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REVIEW ARTICLE

EFFECT OF PHYSIOTHERAPY TREATMENT IN THORACIC OUTLET SYNDROME

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ABSTRACT

Introduction: Thoracic outlet syndrome (TOS) comprises a group of disorders that result in compression of the neuro vasculature exiting the thoracic outlet and was first described in 1956. TOS is usually subclassified into neurogenic TOS (nTOS), venous TOS (vTOS), and arterial TOS (aTOS), depending on the appropriate etiology upon presentation. It has been classified as Venous thoracic outlet syndrome and Neurogenic thoracic outlet syndrome. **Causes:** Sometimes, a congenital (from birth) abnormality can cause thoracic outlet syndrome, but it is more likely to occur after injury or bodybuilding. A cervical rib is an extra rib that grows from the cervical spine. Abnormal muscle or first rib formation, some people may have an extra or aberrant scalene muscle his condition is related to abnormalities of bony and soft tissue in the lower neck region. **Symptoms:** Patients with thoracic outlet syndrome will most likely present pain anywhere between the neck, face and occipital region or into the chest, shoulder and upper extremity and paresthesia in the upper extremity. The patient may also complain of altered or absent sensation, weakness, fatigue, a feeling of heaviness in the arm and hand. The skin can also be blotchy or discolored. A different temperature can also be observed. **Management:** Medical Management include Thrombolytic medications are given to dissolve blood clots. Anticoagulant medications decrease the blood's ability to clot. Surgical Management include chest (thoracic surgery or blood vessel (vascular) surgery perform the procedure. Thoracic outlet syndrome surgery has risks of complications, such as injury to the brachial plexus. Physiotherapy management can decrease symptoms of pain and increase muscle strength, improve Postural correction and return to near normal function of upper limb.

Keywords: Thoracic- Venous thoracic outlet syndrome; Neurogenic thoracic outlet syndrome; Thrombolytic and Anticoagulant medications; Postural correction

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INTRODUCTION

Thoracic outlet syndrome (TOS) comprises a group of disorders that result in compression of the neuro-vasculature exiting the thoracic outlet and was first described in 1956. TOS classically occurs in three spaces—the scalene triangle, the costoclavicular space, and the subcoracoid space. Structures involved in TOS include the subclavian artery and vein, the axillary artery and vein, and brachial plexus—any or all of which may be compressed, resulting in distinct clinical pictures, which can include pain, paresthesia, pallor, weakness, feelings of fullness, and muscle atrophy [1-3].

Treatment of TOS is a multifactorial process, and therapeutic options vary depending on the presenting subtype. While physical therapy is typically the mainstay in conservative nTOS management, other aspects of nTOS treatment may include lifestyle modification, pain management, and anticoagulation. Injection therapy has also been shown to be temporarily effective in reducing symptomatic TOS, as well as a positive surgical prognostic factor. Surgery is usually indicated in symptomatic nTOS candidates who have failed 4–6 weeks of conservative therapy, as well as the vascular etiologies of TOS. While many TOS treatment options exist, the optimal therapy regimen remains unclear. This review aims to provide physicians a brief summary of both pathogenesis, diagnosis, and treatment of TOS, as well as significant findings in the recent literature [4-7].

In the 1% of neurologic cases that are called "true," there is a bony abnormality such as a cervical rib found or abnormalities on electrodiagnostic studies. The most common mechanism of injury resulting in TOS is neck hyperextension injuries followed by work-related repetitive strain[8].

Both true and disputed nTOS are more common in women. Teenaged to 60-year-old females are most frequently affected by true nTOS. Whereas true nTOS is primarily unilateral, the disputed variety is often bilateral. The lower brachial plexus is affected in about 80% of patients with the disputed subtype, while the upper brachial plexus is compromised in the other 20%. Arterial TOS, a predominantly unilateral condition, affects both genders equally and more often affects young adults. Venous TOS also tends to be unilateral and is more common in men than women. Due to its association with repetitive upper extremity activity, vTOS is more common in younger, able-bodied individuals, and most often affects the dominant upper extremity[9].

Several variants of thoracic outlet syndrome exist, with neurogenic thoracic outlet syndrome being the most prevalent by far, accounting of over 90% of all cases. TOS is more prevalent in females and those with poor muscle development, poor posture, or both. Due to the general nature of symptoms, the true prevalence of TOS is hard to determine. Its estimated incidence is anywhere between 3 to 80 cases per 1000 population.[10]

Neurovascular Anatomy and Embryology

Subclavian Artery: The subclavian arteries are the primary blood supply to the upper extremities. The left subclavian artery branches directly from the aorta, whereas the right subclavian artery arises from the brachiocephalic artery. Each subclavian artery ascends superiorly into the neck before arching laterally and traveling posterior to the anterior scalene muscle through the scalene triangle and exiting the thoracic outlet via the costoclavicular space (above the first rib, below the clavicle) to

become the axillary artery. Because of the close proximity of the clavicle, first rib, and anterior and middle scalene muscles, the costoclavicular space is the most frequent site of arterial compression.

Subclavian Vein: The subclavian veins provide the venous drainage of the upper extremities. The left subclavian vein also receives chyle from the thoracic duct drainage. On either side, the vein ascends superiorly with the subclavian artery into the neck. It then travels anterior to the anterior scalene muscle (outside of the technical scalene triangle) and continues in parallel to the artery with the anterior scalene muscle separating the two structures. It then exits through the costoclavicular space as the axillary vein.

The subclavian vein develops in the fourth gestational week and is formed by the fusion of venous tributaries from the upper limb bud. The vein can be found in an anomalous location posterior to the anterior scalene muscle, immediately adjacent to the subclavian artery. More rarely, the subclavian vein splits to form a "clavicular loop" or travels between the clavicle and the subclavius muscle.

Brachial Plexus: The brachial plexus is composed of nerves from the C5 to T1 roots that innervate most of the shoulder and arm. As the nerve roots exit the spinal cord and form the brachial plexus trunks, they travel through the scalene triangle, posterior to the subclavian artery and anterior to the middle scalene muscle, split into anterior and posterior divisions, and exit through the costoclavicular space alongside the subclavian artery

Phrenic Nerve: The phrenic nerve innervates the diaphragm and forms from branches of C3–5, of which C3 and C4 normally combine cephalad to the thoracic outlet.[1] The combined branches and the C5 branch descend along the anterior surface of the anterior scalene muscle posterior to the subclavian vein. The C5 branch typically joins as the combined branches cross the anterior scalene muscle from lateral to medial. If the C5 branch continues along a separate course, it is termed an "accessory phrenic nerve. Rarely, the phrenic nerve may travel anterior to the subclavian vein and may even obstruct it.

Long Thoracic Nerve: The long thoracic nerve innervates the serratus anterior muscle and forms from branches of C5–7. The C5 and C6 branches travel through the belly of the middle scalene muscle where they combine and exit the muscle as a single nerve which crosses the lateral edge of the first rib.

Dorsal Scapular Nerve: The dorsal scapular nerve innervates the rhomboid muscles and part of the levator scapulae muscle. It arises from C5, travels briefly with the C5 branch of the long thoracic nerve, and then separates at the top of the middle scalene muscle to descend through its lateral edge.

Cervical Sympathetic Nerve Chain: The cervical sympathetic nerve chain is part of the autonomic nervous system and travels along the anterior surface of the cervical transverse processes. Although not technically located in the thoracic outlet, operations to decompress the thoracic outlet place the sympathetic chain at risk for injury, particularly when the middle scalene muscle is released from the proximal rib in the costotransverse space. Injury to the sympathetic chain results in Horner's Syndrome, although this is typically self-limited.

Cervical Rib: A cervical rib arises anomalously from a cervical vertebral body, mostly commonly C7. It was first described in dissections by Galen and Vesalius (Fig. 4). A complete cervical rib attaches to the normal first rib by fusion or with a true joint. The incidence is reported in 0.1% to 6% of the adult population and is more frequent in women.

Costal elements for cervical ribs 5 to 7 form during embryologic development and then regress to become transverse processes as a result of the rapid development of brachial plexus nerve roots during the formation of the upper extremity limb bud. The formation of a cervical rib is considered an error in *HOX* gene expression, which is responsible for segmental development of the vertebral column. Ossification of the C7 costal element becomes a precursor to development of a supernumerary cervical rib.

The neurovascular structures are considered to be the main limiting factor in the development of a cervical rib. The contribution of the nerve root to the brachial plexus has been linked to the presence or size of the rib, as the embryonic nerve trunk is proportionally larger than the cervical rib. This is demonstrated by the association of persistent C7 rib in the prefixed plexus in which the C4 nerve root may be included, and the T1 nerve root is often small, as opposed to the postfixed plexus, which has a larger T2 nerve root and is associated with a rudimentary first thoracic rib.

Rather than a complete cervical rib, some people may develop an enlarged C7 transverse process or a rudimentary incomplete C7 rib 0.5 to 3 cm in length with a thick fibrocartilaginous band attaching it to the first rib (Fig. 5). This band is not visible on the radiograph but can cause compression similar to a complete C7 rib. When the band extends from a rudimentary cervical rib, it is termed a Type I band. When it extends from an enlarged C7 transverse process, it is termed a Type II band. These were first described by Roos, who identified and numbered many fibromuscular anomalies. The enlarged C7 transverse process has been reported in familial forms of TOS and is thought to be inherited in an autosomal dominant pattern.

Scalene Muscles: The scalene muscles are accessory muscles of respiration in that they function to elevate the upper thoracic cage. They consist of the anterior, middle, and posterior scalene muscles and extend from the cervical vertebrae to the first and second ribs. The anterior scalene muscle separates the subclavian vein (anterior) from the subclavian artery (posterior). The middle scalene is posterior to the brachial plexus, which is posterior and lateral to the subclavian artery. The posterior scalene is posterior to the middle scalene, inserts on the second rib, and does not play a role in the thoracic outlet.

Subclavius Muscle: The subclavius muscle stabilizes the clavicle with shoulder motion. It originates at the junction of the first rib and its cartilage, travels along the inferior surface of the clavicle, and inserts at the subclavian groove of the clavicle. The subclavius muscle tendon compresses the subclavian vein against the first rib when the shoulder is abducted or retracted. Hypertrophy of the subclavius tendon has been noted in Paget-Schroetter deformity.

Pectoralis Minor Muscle: The pectoralis minor moves the scapula anterior and inferior. It also functions as an accessory muscle of respiration by elevating the upper ribs. It originates on the anterior surfaces of ribs 3 to 5 and inserts on the coracoid process of the scapula. The pectoral nerve to the pectoralis major muscle travels

within the pectoralis minor muscle. The tendon of the pectoralis minor plays a role in compression of the neurovascular bundles as it transits the subcoracoid tunnel. Excising the tendon from the coracoid process and removing 2 to 3 cm of tissue results in decompression of this space and is a useful adjunct to the first rib resection and scalenectomy for TOS.

Thoracic Duct: The thoracic duct is a lymphatic vessel that transports chyle and lymphatic drainage from the left upper extremity, left thorax, and lower body to the venous system. In the neck, it is located in the left scalene fat pad, posterior and inferior to the clavicle as it travels to the junction of the left internal jugular and left subclavian veins. It has an associated network of fine lymphatic channels along the internal jugular vein. Lymphatic leaks in the left neck are avoided by careful attention to all small lymphatic tributaries during dissection and by avoiding separating the scalene fat pad from the internal jugular vein.

Biomechanics: Thoracic outlet syndrome is most often seen in patients who engage in repetitive motions that place the shoulder at the extreme of abduction and external rotation. An example of such activity is swimming, especially with the freestyle stroke, butterfly stroke, and backstroke. When a swimmer reports tightness and pain around the shoulder, neck, and clavicle as his or her hand enters the water, thoracic outlet syndrome should be suspected.

Classification Of Thoracic Outlet Syndrome

1.Venous thoracic outlet syndrome: This condition is caused by damage to the major veins in the lower neck and upper chest. The condition develops suddenly, often after Neurogenic thoracic outlet syndrome: This condition is related to abnormalities of bony and soft tissue in the lower neck region (which may include the cervical rib area) that compress and irritate the nerves of the brachial plexus, the complex of nerves that supply motor (movement) and sensory (feeling) function to the arm and hand.

Neurogenic thoracic outlet syndrome can also develop in people who experiences trauma to the neck or chest from a car accident or a fall. Sometimes, people with this condition are born with a misshape first rib or a cervical rib, which is an extra rib located above others. This can cause compression on the nerves in the area.

2.Neurogenic thoracic outlet syndrome: unusual and tiring exercise of the arms. Symptoms include swelling of the hands, fingers and arms, as well as heaviness and weakness of neck and arms.

In this case, compression of the compression of the subclavian vein will occur-which carries blood from the upper extremities –including the shoulders, arms, and hands-to the heart. This compression can lead to blood clots, which can travel to the heart and lung and be life threatening.

People with this condition are frequently born with a narrowing of the space where the subclavian vein extends from the shoulder to the heart. Overuse of the arm and shoulder, such as during sports or work, causes the veins in the thoracic outlet to become compressed, which can lead to blood clots.

3.Arterial thoracic outlet syndrome: The least common, but most serious, type of TOS is caused by congenital (present at birth) bony abnormalities in the lower neck and upper

chest. Symptoms include cold sensitivity in the hands and fingers; numbness, pain or sores of the fingers; and poor blood circulation to the arms, hands, and fingers.

This type of thoracic outlet syndrome is caused by a blood clot in a subclavian artery, which carries blood from the heart to the arm. It occurs in people born with a cervical rib or an unusually shaped first rib, which can compress the subclavian artery. The repeated compression can lead to a permanent narrowing in the artery, causing clots to form and travel down the arm toward the hand.

Causes: Sometimes, a congenital (from birth) abnormality can cause thoracic outlet syndrome, but it is more likely to occur after injury or bodybuilding. Specifically:

Cervical rib: A cervical rib is an extra rib that grows from the cervical spine — the neck part of the spine. Between 1 and 3 percent of the population has a cervical rib, which may grow on one side or both, and may reach down to attach to the first rib or may not be fully formed. Having a cervical rib increases the chance of nerve or blood vessel compression between the rib or its muscles and ligamentous connections sharing this small space. A small percentage of people with a cervical rib develop thoracic outlet syndrome. Many people with a cervical rib never know it, because the bone is often tiny and isn't noticed, even in X-rays.

Abnormal muscle or first rib formation: Some people may have an extra or aberrant scalene muscle (an inner muscle of the neck) or an abnormal first rib or clavicle (collarbone). Any of these abnormal formations can compress blood vessels or nerves.

The following events may cause thoracic outlet syndrome, especially in people with the above bone or muscle abnormalities in the neck:

- **Whiplash**: Arm and hand symptoms that persist long after a whiplash injury may be a sign of thoracic outlet syndrome.
- **Bodybuilding:** Built-up muscles in the neck may grow too large and compress nerves or the subclavian vessels.
- **Repeated overhead motions:** People who take up swimming, baseball or painting, or who work as hairstylists, auto mechanics or other jobs that require raised arms may develop thoracic outlet syndrome.
- **Weight gain:** As with extra muscle mass, extra fat in the neck may compress nerves or subclavian vessels.
- **Tumor in the neck:** On rare occasions, a tumor may be the cause of the compression.

Symptoms: Signs and symptoms are typically worsened when the arm is abducted overhead and externally rotated with the head rotated to the same or the opposite side.as a result activity such as, serving a tennis ball, painting a ceiling, driving, or typing may exacerbate Signs and symptoms of thoracic outlet syndrome vary from patient to patient due to the location of the nerve and/or vessel involvement. Symptoms range from mild pain and sensory changes to limb-threatening complications in severe cases.Patients with thoracic outlet syndrome will most likely present pain anywhere between the neck, face and occipital region or into the chest, shoulder and upper extremity and paresthesia in the upper extremity. The patient may also complain of altered or absent sensation, weakness, fatigue, a feeling of heaviness in the arm and hand. The skin can also be blotchy or discolored. A different temperature can also be observed.

There are four categories of thoracic outlet syndrome and each present with unique signs and symptoms. Typically, TOS does not follow a dermatomal or myotome pattern unless there is nerve root involvement, which will be important in determining your PT diagnosis and planning your treatment

Arterial TOS: Young adult with vigorous arm activity, Pain in the hand, Claudication Pallor, Cold intolerance, Paresthesia's

Venous TOS: Younger men with vigorous arm activity, Cyanosis, Feeling of heaviness Paresthesia in fingers and hand, Oedema of the arm

Neurogenic TOS: Weakness or numbness of the hand, decreased size of hand muscle Pain, tingling, pricking, numbness and weakness of the neck, chest, arm.

Risk factors: There are several factors that seem to increase the risk of thoracic outlet syndrome, including:

- **Sex.** Females are far more likely to be diagnosed with thoracic outlet syndrome than are males.
- **Age.** Thoracic outlet syndrome is more common in young adults, between 20 and 40 years old.

Risk factors include occupations that involve heavy usage of the upper extremities against resistance, including jack-hammer operators and dental hygienists, weight lifting, pregnancy, and obesity. Any condition that causes encroachment of the space for the brachial plexus at the thoracic outlet can lead to thoracic outlet syndrome, including poor posture.

Complications: If your symptoms haven't been treated early, you may experience progressive nerve damage, and you may need surgery. Doctors recommend surgery to treat thoracic outlet syndrome only when other treatments haven't been effective. Surgery has higher risks than do other treatments and may not always treat your symptoms.

Due to the benign nature of most treatment modalities and the insidious nature of the condition, TOS does not correlate with high rates of complications. Ischemic change could manifest if a vascular compromise occurs. Venous gangrene and potentially even phlegmasia cerulea dolens can arise in severe cases.

Most of the complications arise from surgical intervention, which is why most physicians recommend conservative therapy. Iatrogenic nerve injury is a feared complication of surgical intervention for TOS. Pneumothorax can result from first rib resection. Bleeding complications are far less common but also are risks of surgical intervention.

Differential Diagnosis: Due to its variability, TOS can be difficult to tease out from other pathologies with similar presentations. A thorough history and evaluation must be done to determine if the patient's symptoms are truly TOS.

There are conditions that can coexist with TOS. It is important to identify these conditions because they should be treated separately.

These associated conditions include: carpal tunnel syndrome, peripheral neuropathies (like ulnar nerve entrapment at the elbow, shoulder tendinitis and impingement

syndrome), fibromyalgia of the shoulder and neck muscles, cervical disc disease (like cervical spondylosis and herniated cervical disk).

Diagnosis: Making a proper diagnosis is the most important step in TOS. Doctors who treat this condition include vascular surgeons, chest (thoracic) surgeons and vascular medicine physicians. To diagnose your condition, your doctor will perform a complete physical exam and will review the results of previous diagnostic tests. In some cases, a thorough evaluation by a skilled neurologist may be recommended to rule out cervical spine disease or other neurological conditions that may be mimicking or causing your symptoms.

If neurogenic thoracic outlet syndrome is suspected: Brachial plexus block: local anaesthetic is injected into the scalene muscles of the neck. The chance of having neurogenic TOS is stronger if other symptoms disappear while this area is numb .

Physical Examination: Observation, Posture, Cyanosis, Atrophy, Paleness, Temperature changes, Supraclavicular fossa, Scalene muscles (tenderness), Trapezius muscle (tenderness).

Neurological Screen: MMT & Flexibility of following muscles: Scalene, Pectoralis major/minor, Levator scapulae, Sternocleidomastoid, Serratus anterior

Special Tests: Symptoms are reproduced within 90 seconds; the test is positive. Adson's: the patient is asked to rotate the head and elevate the chin toward the affected side. If the radial pulse on the side is absent or decreased then the test is positive, showing the vascular component of the neurovascular bundle is compressed by the scalene muscle or cervical rib.

Prognosis: Overall, the prognosis is excellent in patients with thoracic outlet syndrome. Patients who undergo conservative therapy have their symptoms resolve in about 90% of cases. Most of these individuals do not have relapses, as long as their injury was not the result of repetitive movements in which lifestyle modifications would be imperative. Avoidance of activities where their arms remain elevated for extended periods should be limited to produce the best result[11].

Medical Management

Treatment of venous thoracic outlet syndrome: To reduce the risk of blood clots and pulmonary embolism, treatment for venous thoracic outlet syndrome may include thrombolytic (clot-busting) or anticoagulant (blood thinning) medications and surgery. In many cases, the patient will be treated with thrombolytic medications and start anticoagulation therapy before surgery [12-14].

Thrombolytic medications are given to dissolve blood clots. This type of medication is always given to the patient in the hospital so he/she can be closely monitored. The medication(s) may be injected directly into the vein or delivered via a catheter, a long slender tube, which is guided through the vein to the area where the blood clot is located. The clot-dissolving drug is sent through the catheter into the clot. The clot usually dissolves in a matter of hours to a few days. In some cases, the narrowed area of the vein will need to be treated with angioplasty (opening the vein using a balloon) to keep more clots from forming. Surgery is often recommended after the clot in the vein has been effectively treated/dissolved [15].

Anticoagulant medications decrease the blood's ability to clot and keep more clots from forming. Anticoagulant medications include warfarin (Coumadin), heparin, low-molecular weight heparin and fondaparinux (Arixtra). You will receive information about how to take the anticoagulant medication that is prescribed for you.

Treatment for Arterial Thoracic Outlet Syndrome: Thrombolytic medications may be given before surgery, if necessary, to dissolve blood clots. This type of medication is always given to the patient in the hospital so he/she can be closely monitored. The medication(s) may be injected directly into the artery or delivered via a catheter, a long slender tube, which is guided through the artery to the area where the blood clot is located. The clot-dissolving drug is sent through the catheter into the clot. The clot usually dissolves in a matter of hours to a few days. In some cases, the narrowed area of the artery will need to be treated with angioplasty (opening the artery using a balloon) to prevent more clots from forming[16].

Surgical Management.

Your doctor may recommend surgery if other treatment hasn't been effective, if you're experiencing ongoing symptoms or if you have progressive neurological problems. A surgeon trained in chest (thoracic) surgery or blood vessel (vascular) surgery will perform the procedure. Thoracic outlet syndrome surgery has risks of complications, such as injury to the brachial plexus. Also, surgery may not relieve your symptoms, and symptoms may recur. Surgery to treat thoracic outlet syndrome, called thoracic outlet decompression, may be performed using several different approaches, including:

Trans axillary approach. In this surgery, your surgeon makes an incision in your chest to access the first rib, divide the muscles in front of the rib and remove a portion of the first rib to relieve compression. This approach gives your surgeon easy access to the first rib without disturbing the nerves or blood vessels. But that only gives your surgeon limited access and makes it harder to see muscles and cervical ribs that may be contributing to compression behind the nerves and blood vessels.

Supraclavicular approach. This approach repairs compressed blood vessels. Your surgeon makes an incision just under your neck to expose your brachial plexus region. Surgeon then looks for signs of trauma or muscles contributing to compression near your first (uppermost) rib. Your surgeon may remove the muscles causing the compression and repair compressed blood vessels. Your first rib may be removed if necessary to relieve compression.

Infraclavicular approach. In this approach, your surgeon makes an incision under your collarbone and across your chest. This procedure may be used to treat compressed veins that require extensive repair. In venous or arterial thoracic outlet syndrome, your surgeon may deliver medications to dissolve blood clots prior to thoracic outlet compression. Also, in some cases, your surgeon may conduct a procedure to remove a clot from the vein or artery or repair the vein or artery prior to thoracic outlet decompression.

If you have arterial thoracic outlet syndrome, your surgeon may need to replace the damaged artery with a section of an artery from another part of your body (graft) or an artificial graft. This procedure may be done at the same time as your procedure to have the first rib removed.

Physiotherapy Management

Aim Of the Treatment is to decreasing symptoms, improving posture and returning to more normal function

Exercise: Warm your muscles before stretching: Heat the neck and shoulder area with a warm shower or heating pad set to LOW for about 10 to 15 minutes or until you feel warm. You should NEVER feel hot, as this may lead to a burn. Stretch gently: You should feel a pull in your muscles, but not pain. If stretching becomes painful, try to not go so far into the stretch. Hold your stretches: avoid "bouncing" when you stretch. Pay attention to how you feel: If you hand starts to feel cold, numb or begins to tingle, stop stretching.

How to correct posture: Try to sit tall when you are sitting or standing. Slouching causes the shoulders and neck to roll forward, and can tighten the muscles in your neck and shoulders.

1.Neck stretch: Look straight ahead. Bend your right ear to your right shoulder, without looking down or looking up. If your physiotherapist says it is OK, turn your chin down or up. Hold for 20 to 30 seconds. Repeat times, times a day

2.Shoulder stretch: Start with your elbows or arms low or with your arms straight by your side. Lean your body weight forward until you feel a stretch in the front part of the shoulder or chest. Hold for 20 to 30 seconds.

3.Shoulder blade squeeze: Squeeze shoulder blades together. As this exercise becomes easier, you can increase the number of squeezes, for example: Do 1 set of 10, 2 sets of 10, 3 sets of 10. Conservative management should be the first strategy to treat TOS since this seems to be effective at decreasing symptoms, facilitating return to work and improving function, but yet a few studies have evaluated the optimal exercise program as well as the difference between conservative management and no treatment. Conservative management includes physical therapy, which focuses mainly on patient education, pain control, range of motion, nerve gliding techniques, strengthening and stretching.

Stage 1: The aim of the initial stage is to decrease the patient's symptoms. This may be achieved by patient education, in which TOS, bad postures, the prognosis and the importance of therapy compliance are explained. Furthermore, some patients who sleep with the arms in an overhead, abducted position should get some information about their sleeping posture to avoid waking up at night. These patients should sleep on their uninvolved side or supine, potentially by pinning down the sleeves. The Cyriax release test may be used if a 'release phenomenon' is present. This technique completely unloads the neurovascular structures in the thoracic outlet before going to bed.

Cyriax Release Maneuver: Elbows flexed to 90°, Towels create a passive shoulder girdle elevation, supported spine and the head in neutral, the position is held until peripheral symptoms are produced. The patient is encouraged to allow symptoms to occur as long as can be tolerated for up to 30 minutes, observing for a symptom decrescendo as time passes. The patient's breathing techniques need to be evaluated as the scalene and other accessory muscles often compensate to elevate the ribcage during inspiration. Encouraging diaphragmatic breathing will

lessen the workload on already overused or tight scalene and can possibly reduce symptoms.

Stage 2: Once the patient has control over his/her symptoms, the patient can move to this stage of treatment. The goal of this stage is to directly address the tissues that create structural limitations of motion and compression. How this should be done is one of the most discussed topics of this pathology. Some examples of methods that are used in the literature are.

Massage, strengthening of the Levator scapulae, sternocleidomastoid and upper trapezius (This group of muscles open the thoracic outlet by raising the shoulder girdle and opening the costoclavicular space), Stretching of the pectoralis, lower trapezius and scalene muscles (These muscles close the thoracic outlet), Postural correction exercises, Relaxation of shortened muscles, Aerobic exercises in a daily home exercise program:

Exercises: Shoulder exercises to restore the range of motion and so provide more space for the neurovascular structures. Lift your shoulders backwards and up, flex your upper thoracic spine and move the shoulders forward and down. Then straighten the back and repeat 5 to 10 times.
ROM of the upper cervical spine. Lower your chin 5 to 10 times against your chest, while you are standing with the back of your head against a wall. The effectiveness of this exercise can be enlarged by pressing the head down by hands.

Activation of the scalene muscles is the most important exercises. These exercises help to normalize the function of the thoracic aperture as well as all the malfunctions of the first rib. Exercises are Anterior scalene (Press your forehead 5 times against the palm of your hand for a duration of 5 seconds, without creating any movement), Middle scalene (Press your head sidewards against your palm), Posterior scalene (Press your head backwards against your palm.

Other Interventions:

- Repositioning/mobilization of the shoulder girdle and pelvis joints: cervicothoracic, sternoclavicular, acromioclavicular, and costotransverse joints
- Glenohumeral mobilizations in end-range elevation with the elbow supported in extension
- Taping: some patients with severe symptoms respond to additional taping, adhesive bandages or braces that elevate or retract the shoulder girdle.

Manipulative Treatment to Mobilize the First Rib. These should be carried out with caution and only after a thorough assessment as they can provoke irritation and pain symptoms in some patients

Posterior Glenohumeral Glide with Arm Flexion: The patient is supine. The mobilization hand contacts the proximal humerus avoiding coracoid process. The force is directed posterolateral (direction of thumb).

Anterior Glenohumeral Glide with Arm Scaption: The patient is prone. The mobilization hand contacts the proximal

humerus avoiding acromion process. The force is directed anteromedially.

Inferior Glenohumeral Glide: The patient is prone. The stabilizing hand holds the proximal humerus, the humerus distal to the lateral acromion process. The mobilization hand contacts the axillary border of the scapula. Mobilize the scapula in a craniomedial direction along the ribcage.
Post-Op Physical Therapy: If a patient does require surgery, then physical therapy should follow immediately to prevent scar tissue and return the patient to full function[17].

Rehabilitation Exercise

1.Scalene Stretch: This stretches the neck muscles that attach to your rib. sitting in an upright position, clasp both hands behind your back, lower your left shoulder, and tilt your head towards the right. Hold this position for 15 to 30 seconds and then come back to the starting position. Lower your right shoulder and tilt your head towards the left until you feel a stretch. Hold for 15 to 30 seconds. Repeat 3 times on each side.

2.Pectoralis Stretch: Stand in a doorway or corner with both arms on the wall slightly above your head. Slowly lean forward until you feel a stretch in the front of your shoulders. Hold 15 to 30 seconds. Repeat 3 times.

3.Scapular Squeeze: While sitting or standing with your arms by your sides, squeeze your shoulder blades together and hold for 5 seconds. Do 3 sets of 10.

4.Arm slide on wall: Sit or stand with your back against a wall and your elbows and wrists against the wall. Slowly slide your arms upward as high as you can while keeping your elbows and wrists against the wall. Do 3 sets of 10.

5.Thoracic extension: While sitting in a chair, clasp both arms behind your head. Gently arch backward and look up towards the ceiling. Repeat 10 times. Do this several times per day.

6.Rowing Exercise: Tie a piece of elastic tubing around an immovable object and grasp the ends in each hand, keep forearms vertical and your elbows at shoulder level and bent to 90 degrees. Pull backward on the band and squeeze your shoulder blades together. Repeat 10 times. Do 3 sets.

7.Mid Trap Exercise: Lie on your stomach on a firm surface and place a folded pillow underneath your chest. Place your arms out straight to your sides with your elbows straight and thumbs toward the ceiling. Slowly raise your arms toward the ceiling as you squeeze your shoulder blades together. Lower slowly. Do 3 sets of 15. Progress to holding soup cans or small weights in your hands.

Home Exercise Program for Thoracic Outlet Syndrome: The following exercise are designed to stretch the soft tissue structures that may be compressing the neurovascular bundle. Perform the exercise in the order listed. If any of the exercise causes an increase in your symptoms, discontinue the exercise and call your therapist.

Corner Stretches: stand in a corner with your hands against the walls at shoulder height. Lean into the corner until you feel a gentle stretch. Hold for 5 seconds.

Neck Stretches: Place your left hand on the far side of your head and your right hand behind your back. Pull your head toward your shoulder until you feel a gentle stretch. Hold for 5 seconds. Switch hand position and repeat the exercise in the opposite direction.

Shoulder Rolls: Roll your shoulders up, back, and then down in a circular motion.

Neck Retractions: Pull your head straight back, keeping your jaw level. Hold in the retracted position for 5 seconds.

CONCLUSIONS

Since the first use of the term TOS by Peet et al., there have been significant advancements in the understanding and treatment of the syndrome. The upper extremity pain and numbness typical of the condition have been subcategorized into distinct disorders based on the structures involved. A history of trauma or repetitive motions combined with supportive physical exam findings suggests the correct diagnosis. Other diagnostic modalities such as MRI, ultrasound, and nerve conduction studies can further support the diagnosis, and ongoing developments in this sphere are currently underway.

Despite advances, substantial controversy regarding the diagnosis remains. This is evidenced by the lack of objective findings surrounding nTOS, the most common and widely disputed form of TOS. The challenges associated with diagnosis complicate the selection of the appropriate treatment option. In some cases, e.g., acute vascular insufficiency or progressive neurologic dysfunction, surgical decompression is clearly indicated. Prompt recognition and treatment of TOS provide the greatest opportunity for optimal recovery. Unfortunately, the multitude of nonspecific symptoms and challenges in diagnosis can delay treatment and increase the risk of complications.

Surgical intervention for TOS syndrome is reserved for patients who have failed conservative management. Conservative treatment including physical therapy need be trialed for at least 4–6 months prior to consideration of surgical intervention. Definitive therapy for patients with refractory aTOS or vTOS, however, remains surgical intervention.

Physiotherapy management can decrease symptoms of pain and increase muscle strength, improve Postural correction and return to near normal function of upper limb in patients with thoracic outlet syndrome.

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