**Thoracic outlet syndrome**

**What is the thoracic outlet?**

The thoracic outlet is a narrow passageway at the base of the neck, lying just behind the collarbone (clavicle), that runs into the armpit. It is a complex part of the body with many structures within it. It contains the first (upper most) rib of the ribcage, two muscles of the neck called the anterior and middle scalene muscles, the two main blood vessels to the arm (the subclavian artery and vein), and the system of nerves called the brachial plexus that controls the muscles and feeling in the arm and hand.

**What is Thoracic outlet syndrome?**

Thoracic outlet syndrome (TOS) describes a group of conditions that occur when one or more of the nerves or blood vessels in the thoracic outlet get compressed. The commonest form of TOS is where the brachial plexus is compressed and called neurological TOS, and is usually a longer-term condition. Compression of the artery or vein is called arterial and venous TOS respectively, and affects the circulation in the arm and typically arises suddenly.

**Symptoms of Thoracic Outlet Syndrome**

TOS can affect the hand, arm or neck of the affected side. It is typically a condition of younger adults (aged 18-40 years). How TOS affects you can vary and depends on which structure is compressed and at what point.

***Symptoms of Neurogenic (Nerve) TOS:***

* Arm heaviness
* Neck, arm or hand pain, especially when the arm is above the head
* Numbness and/or tingling in the arms and fingers
* Weakness of the hand

***Symptoms of Arterial TOS:***

* Sudden onset of pain in the hand and arm
* Paler than usual skin on the arm
* Arm feels cold
* Altered sensation in the arm

***Symptoms of Venous TOS:***

* Arm swelling and congestion
* Arm heaviness
* Arm pain
* Skin colour change
* Swelling of the veins under the skin

If you suddenly develop symptoms of either venous or arterial TOS, you should seek medical attention urgently.

**Causes of Thoracic Outlet Syndrome**

There are multiple causes of TOS. A common cause is having enlarged neck muscles which put pressure on the nerves and blood vessels, this may be due to intense exercise or sports with lots of overhead stretching such as tennis or swimming. Certain jobs may also lead to TOS, both jobs with lots of overhead work such as mechanics and jobs with prolonged sitting can put stress on structures in the neck, leading to symptoms. Another cause may be a traumatic event such as a traffic accident or sporting injury which can also put pressure on the nerves and blood vessels.

Less commonly, 1 out of 200 people may be born with an extra rib that is attached to the spine in the neck instead of the chest, known as a cervical rib. About 1 in 10 people who have a cervical rib will develop some form of TOS as the extra rib can directly put pressure on nerves and blood vessels in the neck, leading to symptoms.

**Diagnosing Thoracic Outlet Syndrome**

Symptoms of Thoracic Outlet Syndrome can mimic other common conditions such as neck muscle problems, narrowing of the spine in the neck (cervical spinal stenosis), carpel tunnel syndrome or problems with the joints or muscles of the shoulders. Commonly several tests are required to classify the type of TOS and rule out other diagnoses. These tests are commonly performed by a vascular surgeon specialising in TOS, though some sports medicine physicians, plastic surgeons specialising in brachial plexus conditions or shoulder specialists may also arrange the appropriate tests.

For TOS to be diagnosed your doctor will first take a thorough history of the condition and your general health to understand how your symptoms are affecting you. They may also want to do certain manoeuvres to the affected arm to ascertain which structures are being compressed. To further investigate symptoms X-rays and other imaging tests (such as MRI or CT scanning) will likely be requested by your doctor. This will allow them to see how the structures within the neck and shoulder are working and can help establish a diagnosis of TOS. If nerve compression symptoms are suspected, then nerve conduction studies may be requested to rule out other diagnoses that may appear like TOS.

**Managing Thoracic Outlet Syndrome**

Your doctor will lead the management of suspected TOS. There are three ways of managing suspected TOS:

1. Non-invasive – anti-inflammatory medications and physiotherapy
2. Botox – injections into the neck muscles
3. Surgery

Your management will be tailored to your condition and symptoms, just because you have been treated in a certain way does not exclude you from being treated in another way in the future. There are multiple surgeries to tackle your TOS, which your doctor will be able to talk to you through.

***Non-invasive management***

For neurological TOS the initial management is often non-invasive, involving physiotherapy to loosen neck muscles and improve posture, as well as exercises to strengthen back, shoulder and core muscles. Anti-inflammatory medication such as ibuprofen, may also be taken to help ease symptoms.

***Botox***

In certain cases, your doctor might offer Botox injections into the neck muscles which is successful in alleviating symptoms in around 70% of people. Botox works by relaxing the muscles in the neck so they put less pressure on the thoracic outlet, these injections will be needed every 6 months or so.

***Surgical management***

If your doctor thinks you have either arterial or venous TOS, you may be offered surgery. Patients with disabling neurogenic TOS may also be offered surgery. There are a wide variety of surgeries available for TOS and your surgeon will be able to give you definitive information about the procedure you are likely to be having. For any surgery you will be under general anaesthetic so will be ‘asleep’ for the procedure because your surgeon will need to make a cut to reach the problem. The aim of surgery to is relive the compression on the thoracic outlet and conventionally involves removal of a section of the1st rib (or cervical rib, if present) and division of the adjacent muscle. This will be made either just above your collarbone or in the armpit.

**Surgery complications**

The complications of TOS surgery are extremely rare but just like other surgeries, there is still a risk. The most common complication is that there is a recurrence of TOS however there may also be direct damage to structures of the thoracic outlet. These include injury to the arteries and veins of the thoracic outlet (15 people out of 1000) or nerves of the thoracic outlet (5 people out of 100). Surgery may also result in damage to the lung, bleeding, damage to the ‘thoracic duct’ leading to persistent fluid discharge or infection, or injury.

**Recovery from surgery**

After any TOS surgery, there is careful monitoring and follow-up tests to ensure that the vessels are working properly. The initial care will focus on controlling pain from the surgery, reducing swelling, and starting to mobilise the neck and shoulders again. During the first 3-4 weeks after surgery, it is crucial that strength training is avoided. Physiotherapy will be gradually incorporated to help regain full range of motion as well as ensure good posture and breathing. If the individual is looking to rejoin high-level athletic activities, this will take longer and may take between 9 and 12 months. Moreover, if the surgery was for either arterial or venous TOS, you may be given medications to thin your blood too.

**Frequently asked questions**

1. **Is this condition avoidable?**
	* TOS is not always avoidable but there are ways to lower your risk of developing it. If you develop symptoms and your job involves lots of heavy lifting or work above your head you, you may consider speaking to your GP to refer you to a specialist about exercises to lower your risk of TOS. Similarly, if you play sports or have hobbies with lots of overhead movement or repetitive arm movements you may want to speak to a coach or physiotherapist about how to strengthen the muscles of the shoulder.
2. **I have been diagnosed with TOS, are there any steps I can take to help?**
	* Although your care will be led by doctors, you can do things to help. It is best to avoid carrying heavy objects such as backpacks on the affected side and limit the amount of activities you perform above the head. Try and do exercises at home to increase shoulder mobility and improve posture as well as try to avoid activities in daily life that may trigger symptoms.
3. **Will this condition recur?**
	* There is a possibility that TOS symptoms may return after treatment, this is usually due to scar tissue from the management of TOS developing and pressing on structures in the thoracic outlet.
4. **I have TOS on one side, what are the chances of it developing on the other side?**
	* A small proportion of people may develop TOS on both sides. Individuals who are diagnosed with TOS on one side should always have the other side checked, however, the other side will not be treated unless there are symptoms on that side. If you have been diagnosed with TOS on one side it is important to take steps, especially those highlighted above, to avoid developing it on the other side.
5. **How soon will I be able to drive again after having surgery for TOS?**
	* This will be reviewed by your doctor and decided on a case-by-case basis. Usually, people can begin driving again 4 to 6 weeks after surgery.
6. **How long until I can return to playing sport after having surgery for TOS?**
	* Even individuals playing sports at the highest level should be able to return to their standard after management for TOS. The timeframe for returning to sports is generally longer due to the structures needing to tolerate the stresses on the thoracic outlet and is usually around 16-20 weeks.