



Occupational  
Health Clinics  
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Workers Inc.

Centres de  
santé des  
travailleurs (ses)  
de l'Ontario Inc.

# Thoracic Outlet Syndrome

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# Presentation Overview

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- What is Thoracic Outlet Syndrome (TOS)?
  - Anatomy
  - Types
  - Symptoms
  - Diagnosis
  - Causes
- WSIAT Medical Discussion Paper on TOS (2000)

# What is Thoracic Outlet Syndrome (TOS)?



- Disorder that result in compression of one or more of the *neurovascular* structures (nerves or blood vessels) that travel through the passageway from the lower neck to the armpit (thoracic outlet)
- Compression of the nerves and blood vessels within the thoracic outlet can interrupt nerve signaling, while compression of the blood vessels can impact blood flow
- Commonly results from chronic or prolonged movements with arms elevated or overhead and from awkward and static postures of the head, neck, and shoulder girdle

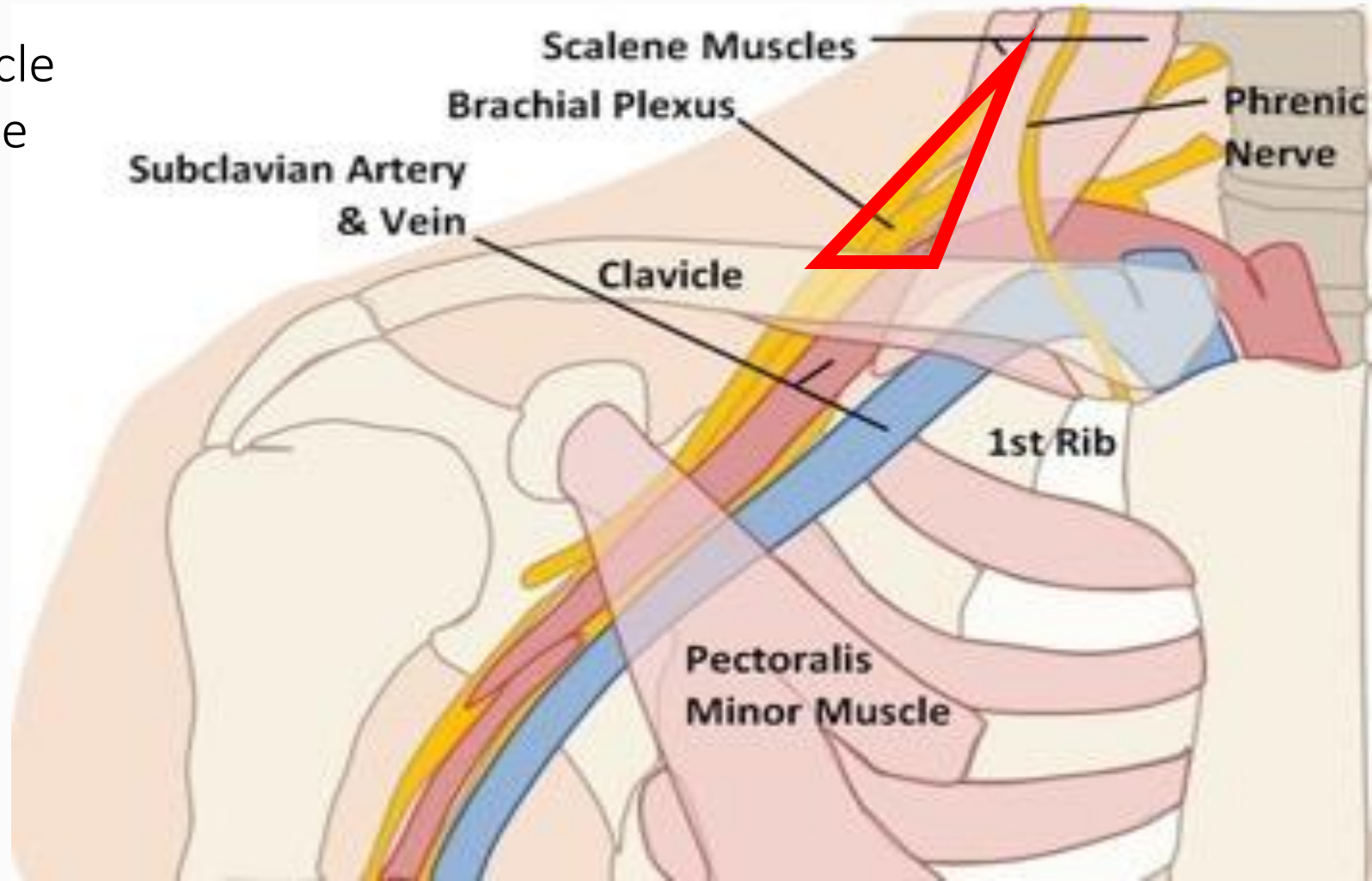
# Anatomy of the Thoracic Outlet



The Thoracic Outlet is comprised of **three** distinct anatomical compartments:

## 1. Interscalene Triangle

- Anterior scalene muscle
- Middle scalene muscle
- First Rib

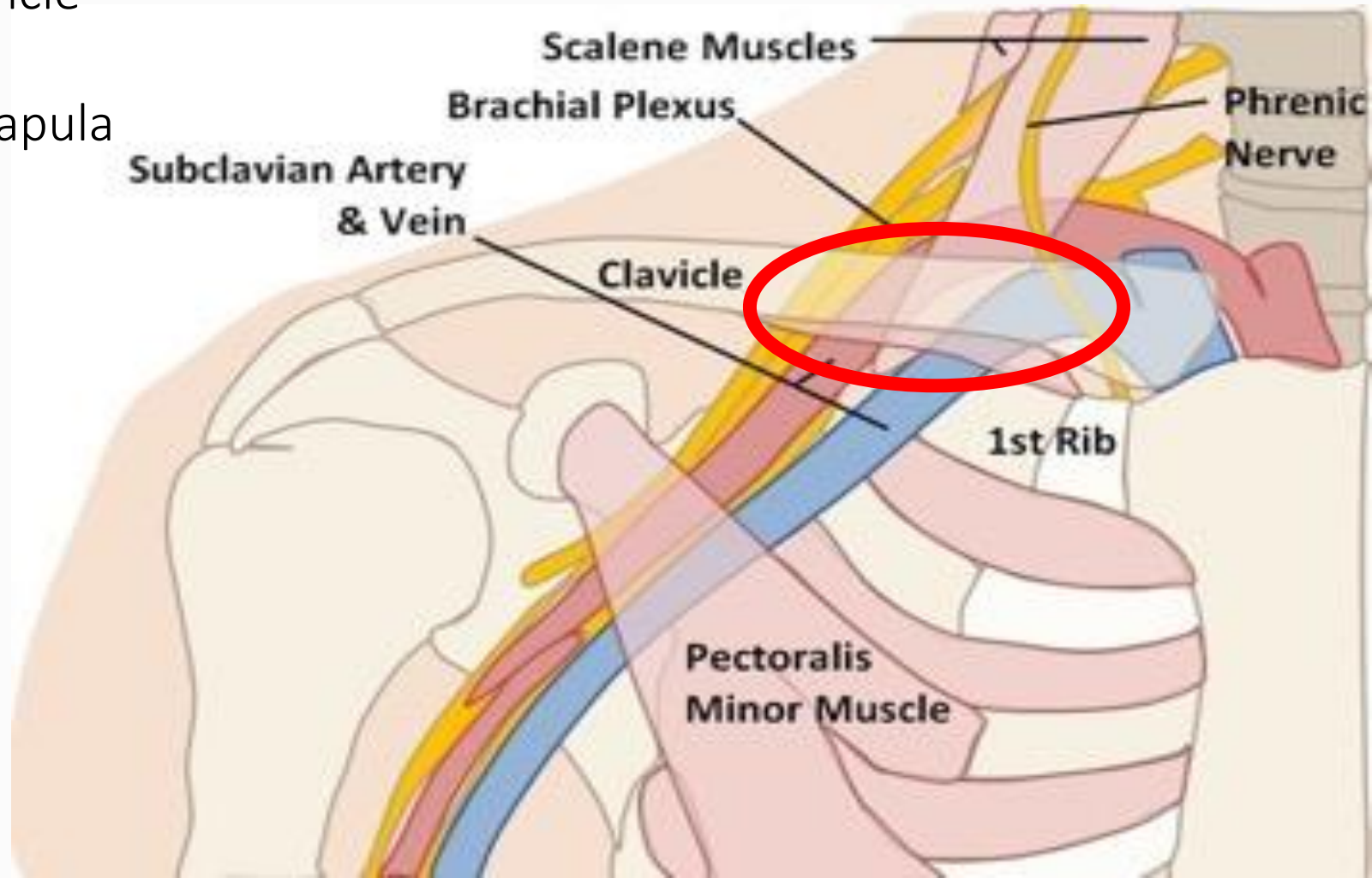


# Anatomy of the Thoracic Outlet



## 2. Costoclavicular Space

- Middle third of the clavicle
- First rib
- Upper border of the scapula



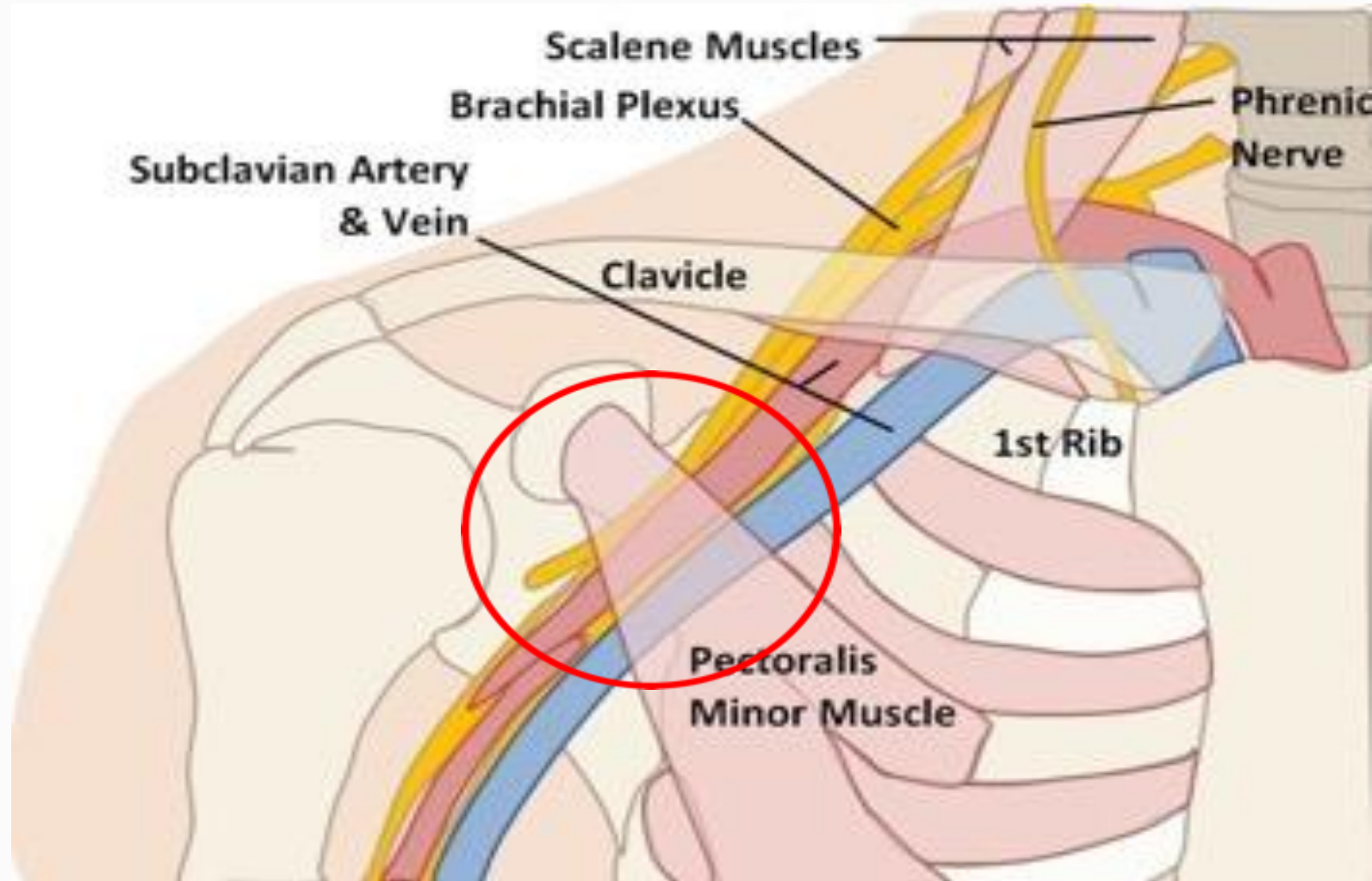


# Anatomy of the Thoracic Outlet



## 3. Pectoralis minor/ Retropectoral space

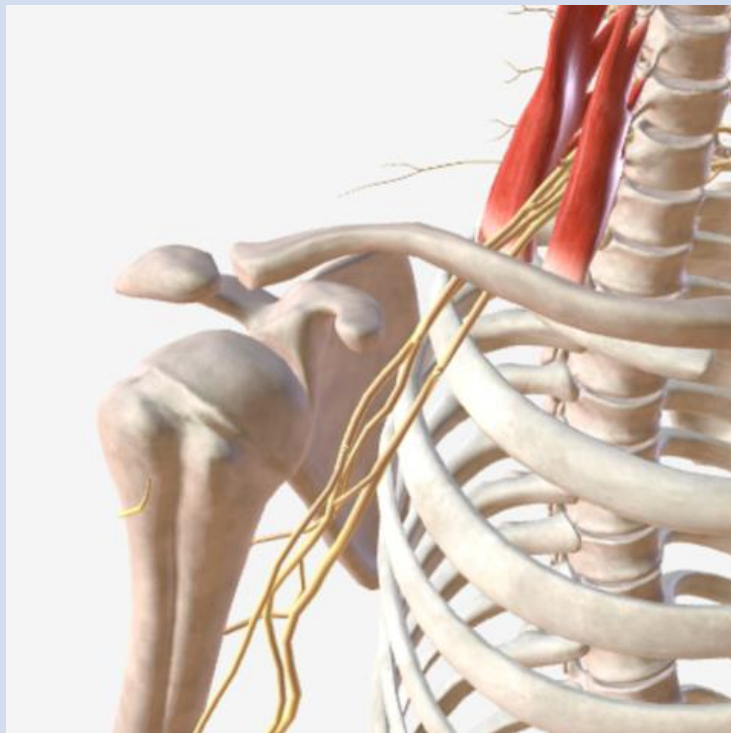
- Pectoralis minor muscle
- Subscapularis muscle
- Coracoid process



# Types of TOS

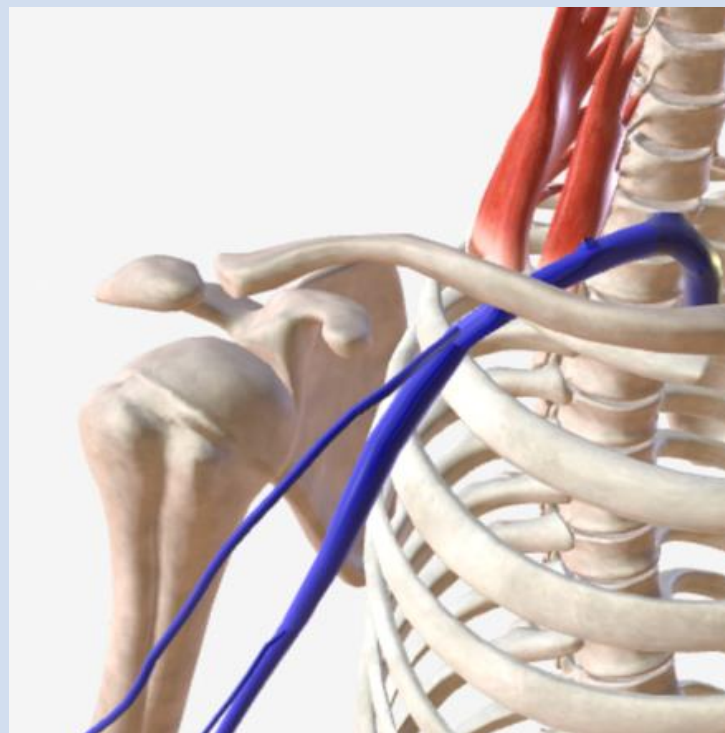


Neurogenic TOS



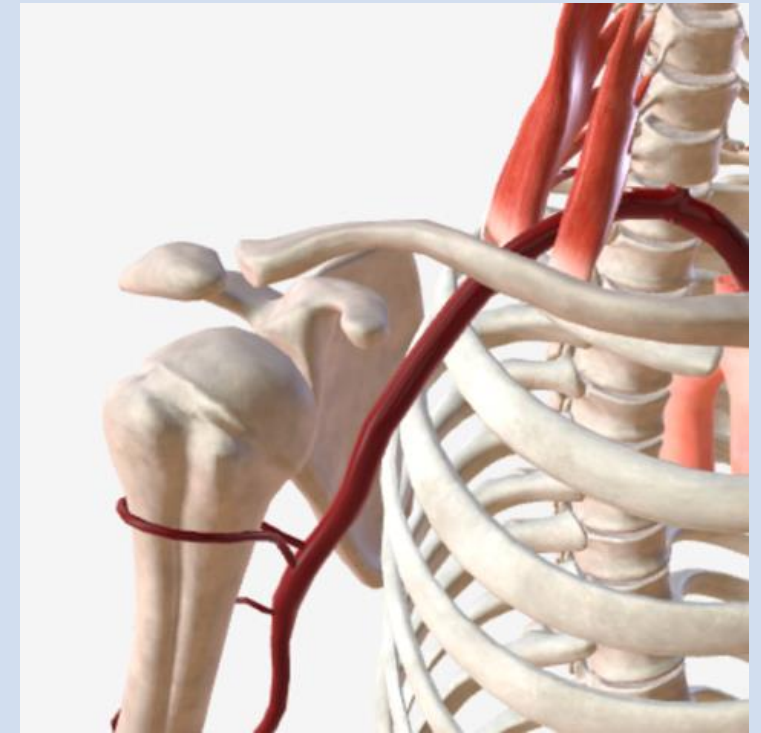
80%

Venous TOS



20%

Arterial TOS

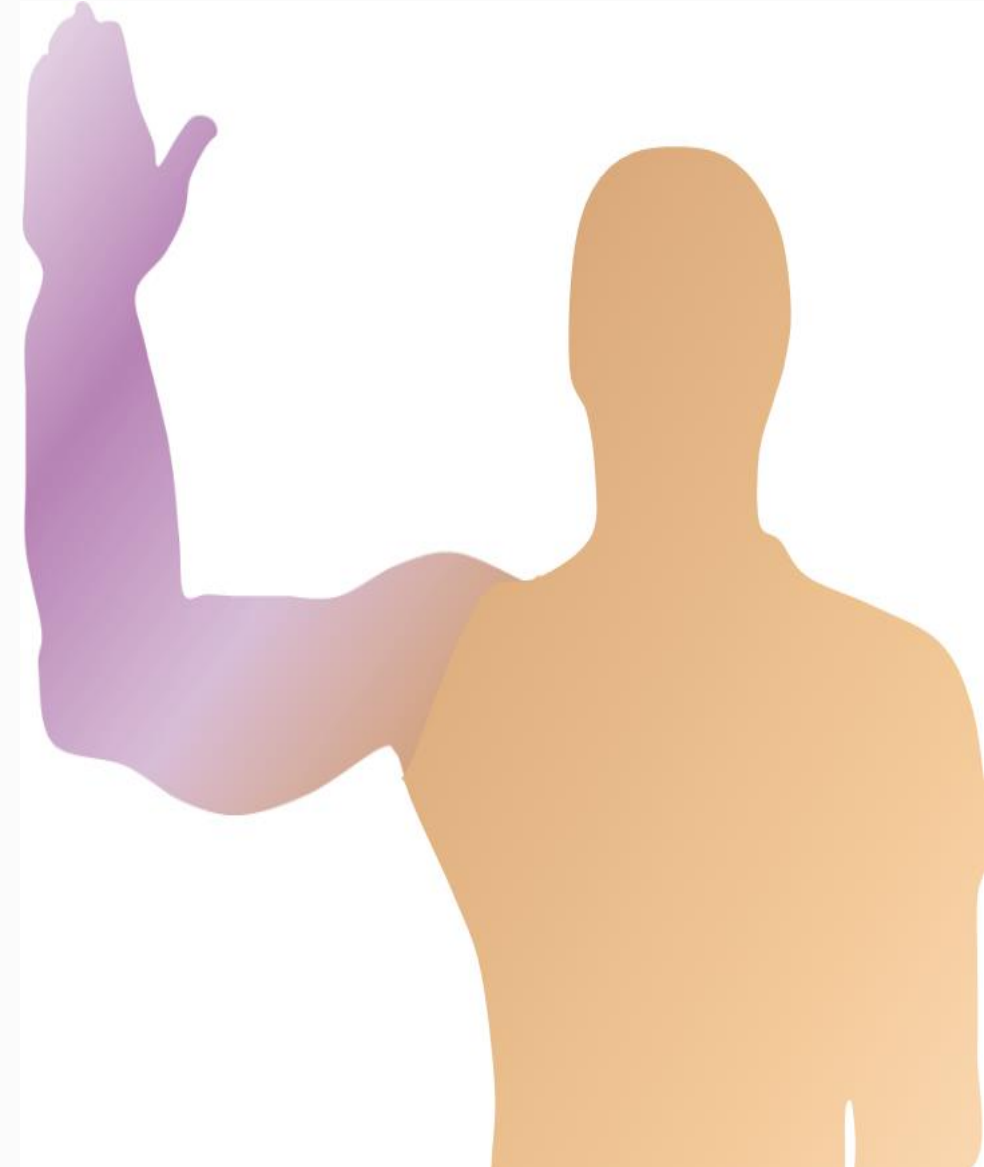


< 1%

# Venous TOS



Incidence	Accounts for ~20% of TOS cases
Location	Costoclavicular space
Cause	Elevated/overhead arm use
Health Effect	Impeded circulation Oxygen/nutrient deprivation

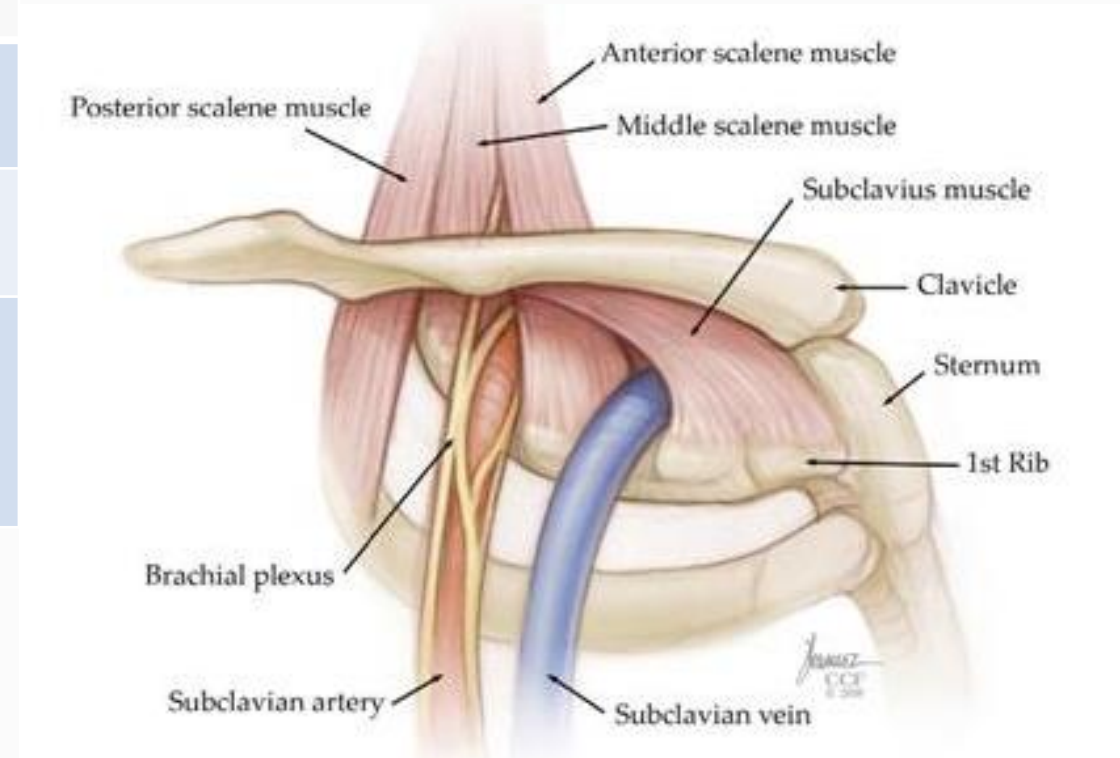




# Arterial TOS



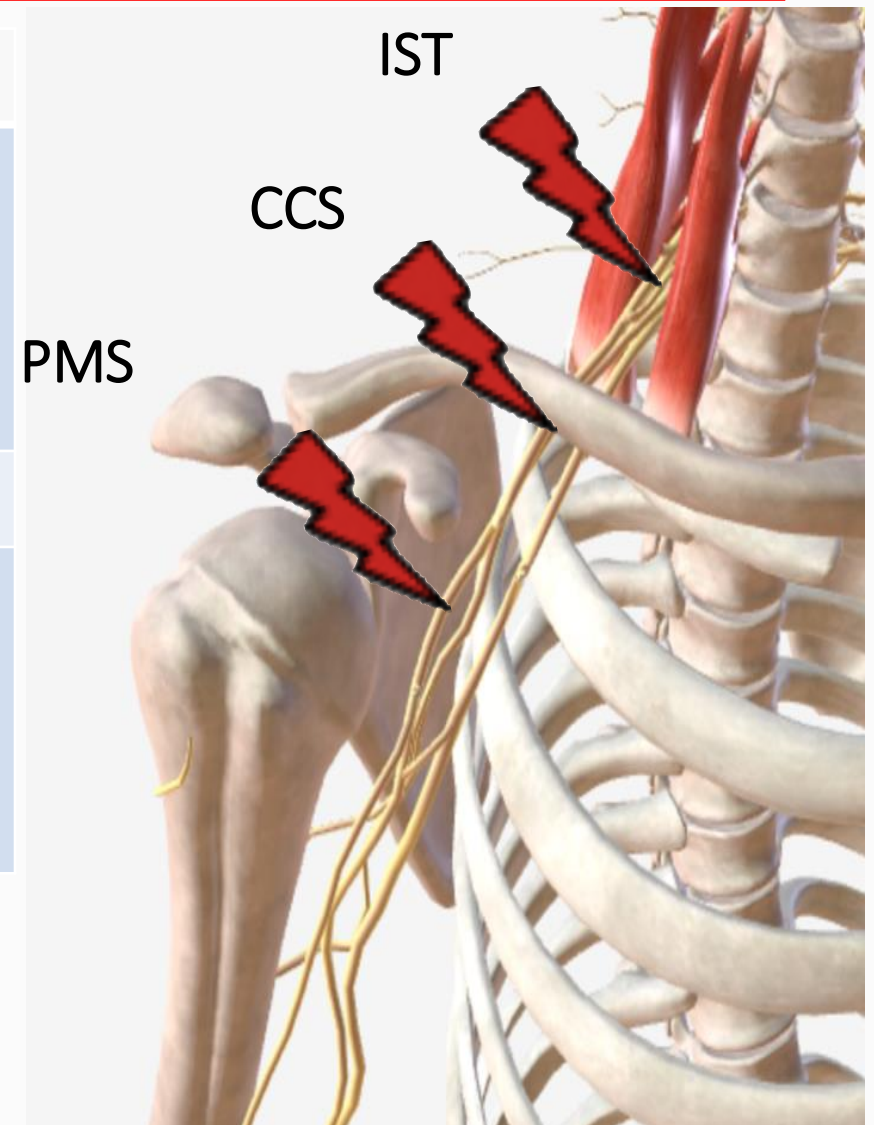
Incidence	Accounts for <1% of TOS cases
Location	Interscalene Triangle
Cause	Structural abnormalities
Health Effect	Ischemia Embolism



# Neurogenic TOS



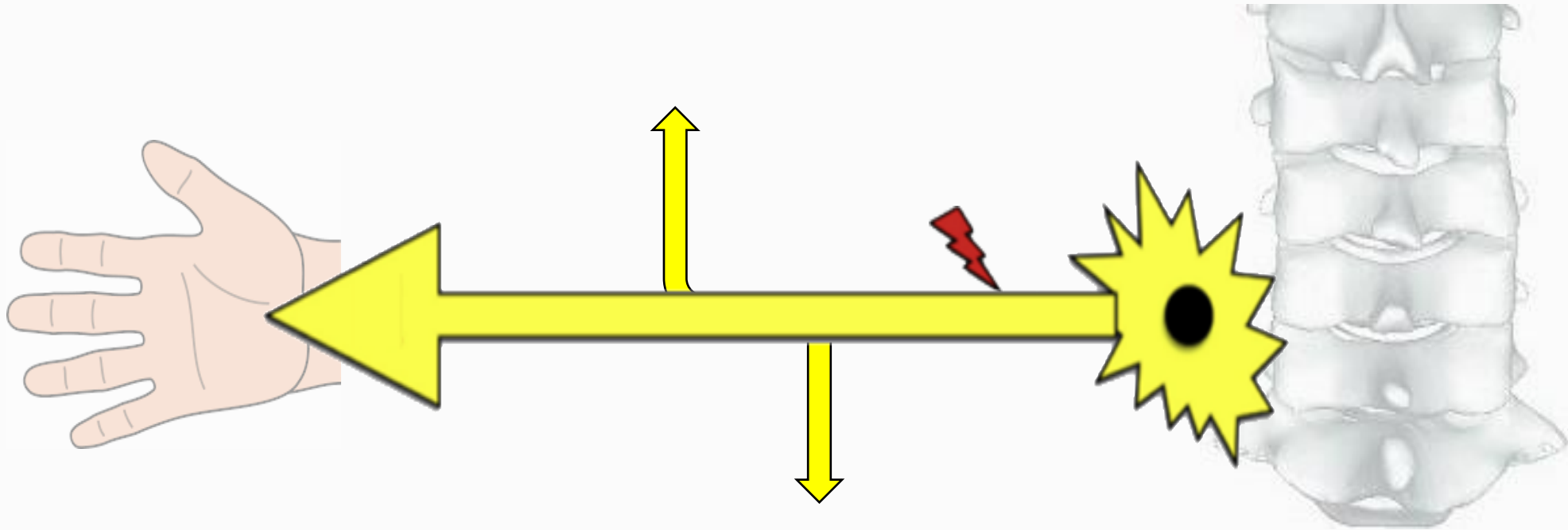
Incidence	Accounts for ~80% of TOS cases
Location	IST = Interscalene Triangle CCS = Costoclavicular Space PMS = Pectoralis minor/ Retropectoral space
Cause	Various
Health Effect	Pain Numbness Tingling Cold Sensation



# Neurogenic TOS - Symptoms



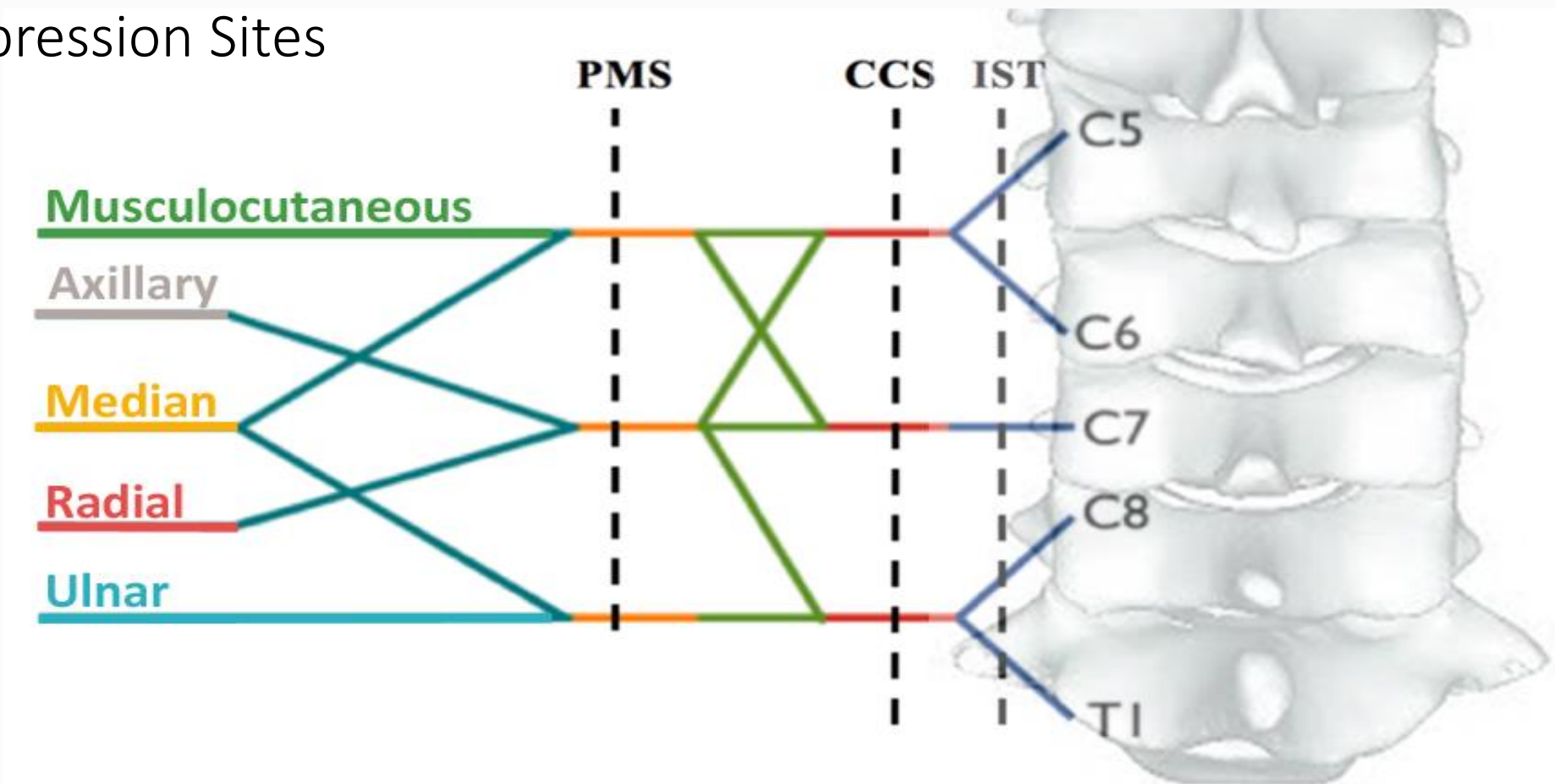
- Symptoms can range from the neck and shoulder to the forearm and hand





# Neurogenic TOS - Symptoms

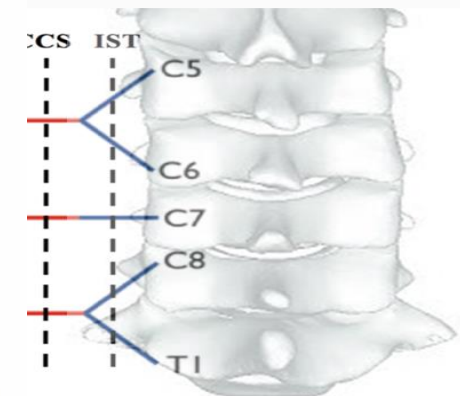
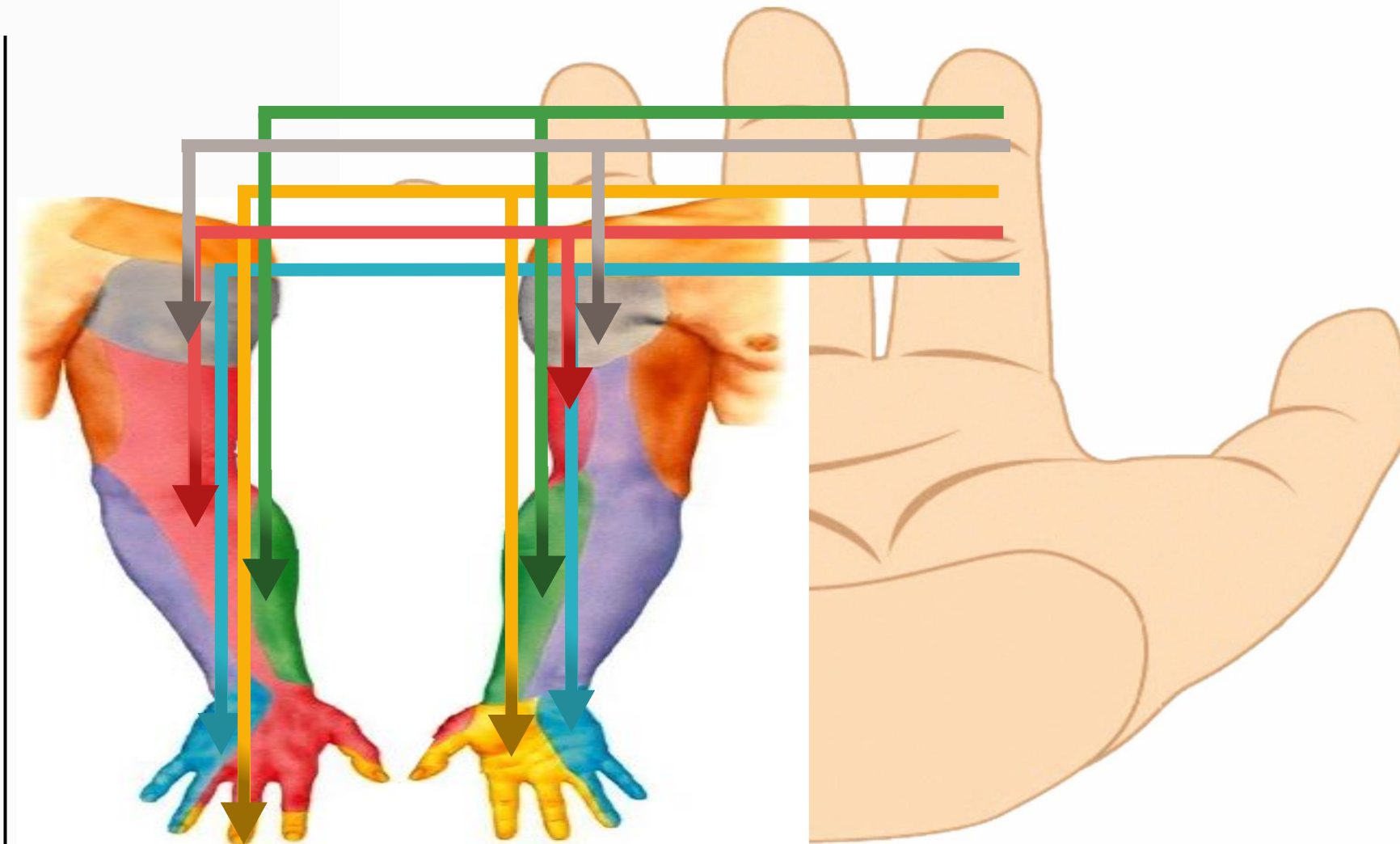
## Potential Compression Sites



IST = Interscalene Triangle  
CCS = Costoclavicular Space  
PMS = Pectoralis Minor Space



# Neurogenic TOS - Symptoms



Symptoms of TOS can often manifest themselves as those similar to Carpal Tunnel Syndrome if branch to Median nerve is compressed



# Neurogenic TOS - Diagnosis



1. Comprehensive, multi-disciplinary evaluation
2. Evaluation of occupational demands & postures
3. Provocative postures



Elevated Arm Stress Test (EAST)

# Neurogenic TOS - Diagnosis



## 4. Consensus-based clinical diagnostic criteria

Upper extremity symptoms extending beyond the distribution of a single cervical nerve root or peripheral nerve, present for at least 12 weeks, not satisfactorily explained by another condition, <i>and</i> meeting at least 1 criterion in at least 4 of the following 5 categories:	
<b>Principal Symptoms</b>	
<b>1A</b>	Pain in the neck, upper back, shoulder, arm, and/or hand.
<b>1B</b>	Numbness, paresthesia, and/or weakness in the arm, hand, or digits.
<b>Symptom Characteristics</b>	
<b>2A</b>	Pain/paresthesia/weakness exacerbated by elevated arm positions.
<b>2B</b>	Pain/paresthesia/weakness exacerbated by prolonged or repetitive arm/hand use, including prolonged work on a keyboard or other repetitive strain tasks
<b>2C</b>	Pain/paresthesia radiate down the arm from the supraclavicular or infraclavicular space.
<b>Clinical History</b>	
<b>3A</b>	Symptoms began after occupational, recreational, or accidental injury of the head, neck, or upper extremity including repetitive upper extremity strain or overuse.
<b>3B</b>	Previous ipsilateral clavicle or first rib fracture, or known cervical rib.
<b>3C</b>	Previous cervical spine or ipsilateral peripheral nerve surgery without sustained improvement in symptoms
<b>3D</b>	Previous conservative or surgical treatment for ipsilateral TOS.
<b>Physical Examination</b>	
<b>4A</b>	Local tenderness on palpation over the scalene triangle and/or subcoracoid space.
<b>4B</b>	Arm/hand/digit paresthesia on palpation over the scalene triangle and/or subcoracoid space
<b>4C</b>	Objectively weak handgrip, intrinsic muscles, or digit 5, or thenar/hypothenar atrophy
<b>Provocative Maneuvers</b>	
<b>5A</b>	Positive upper limb tension test (ULTT).
<b>5B</b>	Positive 3-minute elevated arm stress test (EAST).

# Neurogenic TOS - Misdiagnosis



- Cervical Disc Disorders
- Cubital Tunnel Syndrome
- Radial Tunnel Syndrome
- Carpal Tunnel Syndrome
- Rotator Cuff Injury
- Guyon's Canal Syndrome
- Brachial Neuritis
- Peripheral Nerve Tumors

*“TOS may also be the most underrated, overlooked, and misdiagnosed, and the most important and difficult to manage peripheral nerve compression in the upper extremity.”*

Atasoy 1996

# Neurogenic TOS - Causes



1. Post-Traumatic Onset

*and/or*

2. Structural Abnormalities

*and/or*

3. Work-Related/Functionally Acquired Causes

# Neurogenic TOS - Causes



## 1. Post-Traumatic Onset

- Acute Trauma
- Bone Fracture
- Whiplash



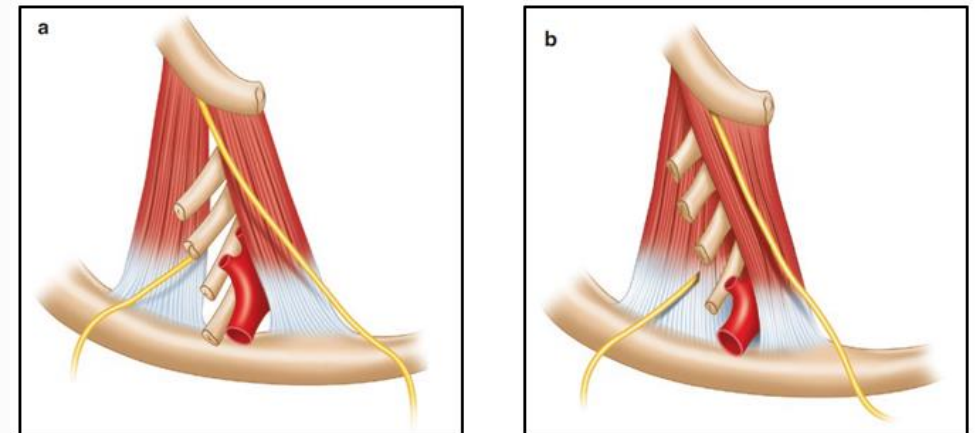
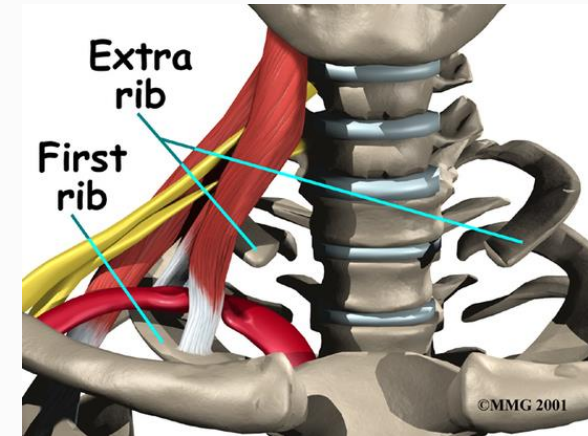


# Neurogenic TOS - Causes



## 2. Structural Abnormalities

- Bone Abnormalities
  - Cervical Rib
  - Elongated C7 Transverse Process
- Muscular Abnormalities
  - Narrow Interscalene Triangle
  - Passage through ASM
- Fibrous Bands
  - Extra ligaments

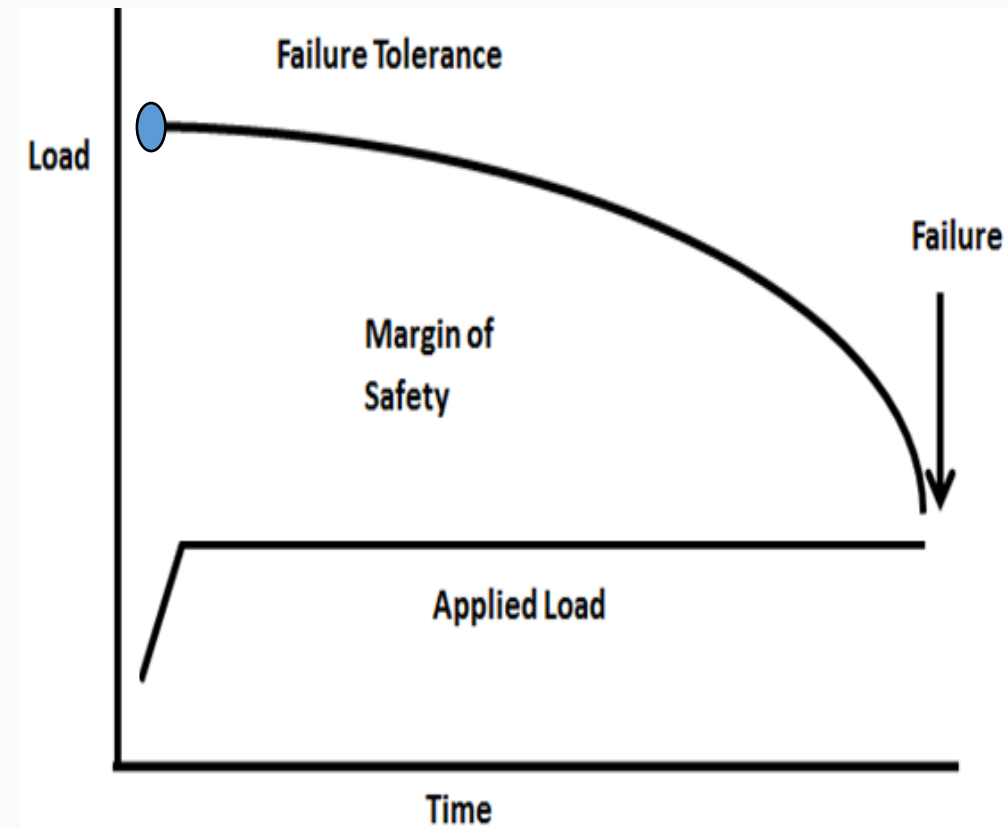
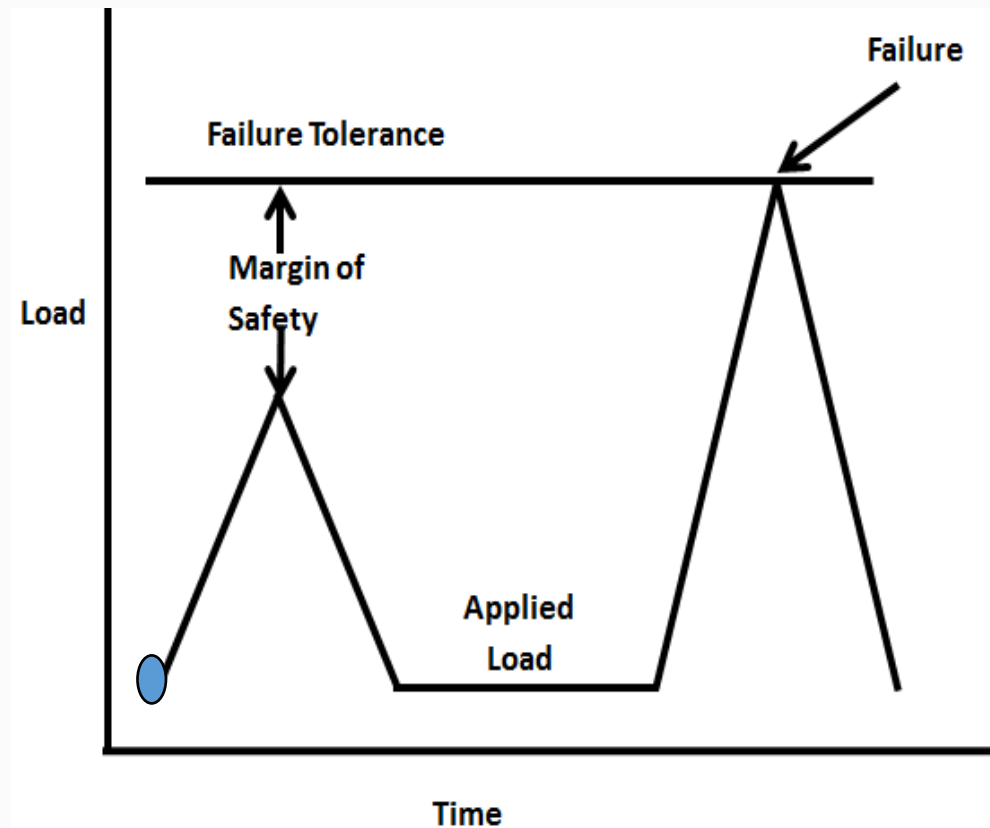


Images: Sanders & Donahue (2021)

# Neurogenic TOS - Causes



## 3. Work-Related/Functionally Acquired Causes

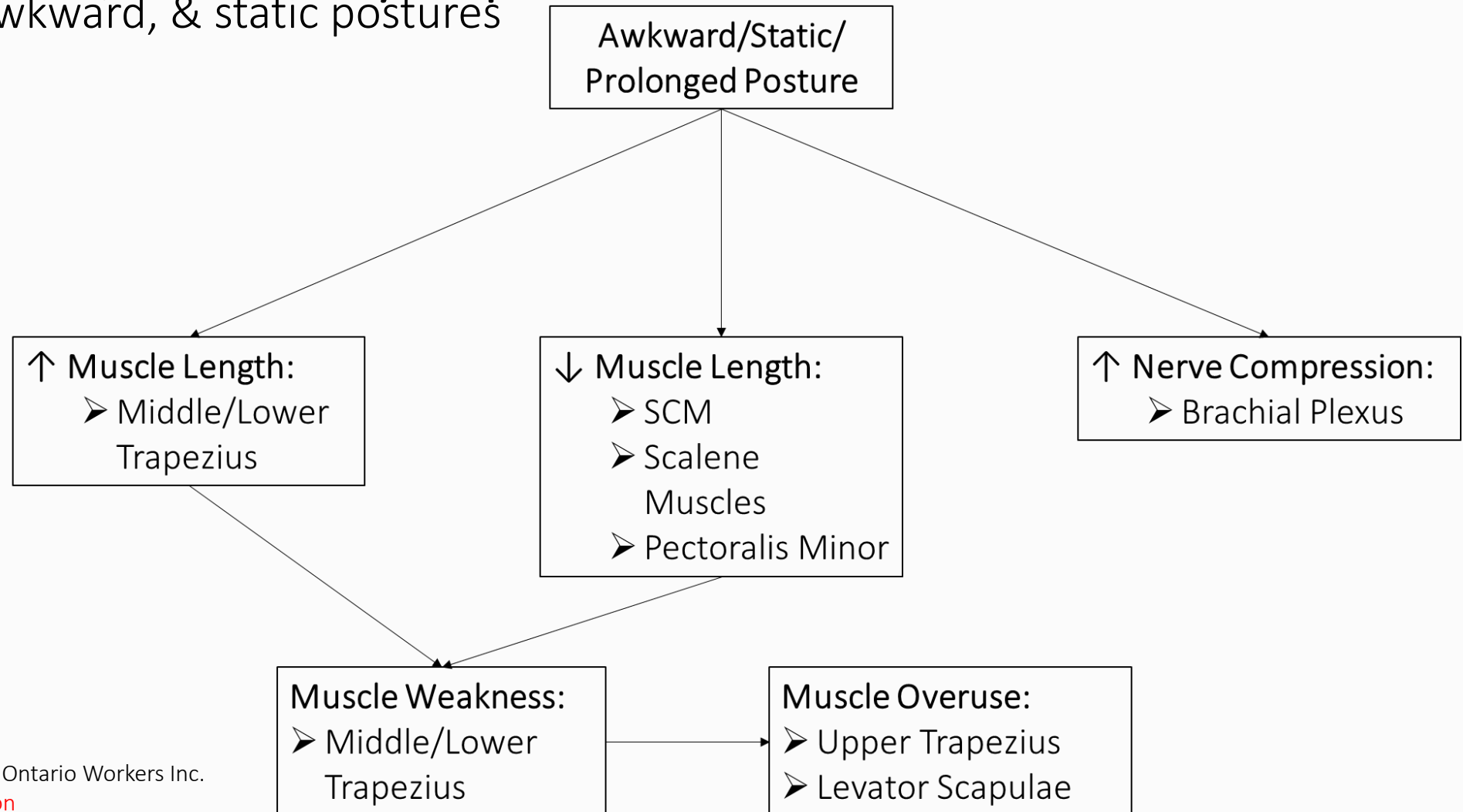


# Neurogenic TOS - Causes



## 3. Work-Related/Functionally Acquired Causes

### A. Prolonged, awkward, & static postures

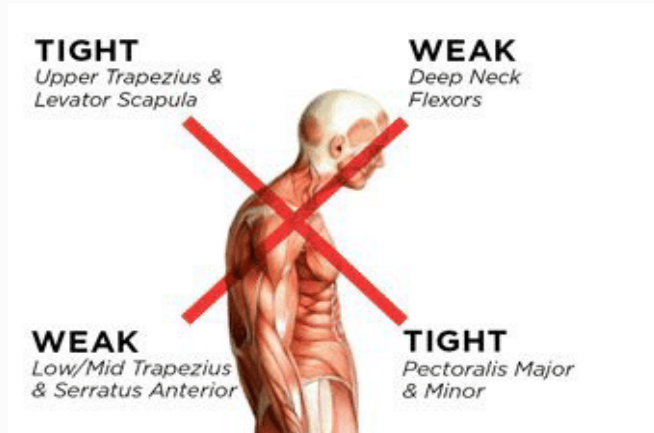
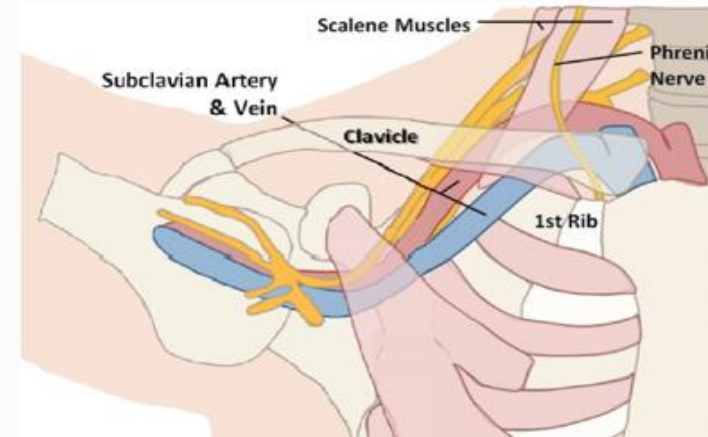


# Neurogenic TOS - Causes



## 3. Work-Related/Functionally Acquired Causes

### A. Prolonged, awkward, & static postures

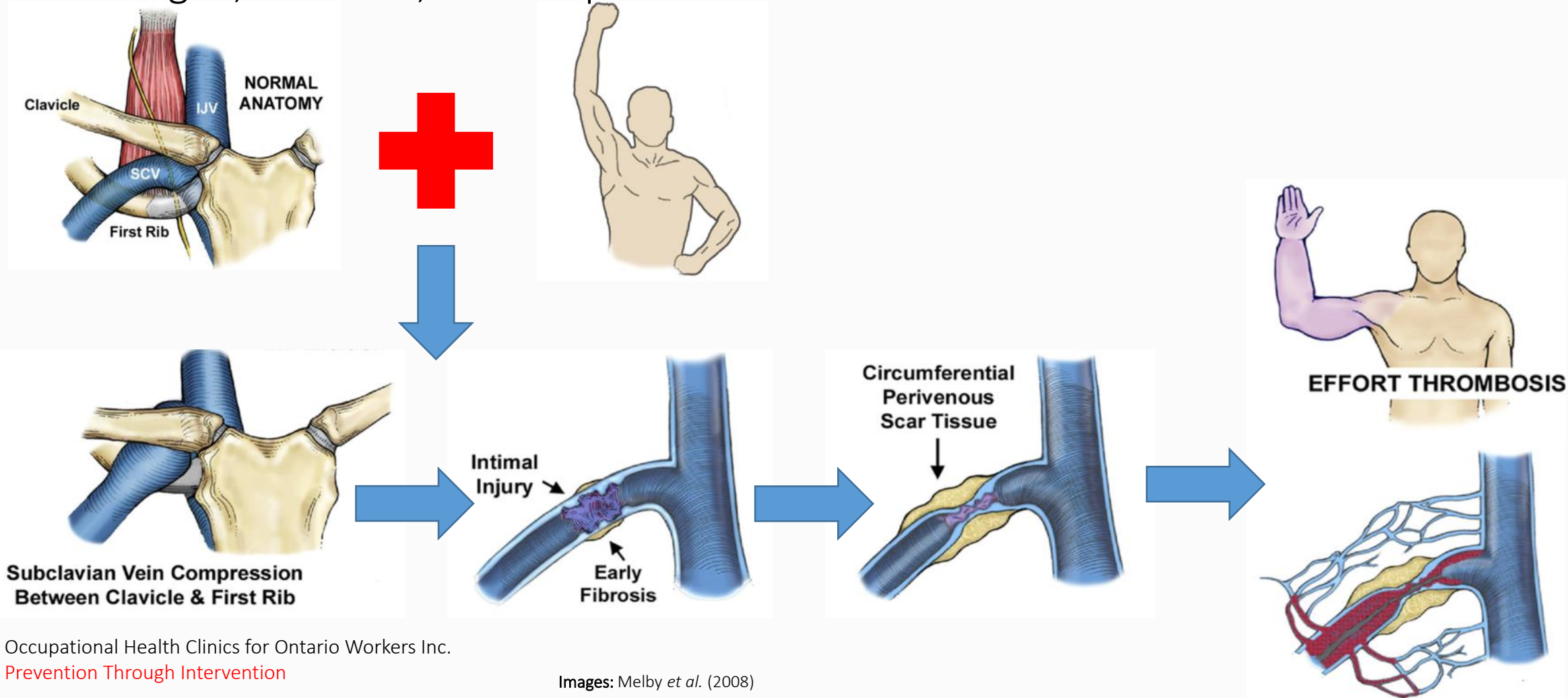




# Aside – Venous TOS

## 3. Work-Related/Functionally Acquired Causes

### A. Prolonged, awkward, & static postures





# Neurogenic TOS - Causes



## 3. Work-Related/Functionally Acquired Causes

### B. External Forces – Compression

- Ex. Carrying heavy shoulder loads, pulling shoulders back and down

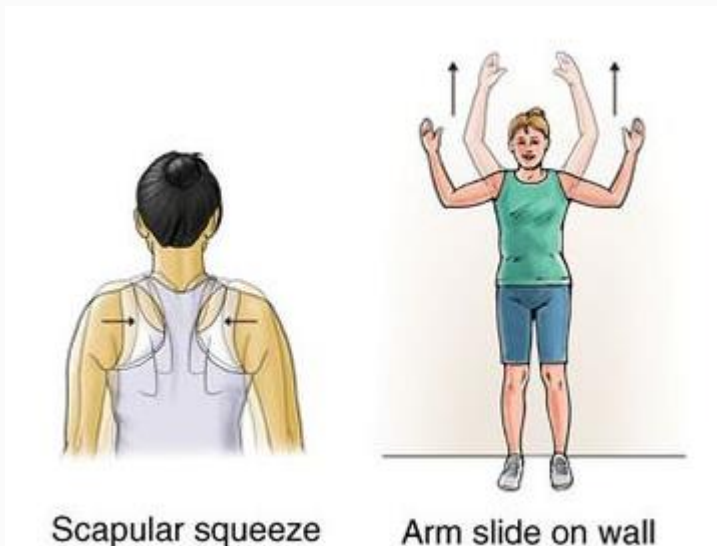


# Neurogenic TOS - Treatment



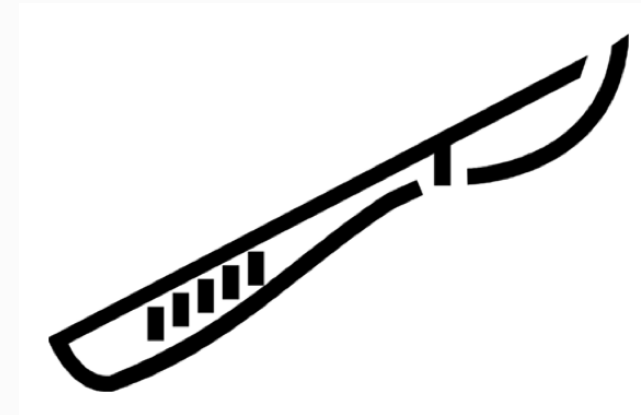
## Non-Surgical Treatment - Preferred

- Physical therapy – Improve muscle and postural imbalance
- Workplace modification
- Ergonomic awareness



## Surgical Treatment – Last Resort

- Removal of the first rib and/or cervical rib
- Scalenectomy



# Concerns with WSIAT Discussion Papers

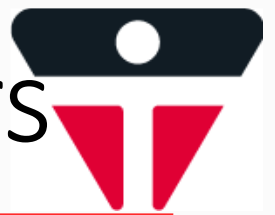


In Ontario, the Workplace Safety and Insurance Appeals Tribunal (**WSIAT**) is the final level of appeal to which workers and employers may bring disputes concerning workplace compensation claim.

WSIAT has prepared **Medical Discussion Papers** (MDP) to make general information about medical issues that commonly arise in WSIAT appeals easily available to parties, representatives and adjudicators.

- **However**, this general medical information can also be used to **deny** a workers claim despite inherent errors.

# Concerns with WSIAT Discussion Papers

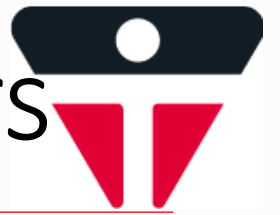


WSIAT states: “MDP’s are intended to provide a **balanced**, broad and general overview of a medical topic that can be understood by individuals that are not medical professionals.”

- This is often **not** the case. Many of these papers are:
  - Overly technical
  - Contain obvious author bias
  - Based on the opinion of a single author
  - Not peer reviewed

Use of a **multidisciplinary** approach with combination of professions with respect to occupational health, such as ergonomists, occupational health nurses, or occupational hygienists, would **prevent** single author bias and allow for **alternative professional opinions** and theories regarding disease or disorder etiology to provide a more **well-rounded** document.

# Concerns with WSIAT Discussion Papers



WSIAT states: *“each MDP is written by a well-qualified medical professional who has been selected by the WSIAT for her or his **specific expertise.**”*

- Aside from the MDP on TOS, the principal author **does not have any publications on the topic of TOS.**
- Selection of medical professional who reviewed the document in 2011 is unclear, especially when his principal areas of clinical and research expertise focused on head injury, cerebrovascular surgery, skull base tumor surgery, and intraoperative neurophysiological monitoring. **Nor did he have any relevant publications on TOS.**





# Concerns with WSIAT Discussion Papers

WSIAT states: “MDP’s are based on the current medical knowledge available **at the time of writing**. MDP are not, however, intended to be the most up to date authority on a medical issue or topic, and are not peer reviewed.”

- However, this is not the case. For example, the TOS paper was last created in 2000 (22 years ago) and last reviewed in 2011 (11 years ago). **Over 40 relevant work-related TOS articles were published in that time.**

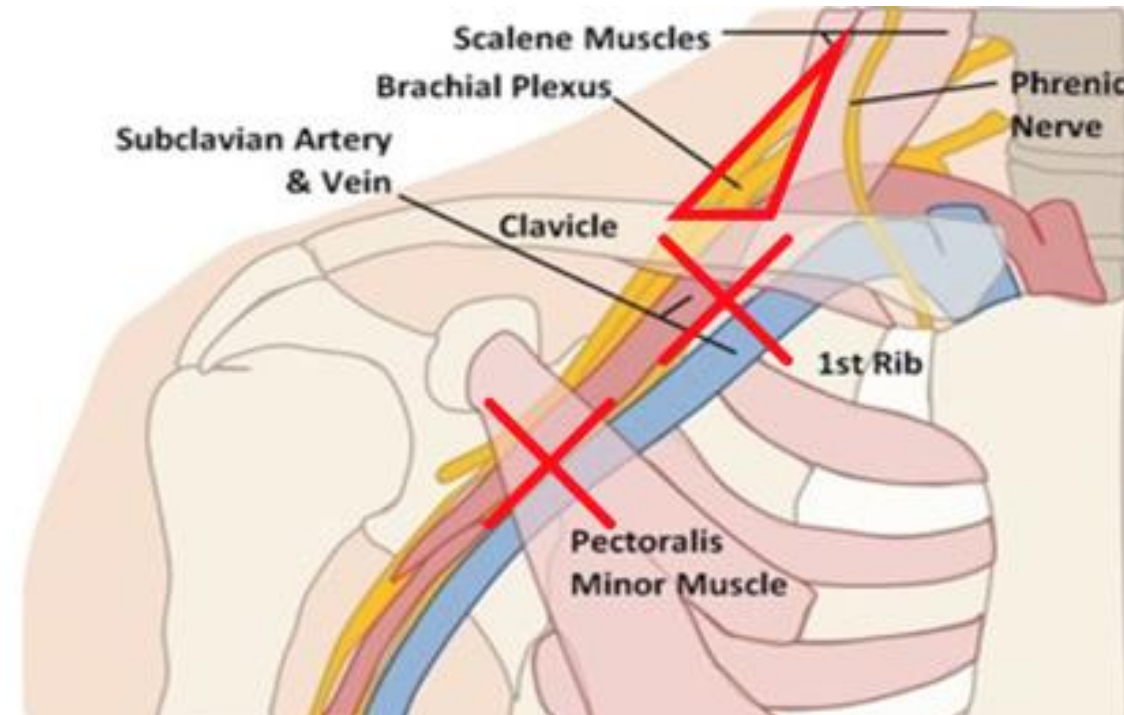
	MDP	Specific Occupational TOS Research		
		Pre-2000	2000 – 2011	2011 – Present
Number of References	6	18	40	54



# WSIAT Discussion Paper on TOS

The MDP identifies the thoracic outlet solely as the *Interscalene Triangle* compartment, ignoring the Costoclavicular Space and Pectoralis Minor Space also associated with TOS.

- As a result, if pathology arises independent of the *Interscalene Triangle*, then the condition is **not** considered TOS and compensation entitlement could be denied.





# WSIAT Discussion Paper on TOS

The MDP classifies Neurogenic TOS into the terms '**true**' and '**disputed**' TOS, terms now largely abandoned and considered to be unhelpful

'True' Neurogenic TOS	'Disputed' Neurogenic TOS
Objective evidence of neurological abnormalities	No objective abnormal neurological findings
Abnormal electro-diagnostic test results	Same symptoms in absence of abnormal electrical tests or motor findings
Weakness/atrophy in hand musculature	Associated with muscle imbalance/ functional/postural abnormalities
Associated with anatomical abnormalities (cervical rib, elongated C7 TP)	Argued that the condition does not exist

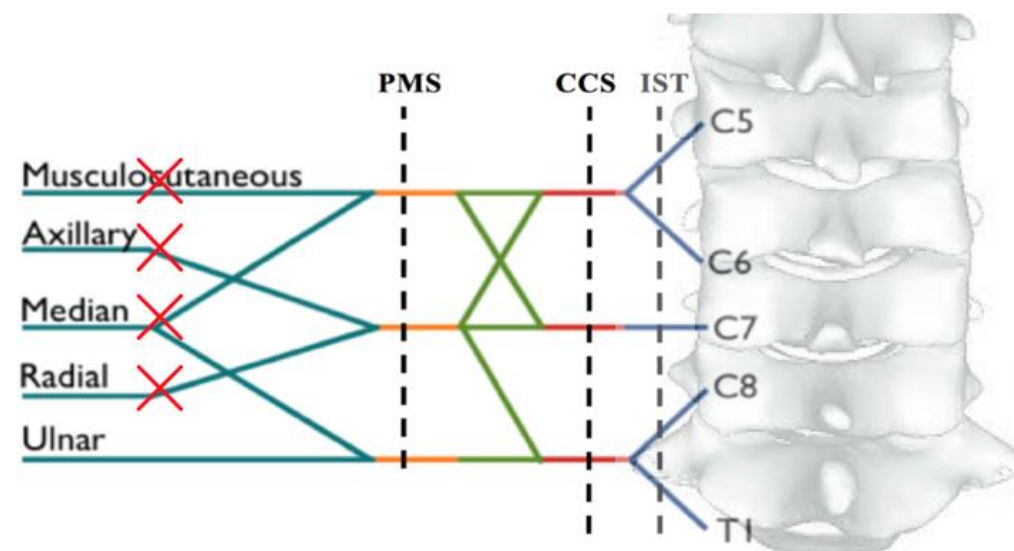
***“Not believing that a condition exists because a test is negative is an example of the myopic approach taken by some physicians who do not believe it exists unless one can see it on a radiograph. Unfortunately, there are many who believe the most common type of neurogenic TOS does not even exist because they cannot see or measure it. That reasoning is akin to believing that the atom did not exist until the twentieth century or that the presence of palpable pulses rules out claudication.”*** (Brantigan & Roos, 2004).



# WSIAT Discussion Paper on TOS

The MDP states: “*only the lowest portion of the brachial plexus [C8 and T1 spinal nerve roots] is affected by TOS*”.

- Urschel & Razzuk (1997)\*, ~ 10% of cases involved the upper plexus only, and 20% involved **a combination** of upper and lower plexus.
- Wood & Ellison (1994)\*, it was reported that 12% of cases involved the upper plexus only, and 24% involved **a combination** of upper and lower plexus.
- Although upper plexus pathology may occur less frequently than lower plexus pathology, it is **irresponsible** to dismiss its possible involvement in *neurogenic* TOS.



\* Research conducted prior to creation of TOS MDP

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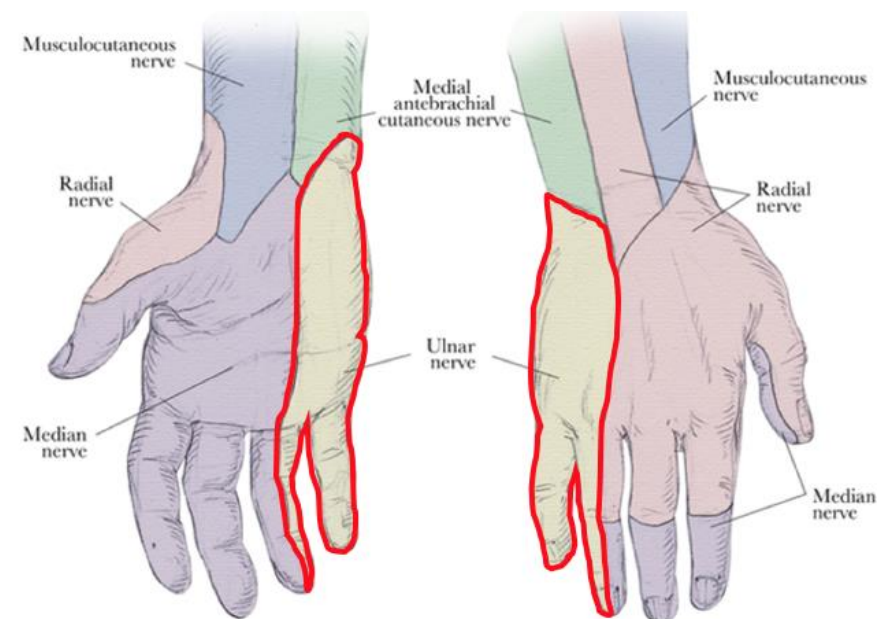
Prevention Through Intervention



# WSIAT Discussion Paper on TOS

The MDP limits the sensations of pain and paresthesia associated with TOS to an Ulnar Nerve (C-8 and T-1) distribution.

- Thompson (2021), while paresthesia commonly involves the ring and pinky fingers, patients often describe involvement of other fingers or the entire hand
- Sanders et al. (2007) reported paresthesia of all five fingers occurring in neurogenic TOS patients almost twice as often as paresthesia limited to the pinky and ring fingers alone.
- Urschel & Kourlis (2007) reference symptoms in the first three fingers (i.e., thumb, index, and middle fingers), and muscle weakness or pain occurring in the cervical, brachial and lateral arm and forearm
- Wood & Ellison (1994), reference median nerve symptomology







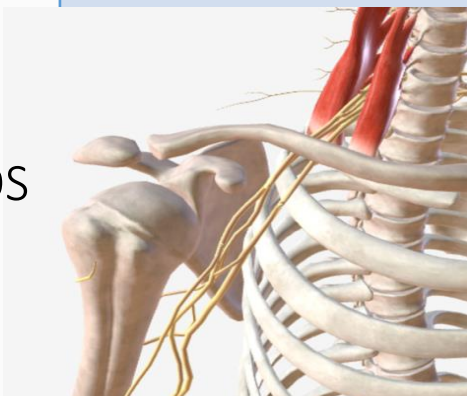
# WSIAT Discussion Paper on TOS

In reference to venous & arterial TOS, according to the definitions provided within the MDP: “**Vascular TOS**, with symptoms due to involvement of the subclavian artery, is extremely rare... Obstruction of the subclavian vein ... **is not part of the thoracic outlet syndrome.**”

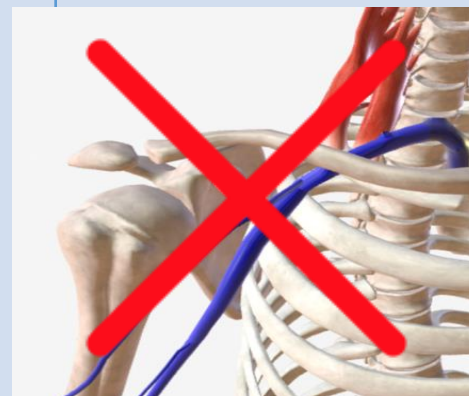
- This classification is incorrect; *venous* TOS and *arterial* TOS are two **clinically distinct entities**, both of which are **universally recognized subtypes** of TOS.

Much like the terms 'true' & 'disputed' neurogenic TOS, the term 'vascular' TOS has largely been abandoned.

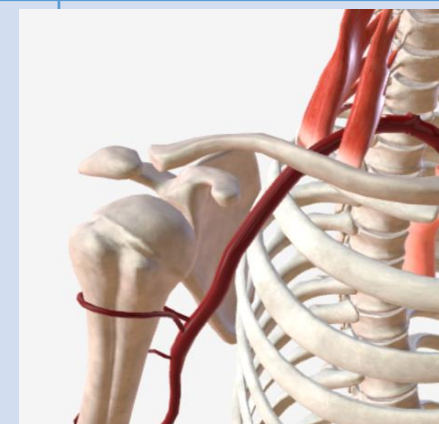
## Neurogenic TOS



## Venous TOS



## Arterial TOS







# WSIAT Discussion Paper on TOS

## Etiology of TOS

The MDP states: *"Whether or how much the thoracic outlet can be narrowed by swelling or overgrowth (hypertrophy) of the scalene muscles, or by swelling of adjacent ligaments or other tissues due to excessive wear and tear, repetitive awkward (e.g. overhead) movements, or by a sudden straining injury, remains **speculative and controversial**."*

- Considers TOS resulting from work-related tasks to be 'speculative' and 'controversial'.
- This quote has been directly used as evidence in the denial of benefits for TOS. Five such WSIAT decisions are listed in the references.

A. Chronic, awkward, & static postures

B. Arm elevation & overhead movement

C. External forces



***"Speculative"***  
***&***  
***"Controversial"***



# WSIAT Discussion Paper on TOS

## Etiology of TOS

Aside from whiplash as a result of automobile accidents, slip and falls or work-related injuries involving **rapid hyperflexion/hyperextension of the neck** can cause acute damage to the tissues and musculature in the cervical and brachial regions.

- Fracture of the clavicle can directly obstruct the thoracic outlet, however **acute trauma to the neck tissue and musculature** is more commonly implicated in TOS (Sanders & Annest, 2014)
- **Hemorrhage and swelling** may lead to acute symptoms of TOS following an acute trauma, while **fibrosis and scarring** may lead to more chronic symptoms





# WSIAT Discussion Paper on TOS

## Etiology of TOS

### *Chronic, Awkward, & Static Postures*

Two main components of the postural constraints implicated in the development of TOS:

- **Posture of the head, neck, and shoulder girdle** - combination of upper body positioning, namely a rounded upper back (*thoracic kyphosis*), sagging of the shoulders and scapula (i.e., anteriorly-rotated shoulders, protracted/depressed scapula), and forward head posture.
- **Arm elevation** - chronic or persistent movements or load carrying with the arms in a flexed or abducted position



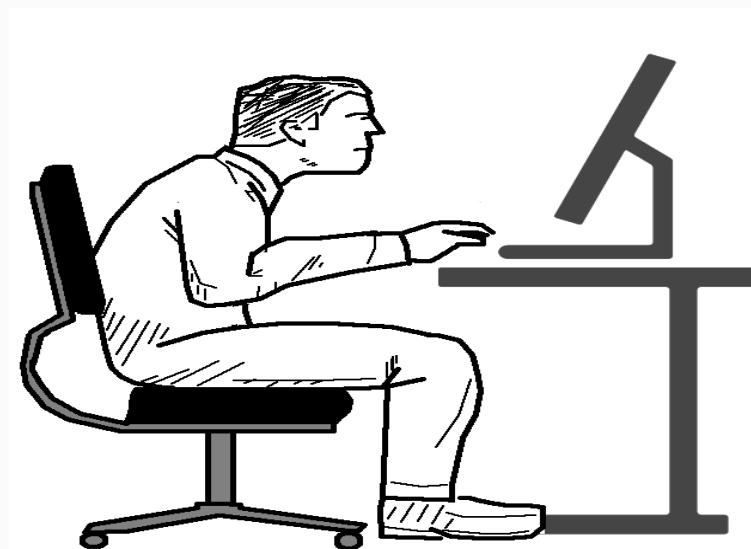
# WSIAT Discussion Paper on TOS

## Etiology of TOS

### *Head, Neck, & Shoulder Girdle Posture*

**Muscle imbalance** is characterized by overuse- and posture-induced weakness in some muscles and tightness of others.

- Rounded upper back, forward/sagging shoulder, and forward head posture is frequently identified in **flexor-dominated occupations** (Page et al. 2009)
- Pascarelli & Hsu (2001) reported that a main commonality between 339 subjects with a diagnosis of *neurogenic* TOS was loss of normal thoracic curvature, rounded shoulders, forward head posture, and tightness in the scalene muscles





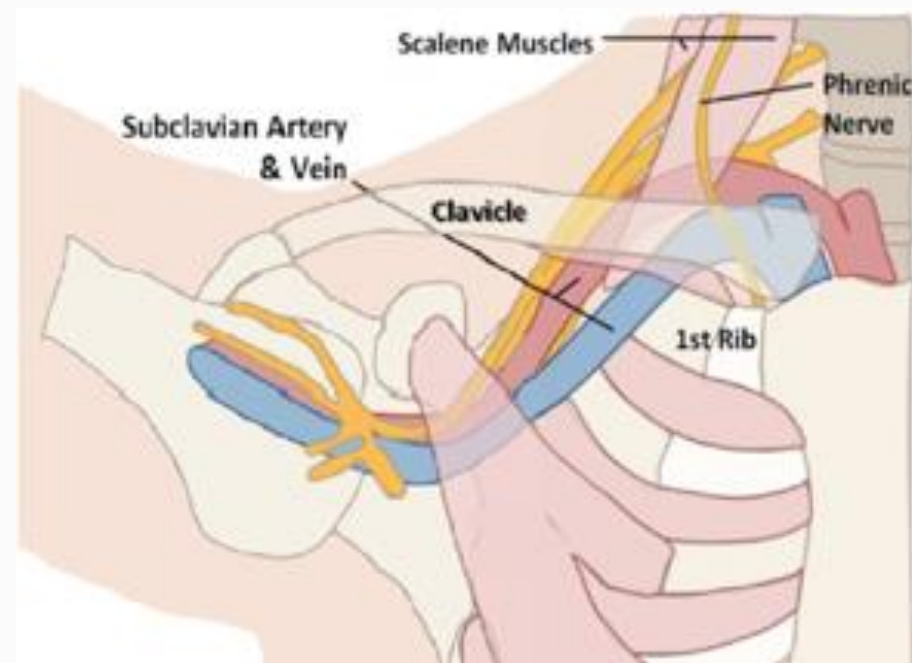
# WSIAT Discussion Paper on TOS

## Etiology of TOS

### Arm Elevation & Overhead Movement

Prolonged & sustained elevated arm activities are thought to involve direct **impingement and traction** in the setting of a narrowed compartmental space

- TOS is common in athletes that perform persistent arm abduction & pulling the shoulders downwards and back, such as baseball players, swimmers, and rowers (Chandra *et al.* 2014)
- An accustomed, inappropriate muscle recruitment pattern during arm raised activities may also contribute to **muscle imbalance** (Mackinnon & Novak, 1994)





# WSIAT Discussion Paper on TOS

## Etiology of TOS

### External Forces – Compression

Externally applied forces to the shoulders that induce a sagging shoulder posture are typically associated with worsening the symptoms of TOS.

- Activities that depress the shoulder girdle include carrying heavy baggage and wearing a heavy bag over the shoulders, which push the clavicle towards the first rib. (Sheth & Belzberg, 2001)
- Carrying heavy loads on the shoulders, as well as load carrying in outstretched arms as compression-inducing due to narrowing of the thoracic outlet. (Laulan, 2011)







# WSIAT Discussion Paper on TOS

## Clinical Presentation

The MDP refers to the symptom of muscle weakness in "**disputed**" neurogenic TOS as "*subjective*" or "*voluntary*", due to the absence of accompanying muscle atrophy and electro-diagnostic abnormality.

- Thompson (2021), pain associated with use of the affected extremity may lead to the *perception* of weakness which is a frequent comment of neurogenic TOS patients; genuine hand weakness is a sign of **late-stage development** and is only present in a small number of cases
- Identifying the disorder as "true" only
- When presented with later stage symptoms may be dangerous to the patient's health and undermines the "disputed" patient's condition. The MDP makes no effort to validate the patients' symptoms; instead, displaying **skepticism**.



# WSIAT Discussion Paper on TOS

## Diagnosis of TOS

MDP states: “...there are no clear diagnostic criteria or standards for [thoracic outlet syndrome].”

- Have been several advancements in the diagnostic approach to TOS since creation and review of the MDP, this statement is no longer considered to be valid.
  - CORE-TOS diagnostic criteria – created in 2013 and validated by Balderman *et al.* (2017) in a peer-reviewed study.
  - The Society for Vascular Surgery (SVS) published a set of reporting standards, including a slightly more streamlined set of diagnostic criteria for each subtype of TOS in 2016 (Illig *et al.*, 2016)

The MDP advocates for certain electro-diagnostic tests that have **fallen out of favor** and against the use of testing methods that have undergone **advancement** since the paper was published in 2000 and have since been considered **clinically important**.



# WSIAT Discussion Paper on TOS

## Diagnosis of TOS Electro-Diagnostic Tests

- Used to confirm the presence of nerve compression by demonstrating abnormalities in the conduction capabilities of the affected nerve
- MDP advocates this test potential utility to demonstrate the presence of *true neurogenic* TOS, but assumes the position that electro-diagnostic abnormalities are inconsistent, and testing is unreliable for *disputed neurogenic* TOS.
- Neither CORE-TOS or SVS diagnostic criteria deem the presence of electro-diagnostic abnormalities (or imaging) a necessary component for the diagnosis of *neurogenic* TOS (Balderman & Johansen, 2021).
- Lack of EMG and NCV evidence of *neurogenic* TOS can include:
  - intermittent or dynamic nature of compression
  - difficulty isolating the brachial plexus nerves for evaluation
- Suggested that the nerve damage necessary to produce electro-diagnostic abnormalities are only present in advanced stages of *neurogenic* TOS (Povlsen & Povlsen, 2018; Roos, 1999; Sanders & Annest, 2014).
- MDP suggests F-wave testing - Özgönenel *et al.* (2012) found no statistical differences between controls and *neurogenic* TOS patients in terms of F-wave latency



# WSIAT Discussion Paper on TOS

## Diagnosis of TOS Venography

MDP states - venography is *“the injection of radio-contrast material into an arm vein, followed by x-rays and only of value in the diagnosis of the very rare condition ‘effort thrombosis’ of the subclavian vein, and not in the diagnosis of TOS.”*

- MDP does not consider *venous* TOS to be a subtype of TOS, stating *“...venography is no longer considered to be of any value in the diagnosis of TOS.”*
- In a modern era in which *venous* TOS is a widely accepted subtype of TOS, inclusion of this information in a WSIAT document is misleading and potentially harmful.
- Venography is one of three imaging modalities recommended by SVS and required for the diagnosis of *venous* TOS (Illig et al., 2016).
- Computed tomographic (CT) and magnetic resonance (MR) venography, are widely cited for their usefulness and accuracy for identifying and evaluating *venous* TOS (Brownie et al., 2020; Ohman & Thompson, 2020; Povlsen & Povlsen, 2018; Vemuri et al., 2016).



# WSIAT Discussion Paper on TOS

## Diagnosis of TOS Ultrasound & Plethysmography

MDP states that “...most experts today find these tests of little value.”

- This statement is **not** supported by current literature and practice.
- Used in combination with other tests to locate blockage or obstructions in the arteries (*Plethysmography*, n.d.).
- Hemodynamic studies, such as a digital version of PMG, are often used in combination with duplex ultrasound in the evaluation of suspected TOS patients to assess arterial waveforms and signals (Chandra et al., 2011).
- Gelabert & Gelabert (2021a), duplex ultrasound and PMG tests are performed in conjunction with more stringent measures, such as arteriography, if significant abnormalities are found alongside appropriate findings on history and physical examination.
- Both testing modalities are considered clinically relevant as components of more thorough diagnostic criteria, as per the SVS reporting standards for TOS, therefore should not be negated by the MDP (Illig et al., 2016; Povlsen & Povlsen, 2018).



# WSIAT Discussion Paper on TOS

## Diagnosis of TOS

### Physical Examination

MDP states: *“Tenderness on pressing over the thoracic outlet above the clavicle, production of pain or numbness in the arm and hand with supra-clavicular pressure... have not been shown to have any consistent reliability or validity in the diagnosis of TOS.”*

- According to the CORE-TOS, the items of greatest diagnostic importance for *neurogenic* TOS (subcategories related to clinical diagnosis) were:
  1. Local tenderness/pain on palpation [of the] scalene triangle
  2. Hand/digit paresthesia on palpation [of the] scalene triangle





# WSIAT Discussion Paper on TOS

## Summary and Conclusion

MDP states that *“there are no clear diagnostic criteria or standards for [thoracic outlet syndrome].”*

- Obsolete statement that serves to represent the outdatedness of the entire MDP document
- Have been significant modern advancements in relation to TOS (CORE-TOS and SVS) in creation of consensus-based diagnostic criteria frequently cited in this report (Illig et al., 2016; Thompson, 2013, 2021).

MDP's failure to acknowledge the three primary compartments universally recognized to be associated with TOS, coupled with its consistent use of biased and largely abandoned classifications of *neurogenic* TOS (i.e. *disputed neurogenic* TOS & *true neurogenic* TOS) further highlights the irrelevance of the majority of the document's content.

MDP's opinion regarding the distribution of symptoms, pathology, and diagnostic testing are overshadowed by a broad body of research arguing the contrary.

- Lack of appreciation for the occupational or functional causes and contributors to TOS make the MDP completely unsuitable for use in WSIAT hearings regarding the work-relatedness of the condition.
- MDP reference to the potential functional causes of TOS comprises of **three sentences** throughout the entire **twelve-page** document, yet it is being used in consideration for workers' compensation claims for TOS resulting from occupational origin.



# Internal Review- Industrial Sectors

- Review of OHCOW database for past 30 years found:
  - TOS accounted for 6.7% of all OHCOW patient referral cases for MSDs
  - 71% of all TOS cases came from the following industrial sectors:

(35.5%) – Manufacturing
(15.2%) - Health Care and Social Assistance
(8.2%) - Public Administration
(6.5%) – Construction
(5.6%) - Transportation and Warehousing



# Internal Review- Industrial Sectors

The top 10 specific industries with TOS were:

(6.2%) - Nursing Care Facilities

(5.1%) - General Medical and Surgical Hospitals

(4.2%) - Other Local, Municipal and Regional Public Administration

(3.4%) - Motor Vehicle Parts Manufacturing

(3.4%) - Postal Service

(2.5%) - Automobile and Light Duty Motor Vehicle Manufacturing

(2.5%) - Building Construction

(2.5%) - Elementary and Secondary Schools

(2.3%) - Motor Vehicle Manufacturing

(2.0%) - Grocery Stores

# Internal Review- Occupations



98% of all TOS cases came from the following occupational classifications

(34%) - Occupations in manufacturing and utilities

(28%) - Trades, transport and equipment operators and related occupations

(21%) - Sales and service occupations

(9%) - Health occupations

(6%) - Natural resources, agriculture and related production occupations

# Internal Review- Occupations



The top 10 specific occupations with TOS were:

- (7.6%) - Other assisting occupations in support of health services
- (4.1%) - Material Handlers
- (3.8%) - Janitors, Caretakers and Building Superintendents
- (3.8%) - Motor Vehicle Assemblers, Inspectors and Testers
- (3.1%) - Other Assemblers and Inspectors
- (3.1%) - Other Labourer in Processing, Manufacturing and Utilities
- (2.4%) - General Farm Workers
- (2.4%) - Light Duty Cleaners
- (2.4%) - Supervisors, Motor Vehicle Assembling
- (2.4%) - Truck Drivers





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