

THORACIC OUTLET SYNDROME

An Essay

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

سُبْحَانَكَ لَا إِلَهَ إِلَّا أَنْتَ

لَنَا إِلَهٌ مَا عَلِمْنَا

أَنْتَ

الْعَلِيمُ الْعَظِيمُ

« سورة البقرة »

صدق الله العظيم



*Dedicated to my
Parents*

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INTRODUCTION

INTRODUCTION

The thoracic outlet syndrome is a compressive neuro-vascular condition of the upper extremity. The neurologic, arterial, and venous structures may be affected individually or in combination in any given patient (Fechter and Kushner, 1993).

Historically, a cervical rib was thought to be the cause of compression, however the majority of cases are due to compressive fibrous band (Balnchard et al., 1992).

It typically occurs in young to middle aged females. The neurological manifestations are common with fibrous band, and should be differentiated from those due to carpal tunnel syndrome. The vascular manifestations occur with cervical rib and may simulate Raynaud's Syndrome (Andrew Kaye, 1991).

Thoracic outlet syndrome lacks special diagnostic test, however plain X-rays may show the cervical rib. Also nerve conduction studies, electromyography, CAT and Doppler Ultrasonography may help in the diagnosis (Panegyres et al., 1993).

Treatment is usually conservative. Surgery is indicated when there is evident neural and/or vascular entrapment (Andrew Kaye, 1991).

ANATOMY OF THE THORACIC OUTLET

ANATOMY OF THE THORACIC OUTLET

The thoracic outlet is reniform in shape. Its anteroposterior diameter is about 5cm and its transverse diameter is about 10cm. Its plane slopes downwards and forwards. It is bounded by the first thoracic vertebra behind and the superior border of manbrium sterni in front and the first rib on each side. Like any other parts of the skeleton the thorax displays variations in dimensions and proportions which are partly individual and also linked to age, sex, race e.g. in female the capacity is less absolutely and proportionately (Gray, 1985). Figure (1).

The structures passing on each side are the upper part of the pleura and the apex of the lung. Between the pleura and the neck of the first rib from medial to lateral side lie the sympathetic trunk, the superior intercostal artery and most of the ventral ramus of the first thoracic nerve (Gray, 1985).

It also includes the subclavian artery, the subclavian vein and the brachial plexus, as these structures traverse through the retroclavicular fossa to the axilla (Nichols, 1985).

1- Anatomy of The Bones:

1. The first rib:

It is the most curved and usually the shortest of the ribs. Its length in the average adult is only about "3" inches from the

vertebral column to the cartilagenous costomanubrial junction: The upper surface of the shaft is crossed obliquely by two shallow grooves separated from each other by slight ridge which ends at the inner border of the rib in a small projection, the scalene tubercle for the scalenus anterior muscle (Nichols, 1986).

The groove in front of the tubercle contains the subclavian vein and the groove behind the tubercle is occupied by the subclavian artery and as a rule the lower trunk of the brachial plexus. The obliquity of the first rib is responsible for the obliquity of the thoracic outlet and accounts for the presence of the apex of the lung in the root of the neck (Gray, 1985).

2. The first thoracic vertebra:

The body of the vertebra is broad, on it is a large facet for the single articular surface of the head of the first rib. There is a demifacet for the second rib at the lower border of the body (Last, 1985).

3. The clavicle:

The clavicle with the scapula form the shoulder girdle which suspends the upper extremity and maintains its distance from the trunk. It has two curves, the medial one with the convexity forward and the lateral one with the concavity forward. The medial curve is in relation, inferiorly and posteriorly, with the subclavian vessels

and with the cords and the terminal nerves of the brachial plexus being separated for them by the subclavius muscle (Nichols, 1986).

2- Anatomy of The Muscles:

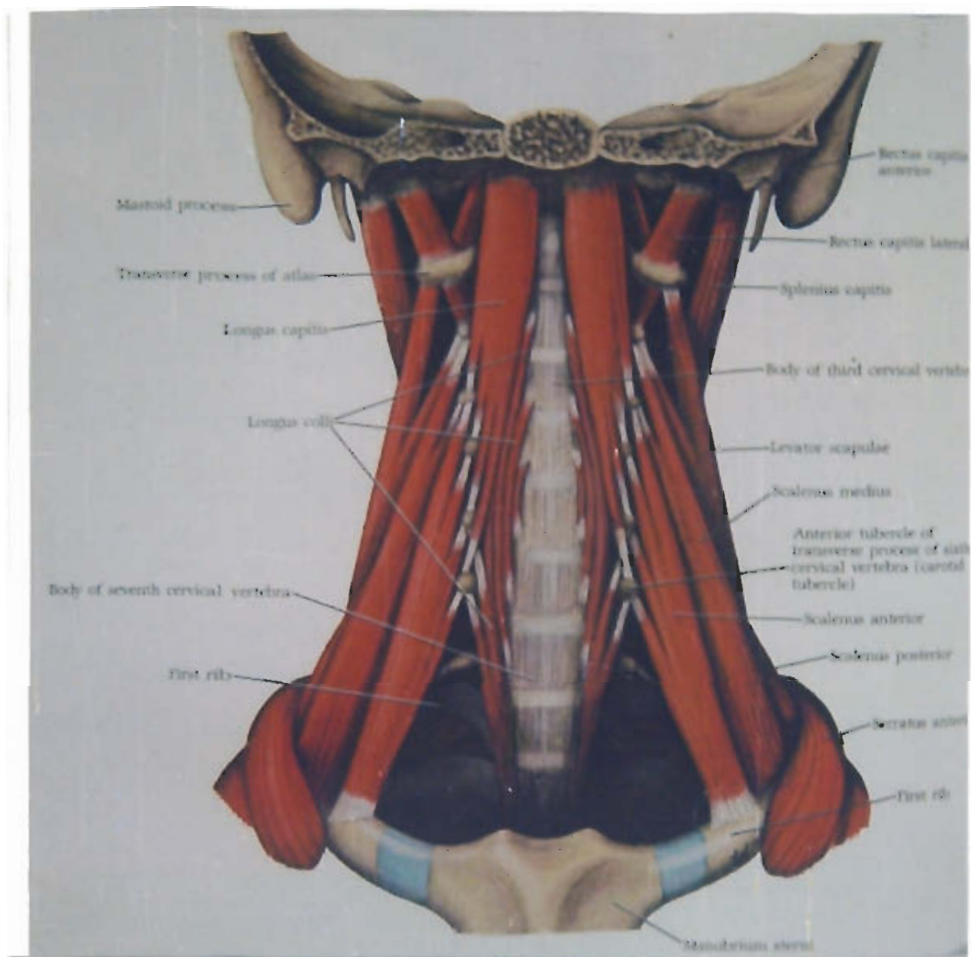
1. The scalenus anterior muscle: (Figure 1):

This flat muscle arises from the anterior tubercles of the four typical cervical vertebrae. The lowest and largest being the carotid tubercle of the sixth vertebra. At the anterior tubercles of the sixth, fifth, fourth and third vertebrae four slender tendons of origin lie end to end with those of the longus capitis. The muscle slopes forwards and laterally as it passes down to end in a narrow tendon attached to scalene tubercle on the inner border of the first rib (Kellman et al., 1987).

The nerve supply is derived segmentally by separate branches from the anterior primary rami of C₅ and C₆. Its action is to assist other muscles in stabilizing the neck. When actively contracts, it bends the neck forward and laterally or if the neck is fixed, elevates the first rib as an accessory muscle of inspiration. It has many important relations:

A- Anterior relations:

- 1- The phrenic nerve.
- 2- The ascending cervical artery.
- 3- The transverse cervical and suprascapular arteries.



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Fig. (1): Prevertebral region and root of neck.

(From Richards-Snell, Atlas of Clinical Anatomy, 2nd edition, Little and Brown Company, Boston, 1972).

B- Medial relations: lies the pyramidal space which contains:

- 1- The stellate ganglia.
- 2- The vertebral artery and vein.
- 3- The inferior thyroid artery.
- 4- The thoracic duct on the left side.
- 5- The 1st part of the subclavian artery.

C- Posterior relations:

- 1- The second part of the subclavian artery separating it from the scalens medius muscle.
- 2- The anterior primary rami of the brachial plexus.

D- Lateral relations:

- 1- The third part of the subclavian artery.
- 2- The trunks of the brachial pelxus

(Last, 1985).

2. The scalenus medius muscle:

It is the largest and longest of the scalene muscles. It arises from the posterior tubercles and costotransverse processes of all cervical vertebrae and is inserted between the neck and the subclavian groove of the first rib. The muscle is supplied segmentally by separate branches of the anterior primary rami of C3 to C8. When actively contracts, it is an abductor of the neck towards its own side or an accessory muscle of inspiration (Last, 1985).

3. The nerve supply of the upper limb:

* *The brachial plexus*: Figure (2):

Five roots contribute to the formation of the plexus for the upper limb. These are the fibers that remain in the anterior primary rami of C5, C6, C7, C8, T1. After these have given their segmental supply to the prevertebral and scalene muscles, they are divided into anterior and posterior divisions to supply the flexor and the extensor compartment respectively. But before doing so, they unite to form three trunks in the following manner:

- 1- The upper two unite to form the upper trunk.
- 2- The lower two unite to form the lower trunk.
- 3- The central root runs on as the middle trunk.

The five roots lie behind the scalenus anterior muscle and the trunks emerge from its lateral border and cross the posterior triangle of the neck. Each of the three trunks divides into an anterior and a posterior division behind the clavicle. At the outer border of the first rib:

1. The upper two anterior divisions unite to form the lateral cord.
2. The anterior division of the lower trunk forms the medial cord.
3. All the three posterior divisions unite to form the post cord.

These three cords enter the axilla above the first part of the axillary artery, approach and embrace its second part and give off their branches around its third part. It is important to appreciate the situations of the constituents of the plexus.