

Thoracic Outlet Syndrome: Concepts and Controversies

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GOALS

- Keep you from falling asleep
- Discuss role of physiatrists
- Discuss different medical approaches
- Help define various medical terms
- Help you understand thoracic outlet syndrome
- Answer your questions
- Quiz?

Outline

- I. About me
- II. Case Study
- III. Concepts
- IV. TOS
- V. Controversies

About me...

- Born and raised in Alabama
- I am a simpleton
- Medical School in Texas (Baylor)
- UW Physical Medicine Residency
- UW Anesthesiology Pain Fellows



Case Study

- 23 year old female involved in (work-related) low speed MVA
- Rear Ended at 10-15 MPH while at complete stop
- Wearing seatbelt, no awareness prior to impact
- Did not hit head or lose consciousness
- Initial headache and neck soreness later on in evening develops left shoulder/arm pain with numbness, tingling, and weakness into her left hand in little and ring fingers

Concept #1: If all you have is a hammer, all you will see are nails.

- No improvement after 8 weeks of chiro/massage
- Referred to Ortho Shoulder: Diagnosed RTC injury
- Referred to Ortho Hand: Diagnosed Carpal Tunnel Syndrome (CTS)
- Referred to Neurosurgery: Diagnosed cervical radiculopathy (pinched nerve in neck)
- Referred to Neurology: Diagnosed Concussion
- Referred to Pain Specialist: Diagnosed CRPS

Concept 2: The (Good)Physiatrist =Monk with 20/20 Vision



Concept 3: Lumpers vs. Splitters

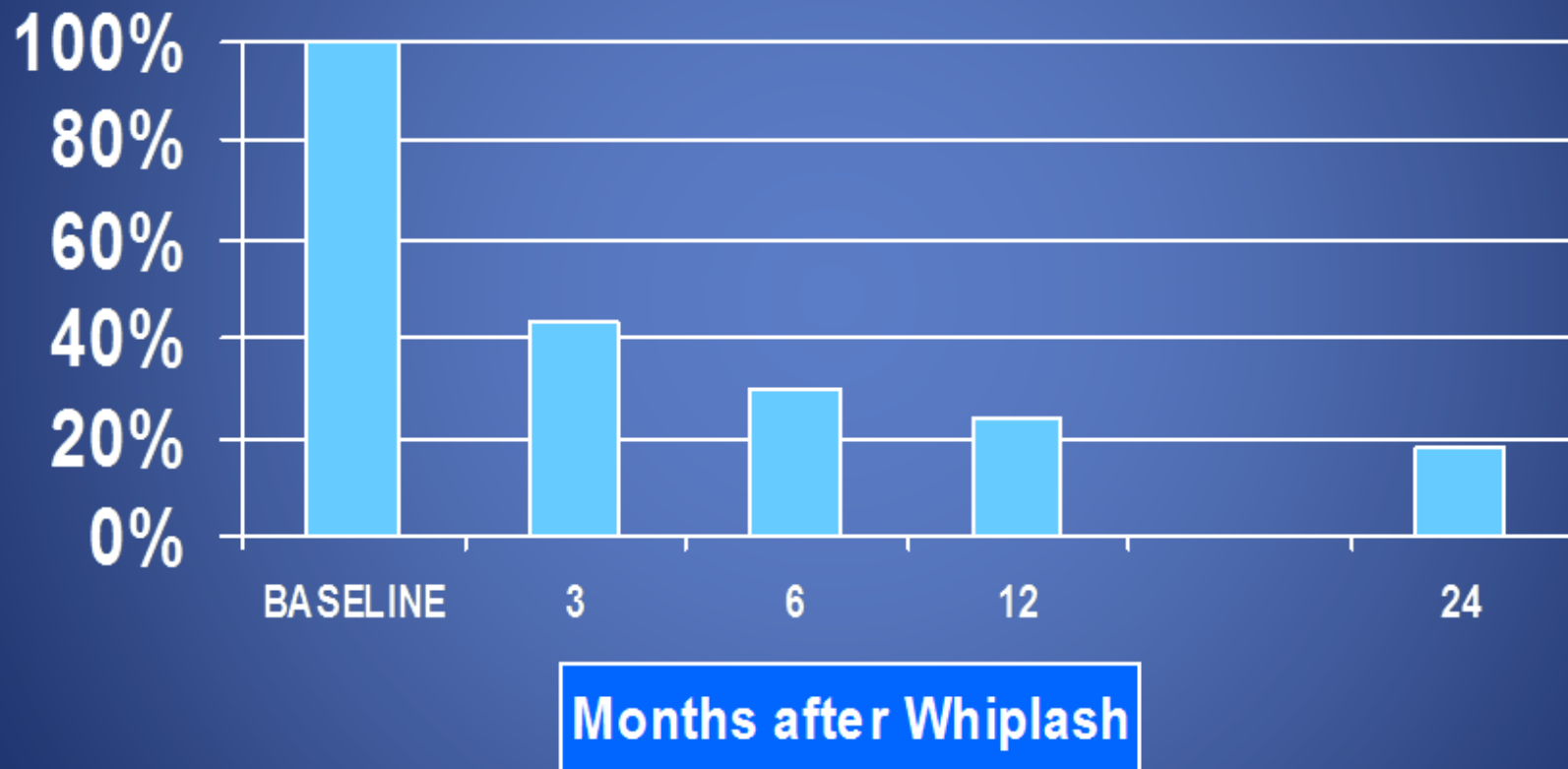
- Occam's Razor: "Entities should not be multiplied unnecessarily."
- Hickam's dictum: "Patient's can have as many diseases as they damn well please."
- Texas: "A dog can have ticks and fleas."

Case Study: Diagnostic Tests

- Ortho shoulder: MRI shoulder normal
- Ortho hand: Electrodiagnostic testing (EMG) normal
- Neurosurgery: MRI neck (C-spine) normal
- Neurology: MRI brain normal

Now we are 6 months out, patient remains symptomatic, all tests have been normal, therefore...patient is faking, time for IME?

Concept 4: It is not always a cervical strain that resolves in 12 weeks



Case Study: Physiatrist Examination

- Neck (C-spine): Spasm/hypertonicity cervical paraspinals, trapezius, scalenes, negative Spurling's, + Upper Limb tension test (ULTT)
- Left Shoulder: Full range of motion (ROM), negative Hawkin's, Rotator Cuff (RTC) strength full
- Neuromuscular Exam: Mild weakness left intrinsic (hand) muscles, reflexes normal, proximal strength normal

Concept 5: Not all hand numbness is a cervical radiculopathy or CTS

Consider TOS if...

- Patient has had a whiplash injury (ergonomics discussed later)
- Patient numbness into their hand, especially the ring and little fingers
- Patient feels heaviness/pain with overhead movements
- Patient has hand weakness, no arm weakness
- Conventional work-up is negative

Thoracic Outlet Syndrome

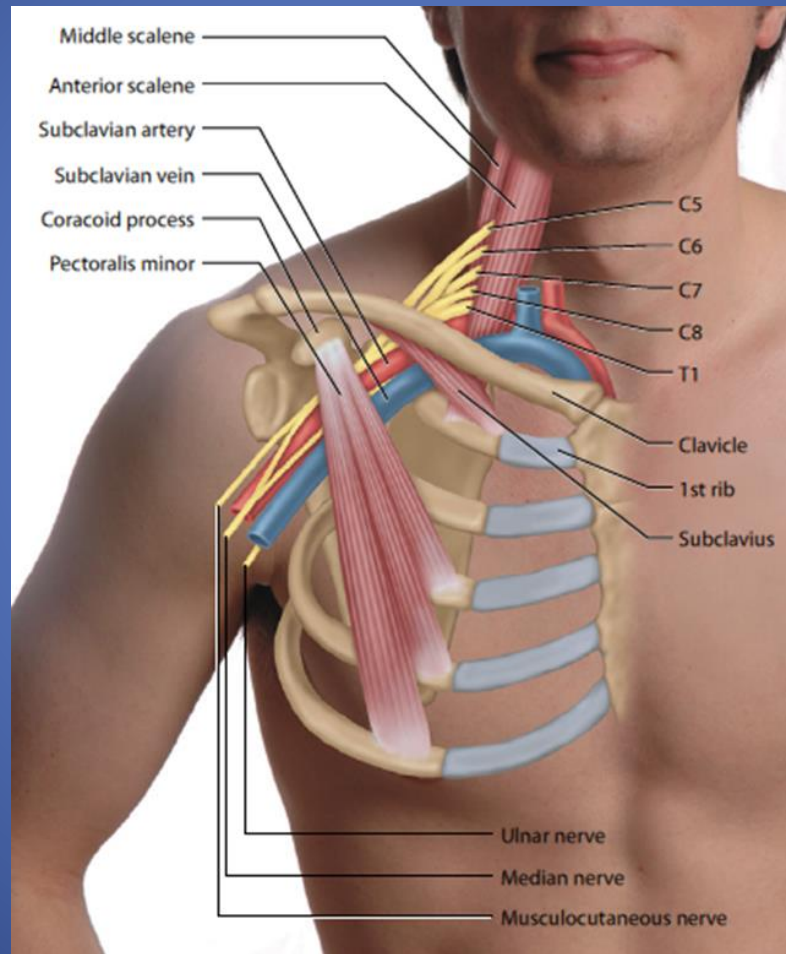
A Review

Richard J. Sanders, MD, Sharon L. Hammond, MD,† and Neal M. Rao, MD,‡*

The Neurologist Volume 14 November 2008

The definition of thoracic outlet syndrome is “upper extremity symptoms due to compression of the neurovascular bundle in the area of the neck just above the first rib.”

Anatomy



TOS Types

- Neurovascular structures
 - Subclavian vein
 - Subclavian artery
 - Brachial plexus
- Each structure can be compressed separately
- Distinct symptom complexes can be produced
 - Venous TOS/Paget-Schroetter disease-swelling into hand/forearm
 - Arterial TOS-loss of pulse (Adson's test)
 - Neurogenic TOS-weakness/numbness-My focus
- 1% of population has cervical rib

Back to our patient...

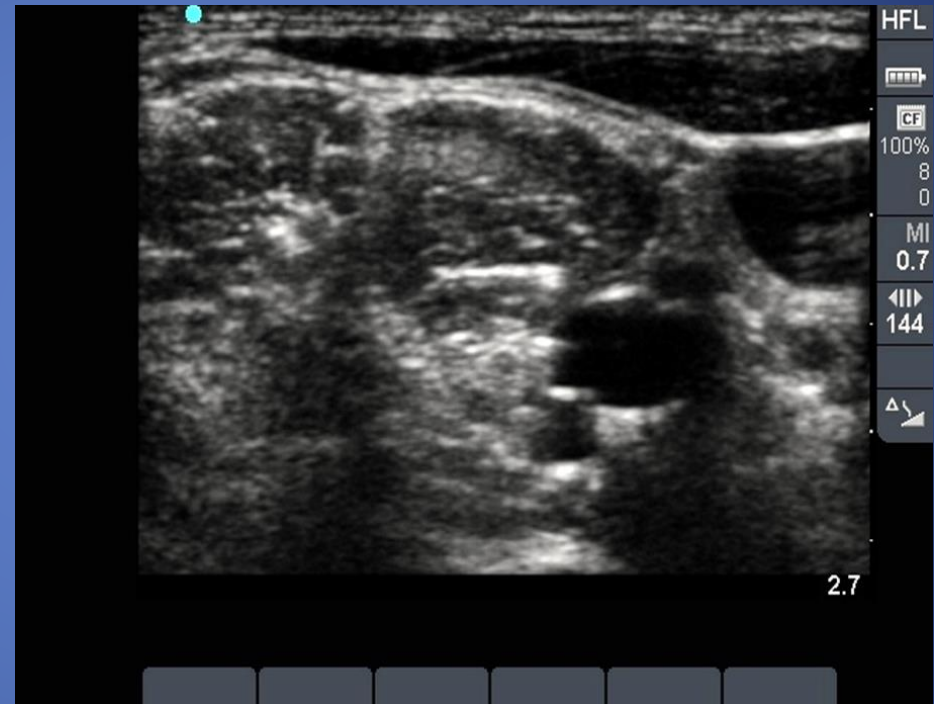
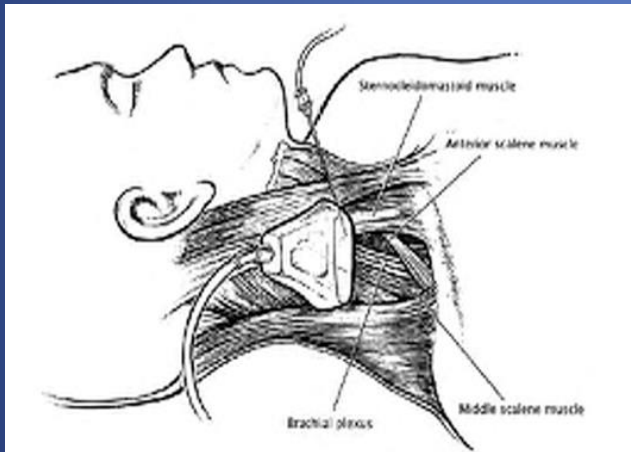
- Women more likely to have TOS than men 4:1
- TOS more likely in cases of trauma or repetitive stress (ergonomics discussed later)
- Hand weakness, think TOS not cervical radiculopathy
- + ULTT, negative Spurling's

TOS and MVA

TABLE 1. Etiology

	%
Neck Trauma	86
Rear end auto accident	32
Side or front end auto accident	24
Work injury, including RSI	22
Other neck trauma	8
Cervical or anomalous first rib	2
Unknown or spontaneous	12
	100

Diagnostic scalene blocks



If positive, what next...

- PT
- OT
- Massage
- Botox
- Surgery
- Psychology
- Vocational

Concept 6: Pain Medicine, Two Models

I. Physical Medicine

- Find the dysfunctional segment
- Rehab the dysfunctional segment via:
 - Physical therapy
 - Occupational therapy
 - Chiropractic care
 - Massage

II. Anesthesiology Pain Medicine

- Find the pain generator
- Block the pain generator

➤ *Best approach integrates both models*

Physical Medicine Model: EARLY Non-invasive Medical Treatment

- **PT/OT:** posture, scapular mechanics, scalene & pectoral stretching, diaphragmatic breathing.
- **Massage:** myofascial release of scalene, pectoral, & latissimus dorsi muscles.
- **Chiropractic:** thoracic extension, postural correction, and myofascial release of scalene muscles.
- **MD:** Sleep restoration (!) & Psych eval (?).
- **ALL:** improve workstation, independent stretching.

Anesthesia Model: Block the pain generator

- Muscle chemodenervation with botulinum toxin.
 - Effective for +ASB group.
 - Dosing issues, may need to repeat.
 - Not permanent, may need to repeat.
 - Likely predicts surgical response (see controversy below)

Controversy: Is TOS due to Cervical Dystonia?

- Also known as spasmodic torticollis
- A “neurologic” condition characterized painful focal contraction of muscles in the cervical spine leading to abnormal movements/postures.
- Thought to be due to excessive motor outflow from the brain.
- Is TOS secondary to cervical dystonia?
- Botulin toxins FDA approved for cervical dystonia but not TOS

Controversy: TOS is outside the box

- Some believe TOS does not exist at all
- Some believe everybody has TOS
- Some call it cervicobrachial syndrome, scalenus anticus syndrome



Controversy: Can TOS be caused by occupational exposure?

- Repetitive overuse of scalene and/or pectoralis minor muscles?
- Seen in dental hygienists, hairstylists, ultrasonographers, office workers with frequent reaching/poor ergonomics.
- Workers with frequent overhead physical tasks.

TOS and RSI

TABLE 1. Etiology

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EARLY Ergonomic Intervention

- RSI patients often already have poor ergonomics.
- Medical Rx without ergonomics Rx is like “*trying to fill a leaky bucket.*”
- Workstation analysis should include:
 - Decrease reaching & shoulder above chest level.
 - Decrease forward or awkward head postures.
- **Problem:** Many jobs cannot be modified, e.g. fire sprinkler installer & dental hygienist.

Controversy: Is surgery a “cure” for TOS?

- Last resort Rx, not perfect.
- A few anatomic approaches, appear to be equal.
- In L&I group, some physicians claim 60-90% effective overall.
- Patient selection important.

Controversy: L&I

- Criteria based on EMG findings.
- Small median CMAP, small ulnar sensory SNAP, no evidence of cervical radiculopathy or CTS
- If negative “disputed TOS”
- Does not consider scalene blocks to be diagnostic
- Does not consider PE findings to be diagnostic

Franklin GM et al:

Outcome of surgery for thoracic outlet syndrome in
Washington state workers' compensation.

Neurology (2000)

- Complex epidemiologic study.
- Retrospective review of TOS surgeries 1986-91 (n=158)
- Function, disability, and patient satisfaction outcomes at 4.8 years after surgery.
- Analyzed baseline predictors of work disability outcome at 1 year after surgery.
- Compared to non-surgical TOS patients (n=150).

Franklin GM et al:
Profile of TOS Surgery Group

- TOS Dx at average 2.3 years after DOI.
- Most had unrelated initial diagnoses (eg Neck sprain in 29%, lumbar sprain in 11%, CTS in 7%).
- 51% with 3+ allowed conditions (eg Mental health Dx in 29%, CTS in 30%).
- 38% with 1+ OTHER surgery BEFORE TOS surgery.
- In short:
 - Complicated.
 - Already at risk for long-term disability.

Franklin GM et al:
Levels of Long-Term Post-Op Disability

- 1-year postop: 60% on work disability.
- 2-year postop: 40% on work disability.
- ≈ 4.8-year postop: 44% on work disability (phone interview).

“At this interview, an average of 4.8 years after surgery, the majority of workers reported that their symptoms were no better or worse than expected (63.5%), and that they were experiencing their worst preoperative symptom “a lot” (61.2%).”

“All of these outcomes were strongly correlated with reported work status (employed for pay in past 4 weeks), with significantly better outcomes in those who reported working.”

Franklin GM et al:

Results Predicting Disability in Surgery Group

Table 3 Predictors of work disability in thoracic outlet syndrome surgical cases in Washington state workers' compensation, multiple logistic regression model*

Predictor	OR (95% CI)	p Value
Age at injury (1-year increase)	1.07 (1.00–1.13)	0.04
Time between injury and diagnosis (1-year increase)	1.34 (1.09–1.64)	<0.01
Time between diagnosis and surgery (1-year increase)	0.93 (0.62–1.40)	0.74
Diagnosed with cervical spine condition before surgery	2.13 (0.90–5.00)	0.08
Number of days of time loss in 6 months before surgery (30-day increase)	1.85 (1.51–2.28)	<0.01
Sex (women versus men)	1.37 (0.58–3.23)	0.47

* Multivariate model with all variables significant in univariate modeling, or potentially confounding (gender), included. Total n = 158.

- ↑ Age
- ↑ Time from DOI to TOS Dx
- ↑ # TL Days in 6 mos before surgery

Franklin GM et al:

Comparison of TOS cases with & without surgery.

- Surgery group had more disability days before TOS Dx than non-surgery group ($p < 0.01$).
- Work disability days 6 months before TOS Dx:
 - Surgery group = 99 days.
 - Non-surgery group = 65 days.
- TOS surgery group > 2x as likely to have had prior surgery vs non-surgery group. (18.9% versus 8.4%, $p = 0.04$)
- TOS Surgery vs Non-Surgery Rx Costs & LT Disability:
 - 50% greater medical \$\$.
 - > 3x work disabled 1.8 years after TOS Dx.
 - > 4x work disabled 2.8 years after TOS Dx.

Sanders & Hammond Critique of Franklin GM et al. Neurology (2000) TOS Paper

“...it is reasonable to assume that surgery was offered to patients who had not responded to conservative therapy, and who were significantly disabled. The patients who did not undergo surgery were presumably those who had responded to conservative therapy and were not significantly disabled.”

“This assumption is supported by the fact that the number of disability days in the 6 months prior to diagnosis was significantly higher in surgical versus nonsurgical patients (95 versus 65 days).”

“Franklin et al. also state that 32.7% of patients reported that overall quality of life was no better or worse after surgery. Can we assume that in the other 67.3% the quality of life was improved? This makes sense, as it is close to the 73.7% who would undergo surgery again.”

Franklin Data &
need for EDS for
TOS Dx

My Approach
as a
Physiatrist

Sanders Data
promoting
Dx & Rx

- Be realistic about focal Dx & Rx for a chronic problem.
- Denying TOS Dx to deny TOS surgery is not logical.
- Emphasize early case mgmt (NCM, PM&R): Ergonomics, light-duty, goal-oriented non-invasive Rx.
- Use anterior scalene block (ASB) to help determine outcome from more specialized treatment.
- Trial(s) of chemodenervation *prior* to surgery consideration.
- Need Waddell-type signs - not for faking - but for surgical prognosis.
- Consider (REAL) psych eval prior to surgery.

Poor Prognostic Factors: The 8 D's

My Personal Experience

1. Disability
2. Deconditioning
3. Depression
4. Dependence on pain medicine
5. Drinking
6. Dysfunctional relations (divorcing)
7. Disagreement with employer
8. District attorney

If there are $\geq 3/8$, claim likely calls for NCM & PM&R consult, preferably before 6 months disability.

Most family doctors, surgeons & chiropractors do not have the training to manage these complex pts.

Pearls, Pitfalls & Possible Future Work

1. Don't be that hammer looking for nails:
 - It may be TOS, but it may be something else...
2. Treat the patient, not the picture OR
3. Treat the numbness, not the numbers.
 - Just because NCS shows CTS, that may not be the (primary) problem.
4. Be diligent about recording response to ASB.
5. Remember: work comp patients often do worse with a number of treatments.

Treat the patient BEFORE the numbness



Pearls, Pitfalls & Possible Future Work

1. Educate about need to abandon EDX for TOS Dx:
 - Disservice to patients, e.g. Washington State L&I.
2. Work with employers to provide early ergonomic intervention & support.
3. Behavioral screen for TOS patients:
 - *Prior* to surgery - currently more art than science.
 - Waddell-type criteria for TOS surgery needed.
4. RCT for neurotoxin (2-4 mo. Rx) among those who “pass” ASB.

Question 1: Worth 2 points

- Which of the following statements about me is true?
 1. I was born in Mississippi
 2. My residency was in anesthesiology
 3. I work at Seattle Spine and Sports Medicine
 4. I am the master to two siamese cats



Question 2: Worth 4 points

- Which of the following exam findings is suspicious for thoracic outlet syndrome?
 1. Positive Spurling's Sign
 2. Negative upper limb tension test
 3. Weakness in the triceps and shoulder
 4. Numbness in hand in ring and little finger

Question 3: Worth 6 points

- Which of the following statements is true?
 1. TOS is most commonly due to having a cervical rib
 2. L&I's criteria for a diagnosis of TOS relies on a combination of physical exam findings, scalene block results, and EMG/NCS
 3. Botox is FDA approved for TOS
 4. Women are more likely to have TOS than men

Final Question: 20 points

- If you have the ball, 2nd and goal from the one yard line, with 30 seconds left in the game, with 1 time-out, down 4 points, which of the following should you not do?
 1. QB sneak
 2. Beast Mode
 3. Run spread option
 4. Throw a slant

Final Score

- If you scored 0 points; you are well rested
- If you scored <4 points: you know me but not TOS
- 4-12 points: You know TOS
- 20+ points: You can coach the Seahawks
- Any questions?

