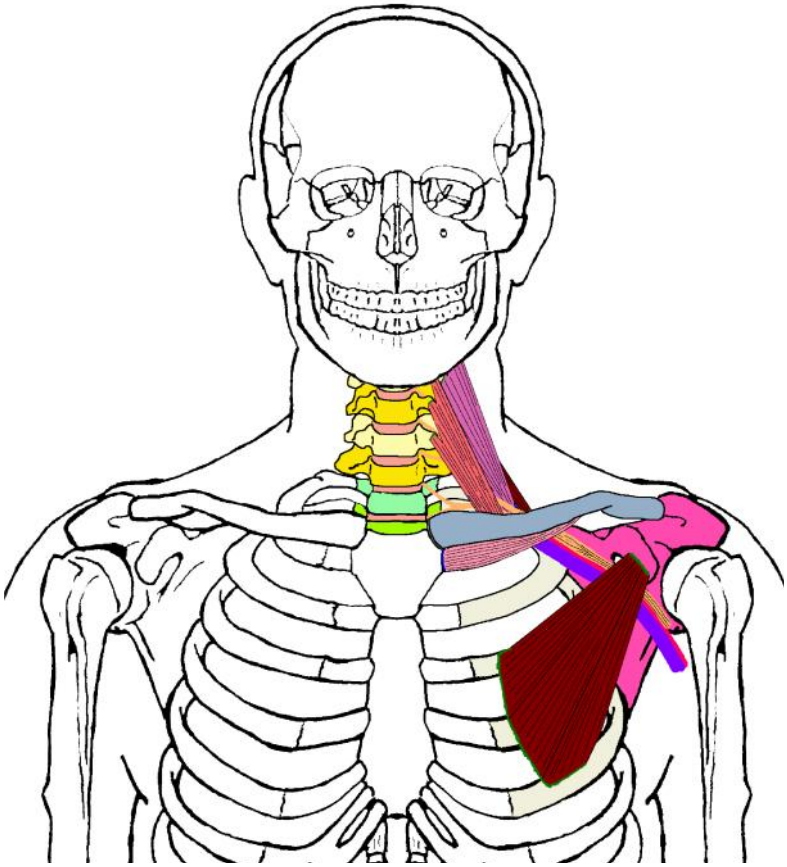
STRUCTURES OF THORACIC OUTLET SYNDROME

OVERVIEW

Thoracic Outlet Syndrome (TOS) is a group of related of symptoms that indicate a restriction in the neurovascular bundle that supplies the upper extremity. Like other syndromes, such as Chronic Fatigue Syndrome or Piriformis Syndrome, it is not a clear diagnosis. It's a condition that may be resolved by addressing one or many of the dysfunctions indicated by the symptoms.

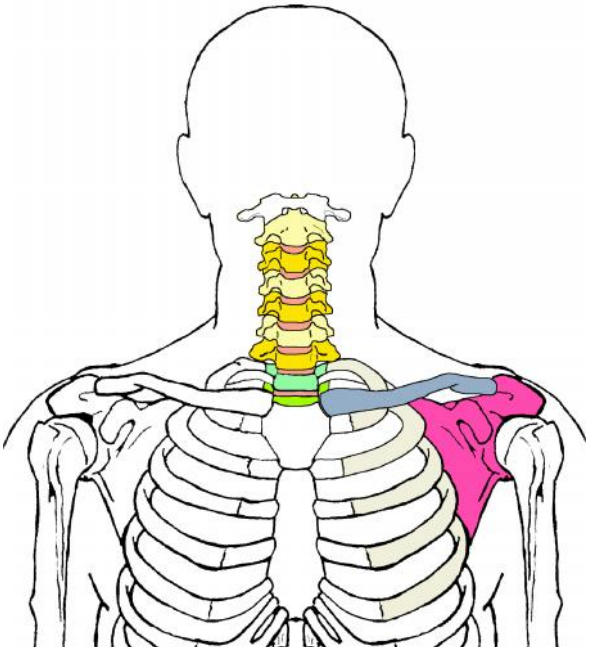
The name "thoracic outlet syndrome" implies that that the dysfunction has occurred in the area where the nerves and vascular structures pass through the shoulder to the upper extremity. Restrictions in myofascial structures of the neck are usually included in this syndrome. This includes restrictions in the brachial plexus, subclavian artery, subclavian vein and the subclavian lymph trunk. These structures may become restricted in one or more places between the cervical vertebrae and the axilla.

The first section of this document reviews the boney structures that are most directly involved. The second section reviews the soft tissues, building from posterior to anterior.



STRUCTURES OF TOS

BONEY STRUCTURES OF TOS



TOS - BONES

C2-C7 (shown in yellow)

Cervical vertebrae are particularly important in the treatment of TOS.

- Trigger point activity in the scalenes is strongly governed by joint displacement in the cervical vertebrae.

Although radiculopathy is technically not a Part of TOS, these vertebrae can compress the nerve roots of the brachial plexus and should be addressed before treatment of the muscles.

C1 is not highlighted as it does not directly attach any of the soft tissues that press on the brachial plexus. It is however, more difficult to resolve displacements in the other cervicals, with lasting results, without addressing displacements in the articulations of C1.

T1-T1 (shown in green)

These two thoracic vertebrae surround the nerve roots of the lower branch of the brachial plexus.

- It is difficult to resolve FORWARD HEAD POSTURE, which can perpetuate TOS, without addressing shearing in the upper thoracis.
- Displacements of the costovertebral joints of these vertebrae govern trigger points in the scalenes.

Clavicle (shown in gray)

- When depressed, the clavicle can apply can apply pressure on the neurovascular bundle.
- Padget-Schroder's syndrome is a variation of TOS where the subclavian vein deviates medially and gets compressed between the clavicle and the first rib.

First Rib (shown in tan)

- An elevated fist rib can press into the brachial plexus
- An elevated first rib governs trigger point activity in the scalenes.

Ribs 2-5 (shown in tan)

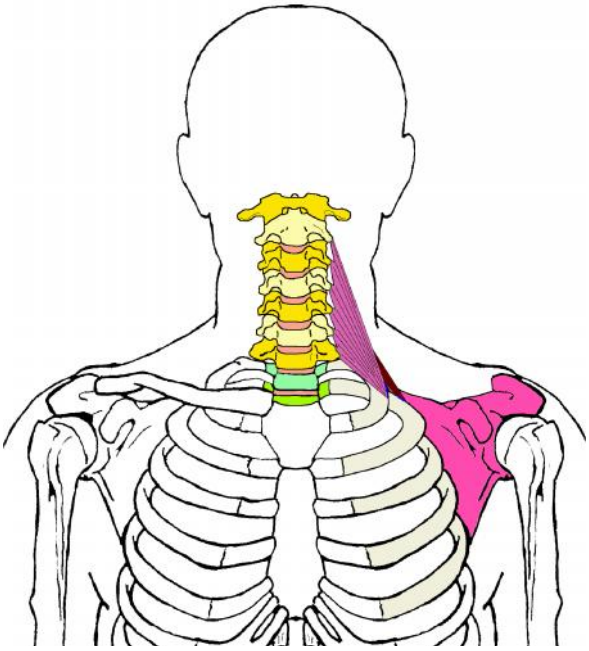
Ribs 2-5 serve as attachments for scalenes, subclavius and pectoralis minor – the muscles that most strongly contribute to TOS.

Scapula (shown in hot pink)

- Tension in pectoralis minor and the elevation of the scapula is strongly affected by the position of the scapula.
- The coracoid process may press into the neurovascular bundle when the scapula has an extreme forward tilt as when the pec minor is very short and the lower trapezius is overstretched.

SOFT TISSUES OF TOS

Scalenus medius (shown in pink)



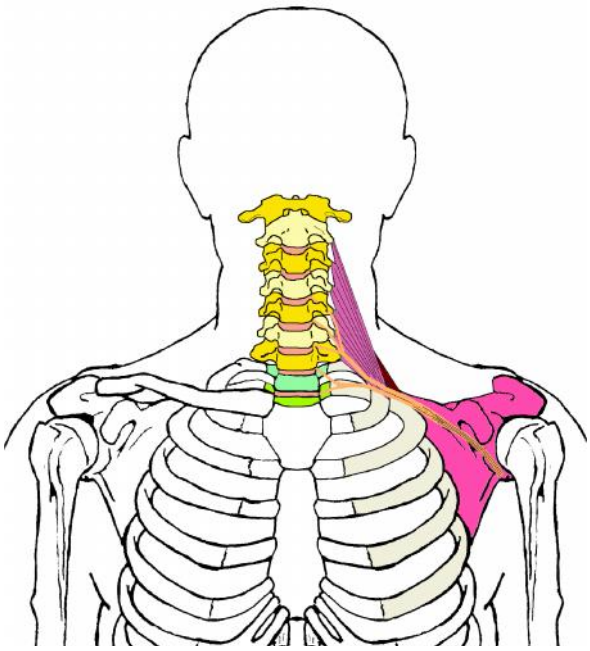
SCALENUS MEDIUS & POSTICUS

The middle scalene attaches to the first rib and all the posterior tubercle of cervical vertebrae from C2-C7.

Contributions to neurovascular pressure:

- It creates a veil of muscle just posterior to where the brachial plexus exits. Tension on this muscle creates a pressure on the brachial plexus and subclavian artery from the back
- It elevates the first rib, pulling it up against the clavicle.

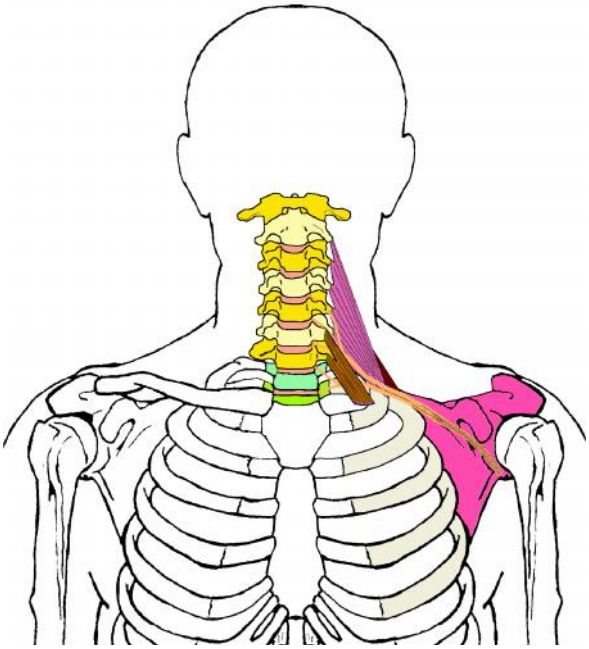
Brachial plexus (shown in amber)



TOS - BRACHIAL PLEXUS

This plexus is composed of nerve roots from C5-T1. Close the vertebrae, they form two main bundles. C5, C6, and C7 combine into the upper trunk. C8 and T1 combine into the lower trunk. These trunks are formed before the plexus passes through the scalenes.

Scalenus minimus (shown in brown)



SCALENUS MINIMUS

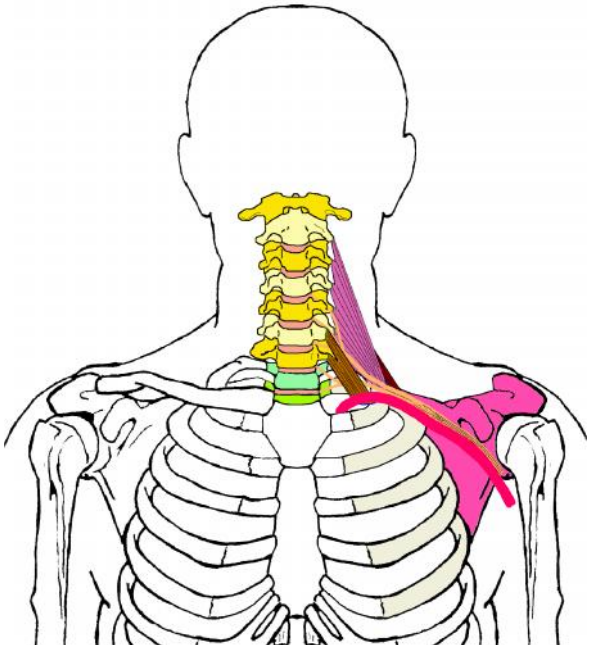
Scalenus minimus is a small muscle that extends from the C7 and/or C6, to the fascia of covering the chest cavity. It appears to reinforce the thick fascia that connects the anterior tubercle of C7 to the first rib.

Travell found scalenus minimus on at least one side of about half the subjects studied. She remarks that it can be a strong, thick muscle.

Contributions to neurovascular pressure:

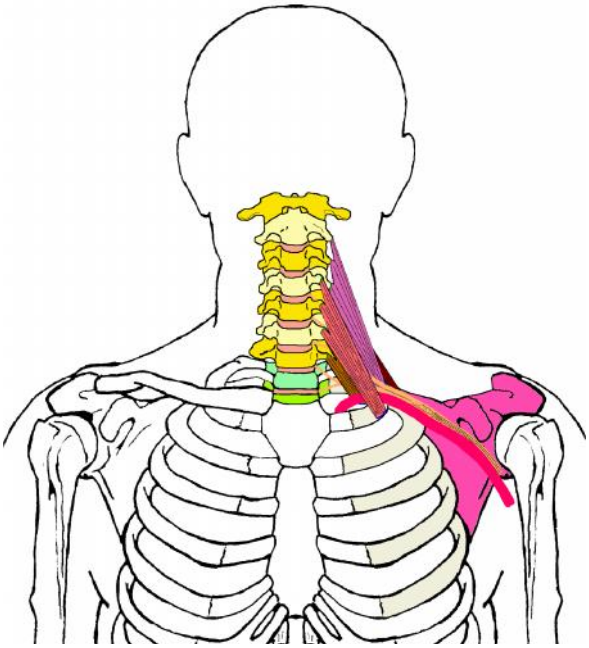
- It elevates the first rib, pulling it into the clavicle
- It presses the brachial plexus into the medial scalene
- It presses the subclavian artery into the anterior scalene

Subclavian artery (shown in red)



The subclavian artery exits the thoracic cage near the mid-line and loops over the first rib. It is mostly medial and, at times, anterior to the brachial plexus as it extends toward the axilla.

Scalenus anticus (shown in orange)



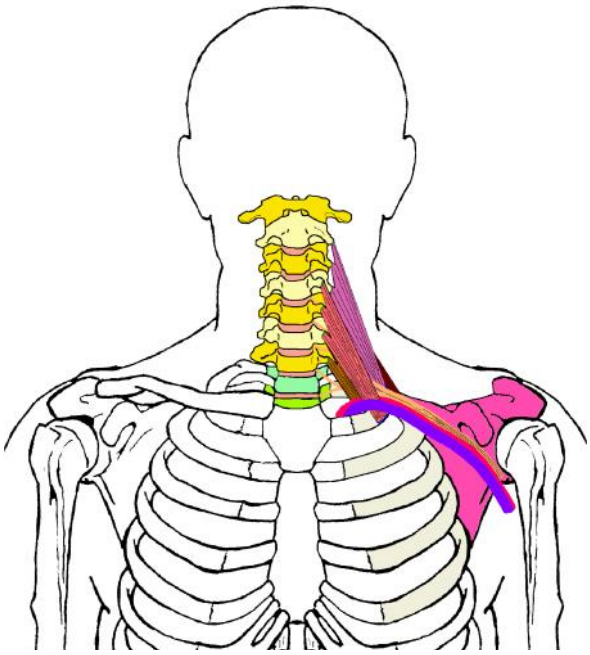
SCALENUS ANTICUS

The anterior scalene usually attaches to the anterior tubercles of the 3rd, 4th and 5th cervical vertebrae; just anterior to the where the nerve roots exit.

Contributions to neurovascular pressure:

- It can press the subclavian artery and brachial plexus against scalenus medius.
- When its attachment along the 1st rib extends more posteriorly than normal, it is particularly prone to cinch on the plexus and artery.
- It elevates the first rib, pulling it up to compress the neurovascular bundle against the clavicle.
- It can press the subclavian artery into scalenus minimus

Subclavian Vein (shown in violet)



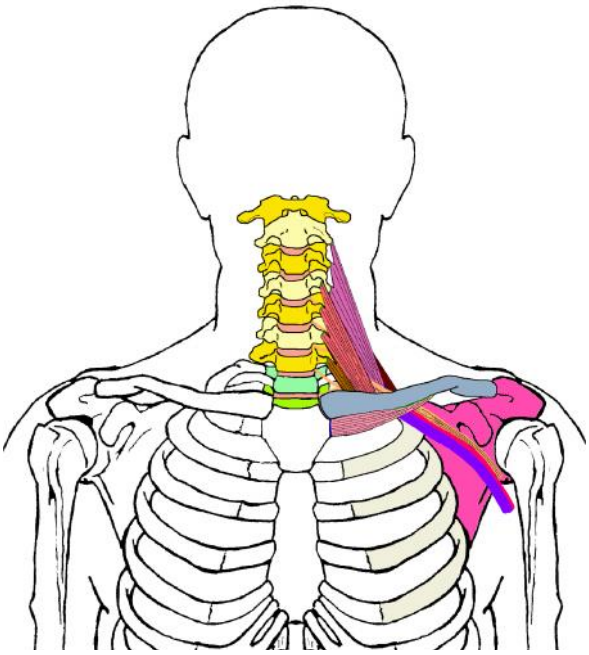
SUBCLAVIAN VEIN

The subclavian vein exits the thoracic cage anterior to scalenus anticus. It travels through a groove in the first rib and then joins the neurovascular bundle before the bundle passes into the axilla.

Subclavian lymphatic trunk (not shown)

The subclavian lymphatic trunk inserts into the subclavian vein medial to the structures that entrap the other structures. Some of the lymph vessels that extend off of the main trunk follow the subclavian vein and can be entrapped to restrict lymphatic flow.

Subclavius (shown in pink)



SUBCLAVIUS

Subclavius is a cylindrical muscle that originates on the costal-cartilage of the first rib and inserts on the underside of the medial third of the clavicle.

Contributions to neurovascular pressure:

- It draws clavicle down trapping the neurovascular bundle between the first rib and upper belly of serratus anterior.
- When over-developed, its belly presses into the neurovascular bundle

Costocoracoid membrane (not shown)

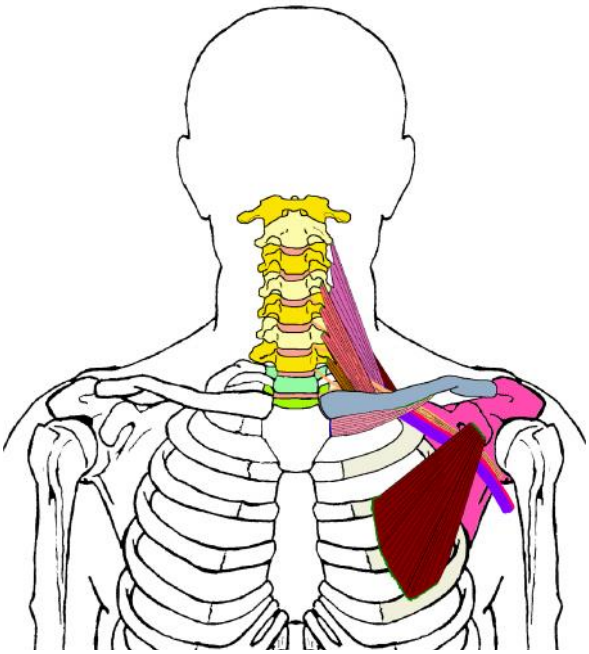
The costocoracoid membrane is a thick fascial membrane that invests pectoralis minor, invests subclavius, and occupies the area in between them.

It attaches to the clavicle, with a layer on either side of subclavius. Those layers blend over the upper ribs and then split again as it invests the pectoralis minor. It continues laterally past the pectoralis minor to become the axillary fascia and fuse with the facia of the short head of the biceps. This, of course varies with the more common anomalies of pectoralis minor.

It fuses with fascia of over the first two ribs, extending medially past the attachment of subclavius.

The costocoracoid ligament is a thickened portion of this membrane extending from the first rib to the coracoid process. It blends with the coracoclavicular ligament that secures the coracoid process to the clavicle.

Pectoralis minor (shown in red)



PECTORALIS MINOR

Pectoralis minor originates on the 3rd, 4th and 5th rib and inserts on the medial portion of the coracoid process. More common anomalies include origins on the 1st, 2nd and 6th rib as well insertions that extend to the greater tubercle of the humerus.

Contributions to neurovascular pressure:

- Protraction of the scapula, to the point of pulling the coracoid process onto the ribs.
- It can apply pressure on the costocoracoid membrane, which covers and protects the neurovascular bundle as it passes under the clavicle to the axilla.

