AN OSTEOPATHIC APPROACH TO THE THORACIC OUTLET SYNDROMES (TOS)

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- I have no disclosures
Learning Objectives

- Define Thoracic Outlet Syndrome (TOS)
- Describe the Mechanisms of Dysfunction
- List Diagnostic tests for (TOS)
- Understand (TOS) referral patterns
- Discuss Treatment Options

Thoracic Outlet Syndrome

- Definition: A condition that results in compression of the neurovascular bundle (subclavian artery, and brachial plexus) as it courses through the thoracic outlet.
- Typically patients experience numbness in the ulnar distribution of the arm and hand (C8-T1).
The thoracic outlet is a space defined by the first rib, the clavicle and the superior scapula

Thoracic outlet anatomy

Normal Anatomy

Thoracic Outlet:
- Interscalene triangle
- Costoclavicular space
- Subcoracoid Space

Neurovascular structures:
- Brachial plexus
- Subclavian vein
- Subclavian artery
Cervicobrachial region anatomy

Anterior and Middle Scalenes
Thoracic Inlet consists of
- T1 Vertebrae
- 1st rib
- Manubrium

Thoracic Outlet is the area that the neurovascular structures pass through to get to the arm. It is an anatomic space bordered by the first rib, the clavicle and the superior border of the scapula. We have 2 thoracic outlets (left and right) and 1 thoracic inlet

Thoracic Outlet Syndrome

- TOS symptoms may be slowly developing with repetitive movements and poor posture or more acute in onset following a neck or shoulder injury.
- Peak age of onset is in the 4th decade
- Female to male ratio is 9:1
COLDERASS

Character
Onset
Location
Duration
Exacerbation
Relief
ASS – Associated sx’s

“I’m a little concerned about your cholesterol and, oh yeah, that’s not good either.”
Entrapment neuropathies are a group of disorders of the peripheral nerves that are characterized by pain and/or loss of function (motor and/or sensory) of the nerves as a result of chronic compression.
Pain may be limited to the hand and forearm or may radiate down the arm. Pain is typically in an Ulnar nerve distribution.

Nerve entrapments more proximal may radiate down to the hand. Common nerve entrapments occur at the elbow and wrist.
Thoracic Outlet Syndrome (TOS)

- Sites of Entrapment – IMPORTANT!
  - Anterior/Middle Scalene (Scalenus anticus syndrome)
  - Costoclavicular Region
  - Pectoralis Minor

Anterior and Middle Scalenes

- Mechanism of Dysfunction
  - Hyperextension injury to the neck
  - Poor posture with head forward position
  - Fatigue of Respiratory Assist muscles (Asthma/COPD)
    - Scalenes
  - Inhaled first and second rib dysfunction
    - Inhaled rib – Up in front/down in back
Brachial Plexus and Costoclavicular Region

Scalenus anticus syndrome
Anatomy of the Interscalene Triangle

Distribution of the Brachial plexus
Brachial Plexus
Robert Taylor Drinks Cold Beer (beverages)

- R - roots
- T - trucks
- D - divisions
- C - cords
- B - branches

Numbness and pain normally felt in the ulnar distribution
- 4th and 5th fingers
**Mechanism of Dysfunction**
- Inhaled first and second rib
  - Inhaled rib – up in front/down in back
- Inferior sternoclavicular head dysfunction
- Excess tension in the scalene muscles
- Abnormal clavicle – previous fx?
- Hypertonicity of the pectoralis minus muscle

**Pectoralis Minor**
- Originates from the 3rd, 4th and 5th ribs and inserts on the coracoid process
- Stabilizes scapula by drawing it inferiorly and anteriorly against the thoracic wall
- Can be hypertonic in very strong people
**Pectoralis Minor**

- **Mechanism of Dysfunction**
  - Hyperextension injury of the shoulder
  - Overuse or fatigue of the muscle
  - Pectoralis hypertrophy
  - Exhaled rib somatic dysfunction
    - Down in front/up in back
  - Abnormal positioning of the Coracoid Process

**Hyper abduction for pectoralis minor syndrome**
Factors which predispose to TOS
- Cervical Ribs and fibrous bands
- Variations in the route of the cervical nerve roots
- Long transverse process of C7
- Abnormal or Somatic Dysfunction of first rib
- Variability in scalene muscles
- Postural Changes
- Trauma
- Degenerative Changes
- Connective Tissue Disease
- Thoracic Tumors
- Distal areas of Somatic Dysfunctions

Clinical Picture
- Neurological Symptoms
  - Weakness, Numbness, Pain and Paraesthesias
- Vascular Symptoms & Signs
  - Cold, Swelling, Cyanosis
Provocative tests

- Provocative tests are used in multiple locations of the body.
- A common example is the Phalen’s test for carpal tunnel syndrome
- A positive test reproduces symptoms or creates a physical finding.
- They are extensively used in physical examinations
Adson’s Test

- Arm is extended posteriorly with head turned away from the affected side while monitoring the radial pulse. Then monitor with the head turned toward the affected side.
- A positive test
  - Diminished radial pulse or reproduction of neurologic or vascular symptoms
  - Indicates compression of the neurovascular bundle as it passes through the scalenes
  - Nerve root impingement proximal to brachial plexus
Anterior and Middle Scalenes attach from the T.P (transverse process) of C4-6 to the 1st rib.
- Tender point is in body of muscle
- Tx: flexion, SB/Rot toward
Abnormally shaped 1st rib

Healed clavicular fracture
Military Posture Test
Costoclavicular Maneuver

- Chest is out with shoulders retracted and down.
- A positive test
  - Diminished radial pulse or reproduction of neurologic symptoms
  - Indicates inhaled 1st rib or inferior clavicle
  - Nerve root impingement distal to the brachial plexus
  - Reproduction of symptoms
Arm is extended behind and raised up to 180 degrees.

Positive test
- Diminished radial pulse or reproduction of neurologic symptom
- Indicates hypertonic Pectoralis Minor

Hyperabduction Test
Wright’s Hyperabduction Test

Who is this young doctor???
Pain Referral of Pectoralis Minor

- Pectoralis Minor attaches from ribs 3-5 to the coracoid process.
- Tender point is 3-4 cm inferior to the coracoid process and 1-2 cm medial or in the muscle belly.
- Tx: arm adducted diagonally across the chest in the plane of the muscle.

Roos test

- Both arms are placed at right angles to the shoulder and the forearms are at right angles to the upper arms. Both hands are opened and closed as fast as possible to see if symptoms occur.
Anatomical variations in the interscalene triangle

CLASSIC PLEXUS ANATOMY

PROVOCATIVE TESTING Adson’s test: Utilizing vascular change at the radial artery to identify compression at the trunks of the brachial plexus

Provocative Test for Thoracic Outlet Syndrome

<table>
<thead>
<tr>
<th>Provocative Test</th>
<th>Description</th>
<th>Positive Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adson’s Test</td>
<td>Indicated for compression of subclavian artery between anterior and middle scalene muscles. Performed by monitoring radial pulse with abduction, extension and external rotation of upper extremity while patient takes a deep breath and turns head ipsilaterally to tested extremity.</td>
<td>Marked reduction of radial pulse</td>
</tr>
<tr>
<td>Costoclavicular Test</td>
<td>Indicated for compression of subclavian artery between clavicle and first rib. Performed by palpating patient’s radial pulse and instructing patient to forcefully hyper-extend scapula posteriorly while flexing this to chest.</td>
<td>Reduction of radial pulse</td>
</tr>
<tr>
<td>Wright’s/Hyperabduction Test</td>
<td>Indicated for compression of subclavian artery by pectoralis minor muscle. Performed by palpating patient’s radial pulse and lifting the ipsilateral arm into hyperabduction.</td>
<td>Reproduction of symptoms or marked reduction of radial pulse</td>
</tr>
</tbody>
</table>
Variations exist in 47.7% of individuals!

**Piercing variant:** Predominant variant within the interscalene space, occurring in 38.5% of individuals studied

![Image](image1.png)

**Additional Variations:**
- C5 Piercing variant: 3.1% of population
- Anterior variant: 3.1% of population

Why do we care??

Structure and function are interrelated!

So how can we diagnose these patients?
How about some ultrasonography!

Classic anatomy:

How about some ultrasonography!

Not so classic anatomy: Piercing variant
Thoracic Outlet Syndrome

The thoracic outlet syndrome is a group of symptoms arising not only from the upper extremity, but also from the chest, neck, and shoulders. The symptoms are produced by a positional, intermittent compression of the brachial plexus and/or subclavian artery and vein.

Differential Diagnosis
Differential Diagnosis

- Peripheral Entrapment neuropathies
  - Carpal tunnel syndrome, cubital tunnel syndrome
- Space-occupying spinal cord dysfunctions
- Spinal stenosis
- Degenerative disease
  - Cervical spondylosis
- Connective tissue disease
- Metastatic malignancies
- Pancoast Tumor
- Post-traumatic damage
  - Fall from ladder
- Metabolic disorders
- Infectious disorders
- Circulatory disorders
- Psychological disorders

Axial Compression Test

- Used to assess spinal nerve impingement at the level of the spine.
- With patient seated the physician pushes straight down on the head.
- A positive test induces pain or numbness in the nerve distribution at the spinal level of the pathology.
- Positive test results from a degenerative disc or spinal stenosis or other boney pathology.
Diagnostic Tests

- X-rays
- CT scan
- Vascular ultrasound
- EMG and Nerve Conduction Velocity
- MRI
- Chest X-ray
- Ultrasound

Treatment TOS

- Conservative
  - OMT
  - Postural education
    - Really important, remove heavy purse
  - Weight reduction
  - Physical therapy
  - Avoidance of aggravating factors
    - Ergonomics with prolonged sitting
- Surgical
  - Complications
So what OMT techniques do you use for this?

- HVLA cervical spine
- HVLA thoracic spine
- Counterstrain to scalene muscles
- Muscle energy to scalene muscles
- Counterstrain to pectoralis minor
- Still technique cervical spine
- On side scapulothoracic release

Let’s talk about treatment!

A case study demonstrated that indirect treatments are more effective than combined OMT techniques. Think of the anatomy!

Focusing on counterstrain, stretching, and myofascial release improved our patient’s pain from a 6/10 between 2 week visits to a 4/10 lasting 3-4 weeks.
Position to do OMT for scalene muscles and cervical somatic dysfunction

Counterstrain to left scalenes
THANK YOU FOR HAVING ME. HANG IN THERE MY FRIENDS