

Thoracic Outlet Syndrome

What is the Thoracic Outlet?

The thoracic outlet is an aperture at the top of the rib cage through which the brachial plexus, subclavian artery and subclavian vein pass through en-route to the upper limb. There are a number of muscles (scalene muscles, pectoralis muscle) that attach to the clavicle and 1st rib within the confines of the thoracic outlet and impact on the aperture size.

What Causes Thoracic outlet syndrome?

Thoracic outlet syndrome (TOS) is a mechanical space problem or the lack of it. As the neurovascular structures pass through the thoracic outlet they negotiate three specific tunnels created by the clavicle, 1st rib, scalene muscles, and pectoralis minor muscle: Interscalene triangle, costoclavicular space, subpectoralis space. Inadequate space within any of these tunnels will result in compression and irritation of the structures passing through them. The compressed neurovascular structures in decreasing frequency are the brachial plexus (90%), the subclavian vein (6%–7%), and the subclavian artery (3%–4%).

Common causes of TOS include:

Congenital anomalies: Cervical rib; additional muscles; fibrous bands; abnormal clavicle or 1st rib anatomy

Acquired causes: Repetitive muscle injuries e.g. golf, swimming, rugby; clavicle fracture; whiplash injury; poor posture; pregnancy

It is our experience that in the majority of cases there is an underlying congenital anomaly that predisposes an individual to TOS, which when combined with a superimposed muscle or bony injury results in the thoracic outlet space becoming sufficiently compromised for symptoms to occur.

Who is affected with Thoracic Outlet Syndrome?

TOS typically affects young adults between the ages of 20 and 40 years old who participate in sport e.g. golf, tennis, swimming. Individuals prone to poor posture or positioning as part of their employment are also prone to develop TOS e.g. computer workers, surgeons.

What Symptoms may I notice?

There is a broad spectrum of symptoms associated with thoracic outlet syndrome depending on which structures are being compressed and to what extent. These can be broadly divided into three clinical sub-types although there remains considerable overlap between the three types with patients often having elements of both nTOS and aTOS or vTOS contributing to their symptomatology:

Neurogenic (n) TOS: This results from compression of the brachial plexus and is the commonest type of TOS. Symptoms are neurological and include numbness, pins and needles (paraesthesia), weakness of the arm, hand or shoulder. These are typically exacerbated by arm exertion or working overhead. Individuals may notice deterioration in their symptoms during the night following a period of heavy work during the preceding day; this may lead to a poor sleep pattern and exhaustion.

Arterial (a) TOS: This results from compression of the subclavian artery. Symptoms associated with aTOS include coldness, pallor and early tiring of the arm during usage. True arm claudication may occur during which an individual experiences a cramping pain in the arm during activity that is relieved almost immediately with rest. A cervical rib is often the underlying cause for aTOS.

Venous (v) TOS: This results from compression of the subclavian vein often at the level of the 1st rib. Symptoms include an intermittently swollen, blue arm that is uncomfortable and aggravated by exercise. However, the majority of patients with vTOS unfortunately present with thrombosis of the subclavian vein because early warning symptoms have either been overlooked or ignored. Individuals with a sudden onset of a swollen, dusky arm and hand that is uncomfortable and tight feeling should attend their local emergency services for investigation of a subclavian vein thrombosis.

How do you diagnose Thoracic Outlet Syndrome?

The diagnosis of TOS is often challenging and centers on a meticulous history and accurate physical examination. We often find to our disappointment that a number of our new patients have been reviewed by multiple other health professionals without success and are attending our clinic in a last ditch to get help.

Once a diagnosis of TOS is suspected a number of additional investigations are performed to identify any underlying anatomical abnormality and to rule out other potential causes for your symptoms. These investigations may include:



1. Blood analysis
2. Duplex ultrasound
3. CT scan
4. MRI
5. Nerve Conduction Studies
6. X-ray of the thoracic outlet

What treatments are available?

Treatment for TOS aims to reduce the underlying neurovascular compression.

Depending on the nature and severity of your symptoms your surgeon may recommend a period of conservative treatment. This consists of:

Physiotherapy: We will organise for you to be reviewed by one of our allied physiotherapists to learn strengthening and stretching exercises to help open up the thoracic outlet and improve your posture. Done over a period of time these exercises may be sufficient to adequately increase the thoracic outlet size and relieve your symptoms

Medications: your surgeon may prescribe you with anti-inflammatory medication and/or pain medication to treat your symptoms

If you have progressive symptoms, evidence of chronic damage to the compressed structures e.g. a subclavian artery aneurysm, or if conservative treatment has been ineffective your surgeon may recommend surgery to correct any underlying congenital or acquired abnormality –thoracic outlet decompression.

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