Thoracic Outlet Decompression Surgery

What is this operation?

Surgery to treat thoracic outlet syndrome -thoracic outlet decompression surgery- may be performed through a number of different surgical approaches, including the supraclavicular (above the collar bone) approach and the transaxillary (through the armpit) approach.

At the Circulation Clinic we elect to use the supraclavicular approach for treating neurogenic (n) and/or arterial (a) thoracic outlet syndrome (nTOS & aTOS). We find it provides better exposure of the nerves and vessels, and injury to these structures is easier to avoid. The supraclavicular approach also provides better access to a cervical rib if present. We reserve the transaxillary approach to treat venous (v) TOS or recurrent thoracic outlet syndrome. (See thoracic outlet syndrome in Conditions section for more detail on TOS)

Why is this operation being offered?

Your surgeon may recommend thoracic outlet decompression surgery to a client if they have progressive TOS symptoms, evidence of chronic damage to the compressed structures e.g. a subclavian artery aneurysm, or if other treatment options (e.g. physiotherapy) have been ineffective.

What happens before your operation?

There is no thoroughly reliable and reproducible laboratory study with which to diagnose TOS and the diagnosis is based on accurate clinical assessment. A variety of pre-operative investigations and clinical assessments will have been undertaken aimed at evaluating and excluding alternative diagnoses e.g. carpal tunnel syndrome, cervical spine pathology.
Once the decision has been taken to proceed to TOS decompression an admission date will be agreed between yourself and your surgeon. A pre-admission visit may be required to complete paperwork and undertake blood tests, or other allied tests required prior to undergoing a general anaesthetic.
Clients are taught how to perform their post-operative exercises prior to surgery. We strongly advise our clients to practise these exercises as they help minimise the excessive scar formation which can cause recurrent thoracic outlet syndrome symptoms.
Please bring all your medications to your pre-admission review.

What happens on the day of admission?

You will usually be admitted the day of surgery and your surgeon will visit you, address any additional queries you may have, and ask you to sign a consent form for your operation. You will also be visited by your anaesthetist. The side of the operation will be marked with an indelible pen: please do not wash this off prior to the operation.

Please do not stop any of your normal medications unless specifically instructed to by your surgeon

If you smoke, we strongly encourage you to stop as soon as possible to reduce the risk of peri-operative complications.

What do I need to bring when I come into hospital?

You should bring the following items with you at the time of admission:

- All your normal medication
- Nightwear & slippers
- Toiletries
- A set of comfortable clothes
- A good book

What happens during the operation?

Your surgeon will discuss in detail your operation prior to surgery including potential complications and recovery time. The below description refers to a *supraclavicular approach* which the majority of our clients undergo.

The first part of your operation involves giving you a general anaesthetic. TOS decompression surgery is performed under general anaesthesia (with you asleep). After general anaesthesia is performed you will be positioned onto the operating table lying on you back (supine).

To access your thoracic outlet a transverse, 5-7cm incision is made 2cm above the clavicle (collar bone) beginning 1cm away from the midline and extending laterally. The incision is deepened into the subcutaneous tissues with retraction of the sternocleidomastoid muscle towards the midline. A fat pad (scalene fat pad) covering the thoracic outlet is mobilised to expose the underlying anterior scalene muscle and phrenic nerve (nerve that supplies the diaphragm). This muscle is carefully divided and resected to expose the underlying brachial plexus (nerve trunks which supply your arm) and subclavian artery. The phrenic nerve is visualised throughout ensuring it is not inadvertently damaged.

Any loose muscle bands or fibrous tissues are resected from around the brachial plexus. There is often an aberrant muscle structure (scalenus minimus muscle) that also requires resection; this muscle often envelopes the brachial plexus nerves contributing to your symptomatology.

Having cleared the area in front of the brachial plexus and subclavian artery of constricting muscles/bands your surgeon will partially remove scalenus medius muscle. This muscle sits behind the brachial plexus and contributes to the thoracic outlet syndrome. It is in this muscle that a cervical rib is found extending from its origin on the cervical spine to its insertion onto the first rib. Rarely is the cervical rib a complete rib; it is often partially tendinous. The cervical rib is removed from its origin and carefully dissected free from surrounding structures before being detached from its insertion in the 1st rib. Throughout this manoeuvre the long thoracic nerve of Bell is in close proximity and is meticulously protected by the surgeon.

At this point your surgeon will assess the extent of the decompression and whether or not you are likely to benefit from a concomitant 1st rib resection. Often 1st rib resection is unnecessary unless an abnormal 1st rib in conjunction with a cervical rib is present. The underlying pathology for the majority of patients with nTOS lies in anomalous scalene muscles constricting their thoracic outlet and not an anomalous 1st rib. Similarly, patients with aTOS often have a cervical rib contributing to their pathology, but rarely is the 1st rib implicated. First rib resection is associated with increased peri-operative morbidity and longer recovery times and therefore for the majority of patients we elect to limit the primary operation to scalenus anterior, medius and minimus resection.

The wound is repaired in layers with stitches and a small suction drain is inserted to drain excess fluid that can accumulate in the first 24 hours post-surgery.

What are the risks?

The majority of patients undergoing thoracic outlet decompression are under the age of 50 years and thus the risk from serious systemic complication, e.g. heart attack, is extremely low. However, all surgery performed under a general anaesthesia is associated with an element of risk no matter how fit and active the individual is.

The vast majority of complications following TOS surgery relate to the difficulties of operating in a confined area of the body through which a number of important vessels, nerves and lymphatics travel. Hence, the importance of choosing a surgeon with experience in operating in this region of the body.

Possible complications associated with a supraclavicular approach include:

- Nerve related
  - Nerves are very susceptible to bruising and even the minimal handling necessary to mobilise them during TOS surgery may result in them not functioning properly in the immediate post-operative period. Thankfully the majority of injuries are temporary, but some may remain beyond one year despite the nerve being intact. Specific nerves that are prone to injury include:
  - Phrenic Nerve
    - This nerve supplies the diaphragm on the side of the operation (ipsilateral side). Injury is rare, but may occur as a result of the nerve being stretched during dissection particularly if it is anomalous in its course through the thoracic outlet. Injury to the nerve paralyses the ipsilateral hemi-diaphragm reducing one's exercise capacity. Injury is often temporary, but recovery may take a few weeks to several months and occasionally, longer than 1 year.
  - Brachial Plexus
    - Injury to the brachial plexus nerves is rare and for the majority of clients temporary. When it does occur it can result in numbness, pins and needles and weakness affecting the arm and hand.
  - Long Thoracic Nerve of Bell
    - This nerve supplies the serratus anterior muscle that attaches between your shoulder blade (scapula) and rib cage and pulls the scapula onto the rib cage when swinging your arm e.g. a boxer throwing a hook punch. Injury may occur during resection of scalenus medius or a cervical rib as it is often displaced from its normal position. This may result in 'winging' of the scapula during aforementioned movements.

- Chest Wall Sensory Nerves
  - The nerves that supply sensation to parts of the upper chest wall on the side of the surgery may be damaged during surgery, deliberately sacrificed to improve access (rarely required), or incorporated into scar tissue during the healing process. This may result in patchy areas of numbness in the clavicle region, but does not cause significant morbidity.

- Sympathetic Chain injury
  - The sympathetic chain may very rarely be damaged during the cautery of small blood vessels at the site of rib removal from the spine. This can result in a drooping eyelid, a constricted pupil, and reduced sweating of the face on the side of the operation (Horner's syndrome). For this reason we minimise the use of cautery (diathermy) during these types of operation and in turn have not seen a case of Horner's syndrome caused by TOS decompression.

- Other

  - Pneumothorax
    - The lining of the lung is intimately associated with the thoracic outlet and may be breached during thoracic outlet decompression allowing air to enter into the lung cavity. This is often recognised and repaired during the primary surgery with a one-way drain left in for 48 hours to allow any residual air to escape. We advise clients not to travel by air for 2 weeks post-surgery if a pneumothorax has occurred.

  - Thoracic duct injury
    - TOS decompressive surgery on the left side is complicated by the presence of the thoracic duct and its tributaries, which drains lymph fluid from the body into the venous system. Injury to the main duct or its tributaries can result in lymph leak and post-operative fluid collection in the wound. Although the majority are successfully treated without a re-exploration of the surgical field occasionally a second operation is required to ligate the injured duct.

  - Injury to the Subclavian Artery and Vein
    - This is a very rare complication that if occurs is repaired during the operation

  - Recurrence
    - Thoracic outlet symptoms may recur when abnormal scar tissue builds up around the brachial plexus, causing adhesions between the nerves and the surrounding structures. The commencement of passive and active neck, shoulder and arm exercises as early as the day after surgery is the key to preventing recurrence.

What happens after the operation?

The majority of clients remain in hospital for 24 hours post-surgery. You will be sore at the site of the operation, which will be treated with pain medication, but will be able to use your arm for simple tasks e.g. washing, dressing. Your drain will be removed the morning after surgery.

What happens when I go home?

Although at the time of discharge we ensure you are safe to go home we ask that there is a responsible adult with you for the first few days following discharge.

You will be able to have a shower at 48 hours post-surgery, but we ask you to refrain from bathing until the wounds are fully dry.

For the first few weeks post-surgery there is often discomfort at the site of the operation, but this will improve quickly.

The majority of clients are able to return to work within 4 weeks of discharge, but this does depend on the nature of your employment, the type of reconstruction you have had and how well you recuperate from your surgery. If in any doubt or you are a high-end athlete please wait until you have been reviewed in clinic by your surgeon.

Post-operative Physiotherapy

You will have been provided with post-operative exercise instructions before the surgery to perform during your recuperation at home. These include active and passive neck, shoulder and arm exercises including neck stretching and shoulder abduction. It is vital you undertake these as directed to minimise the risk of inappropriate scar tissue formation that can lead to a recurrence of your presenting symptoms. You should continue these exercises for at least 6 months.

When Will I be able to drive?

We advise you to not drive a car for the first 4 weeks post-surgery or until you have pain free movement of your shoulder and arm. Different rules apply for different 'Group' license holders and we recommend contacting the DVLA and your car insurance company for further advice prior to recommencing driving.

Will I need to see the surgeon again?

You will be reviewed in clinic approximately 6 weeks following discharge.