

History of thoracic outlet syndrome

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Thoracic outlet syndrome (TOS) is a condition in which important neurovascular structures such as the brachial plexus and the subclavian artery and vein are compressed in the thoracic outlet region by fibromuscular and fibro-osseous tissues. The compression can be caused by congenital or acquired changes in the tissues.

The thoracic outlet region includes three areas in which compression can occur: (1) interscalene space (interscalene triangle), (2) costoclavicular space, and (3) subpectoralis minor space (less important and less frequent) (Fig. 1).

Compression of the neurovascular structures can cause a variety of symptoms in the upper extremity and neck including deep pain, numbness, tingling, weakness, and vasomotor changes (sympathetic overactivity because of nerve compression). Shoulder girdle pain and headaches may also occur, depending on the severity and duration of the compression.

The compressed neurovascular structures in decreasing frequency are the brachial plexus (90%), the subclavian vein (6%–7%), and the subclavian artery (3%–4%).

Because of the lack of objective findings in many TOS cases, some physicians have denied the existence of neurogenic TOS, and it has become a very controversial subject in medicine. Many surgeons strongly believe that TOS is one of the most underrated, overlooked, and misdiagnosed conditions. For example, patients who present with hand and arm pain, tingling, and numbness are generally diagnosed with peripheral nerve compression. However, in several of these patients, especially younger people, these symptoms are caused by higher-level compression.

TOS is the most important (at least from an economical and psychological point of view), most symptomatic, and most difficult neurovascular compression to manage in the upper extremity because of the multiplicity of the complaints and the high risk associated with surgical treatment modalities.

History

The existence of the cervical rib was known at the time of Galen around 150 AD. However, the German anatomist Hunald [1] did not describe the cervical rib and its symptomology until 1742, and it was not until 1920 that Law [2] described ligaments that originate at the tip of the cervical rib and insert into the first rib. Cooper [3] described the clinical symptoms of neurovascular compression in the thoracic outlet area in 1921. In 1931, Telford [3] emphasized the important role that the first rib and cervical rib play in neurovascular compression of the upper extremity. In 1935, Ochsner [4] introduced the term scalenus anticus syndrome following several reports on scalene muscle abnormalities as the cause of TOS. In 1956, Peet [5] first used the term *thoracic outlet syndrome* to express cervical-brachial pain, numbness, and other disorders of the upper extremity. In 1958, Rob [6] proposed the term *thoracic outlet compression syndrome*.

Surgical treatment of TOS began with a cervical rib resection performed by Coote [7] in 1861. Next, Murphy [8] introduced the first rib resection in 1908. In 1927, Adson and Coffey [9] introduced the scalenotomy, which was the most frequently used operative procedure for decompression of the neurovascular structures at the cervico-thoracic junction for many years. In 1953, Lord [10] introduced claviclectomy as a new procedure. This was a rather disfiguring operation and has never gained popularity.

Because the recurrence rate after scalenotomy was very high (60%), Clagett [11] reintroduced the

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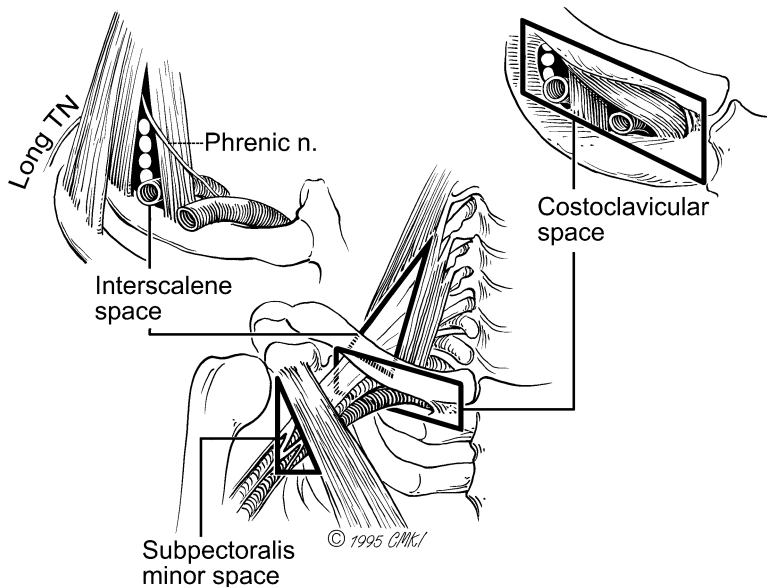


Fig. 1. Three spaces in the thoracic outlet region that may be responsible for TOS symptoms.

first rib resection using a posterior approach in 1962. This was a rather traumatic and bloody procedure. In the early 1960s, supraclavicular and infraclavicular approaches also were used, but these never gained popularity. The transaxillary approach for the first rib resection, which was described by Roos [12] in 1966, was a much less traumatic procedure and has been used more frequently.

Adson first introduced the scalenectomy in its simple form in 1938. This procedure was used sporadically until 1979, when Sanders et al [13] reintroduced a more refined version to treat recurrent TOS following first rib resection and TOS that occurs following the injuries of the neck and shoulder region.

In 1996, Atasoy [14] first introduced a different combined approach. It consisted of a transaxillary first rib resection followed immediately by a transcervical anterior and medial scalenectomy (first performed in 1989). The combination of these procedures achieved total decompression of the thoracic outlet region.

Currently, numerous approaches are used at various centers for the diagnosis and treatment of TOS.

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