

A Toronto Based Diagnostic Algorithm to Neurogenic Thoracic Outlet Syndrome

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Disclosures

- None

What is TOS?

Condition resulting from compression of the neurovascular structures traversing the thoracic outlet

3 types:

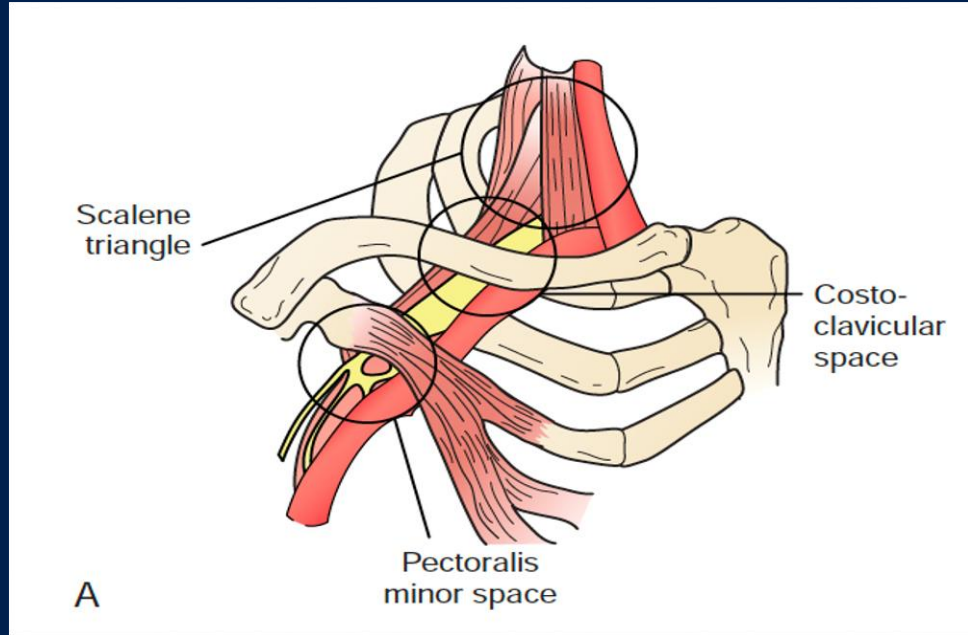
- Neurogenic (nTOS)
- Venous (vTOS)
- Arterial (aTOS)

Most patients 20-50 years of age

70% are female except for vTOS where 2:1 male predominance (Sidawy et al., 2022).

3 anatomical spaces that pertain to the thoracic outlet:

- Scalene triangle
- Costoclavicular space
- Pectoralis minor space



Neurogenic TOS

There are no established diagnostic criteria or reference standards for the diagnosis of nTOS

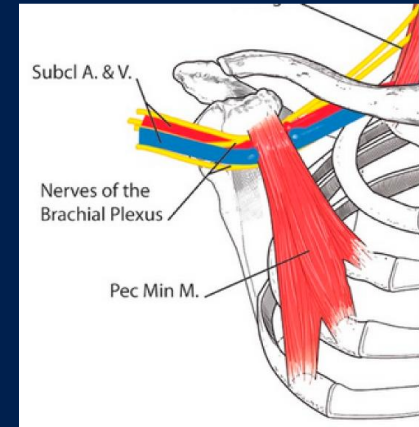
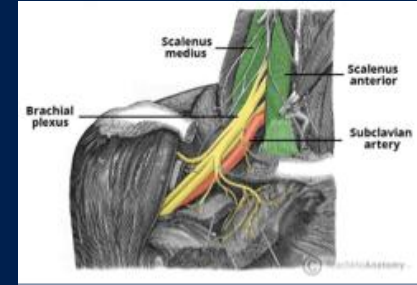
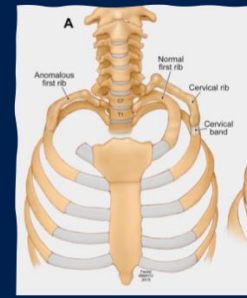
Predisposing factors:

- Presence of Cervical Ribs
- Scalene Muscle Anomalies
- Narrow Scalene Triangles
- Congenital Ligaments or Bands
- Plexus Roots Arising High near Scalene Apex

A common cause of nTOS is neck trauma that involves hyperextension neck injury. Whiplash secondary to MVC is the most common

Other causes

- Repetitive stress movements- common among athletes particularly rowers, baseball pitchers (Garraud, T. et al., 2022)



Rationale

- Neurogenic thoracic outlet syndrome (nTOS) is a challenging diagnosis to make for primary care physicians
- Diagnostic uncertainty in primary care leads to delayed referral and unnecessary imaging (Ho, 2023)
- Physical exam maneuvers demonstrate poor sensitivity and specificity
- There is no standardized diagnostic algorithm tailored to the GTA
- A concise, evidence-informed diagnostic primer can improve early recognition improve referral accuracy.

Objectives

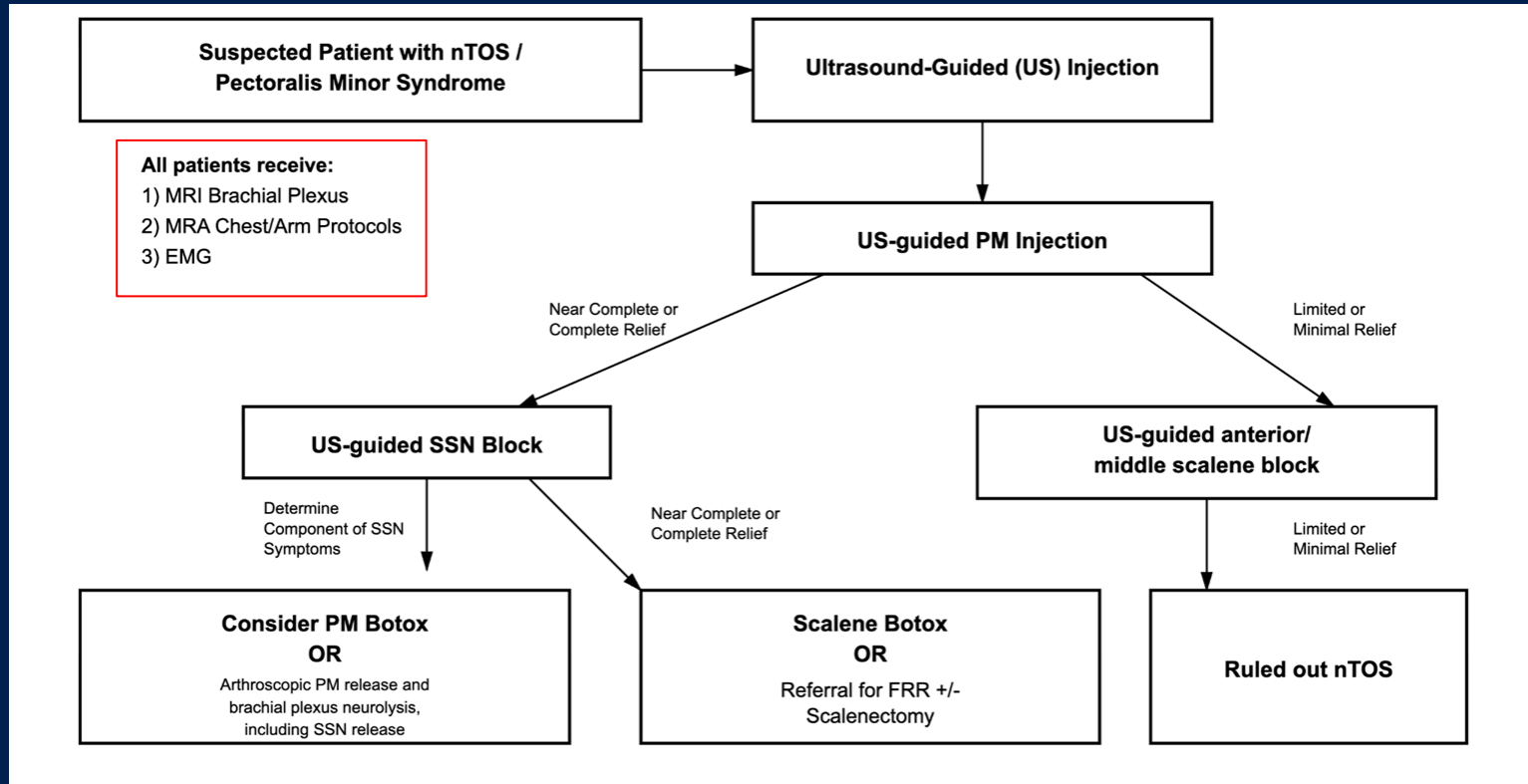
Primary Objective:

- To improve primary care physicians' confidence and accuracy in the initial diagnostic workup of suspected nTOS.

Secondary Objectives:

- To synthesize expert consensus and imaging guidelines into a one-page diagnostic pathway, based on the Toronto context.
- To establish collaboration between primary care and local specialists (e.g., physiatry, vascular surgery).
- Identify the most evidence-based history and exam maneuvers.

Reference Diagnostic Algorithm (Adapted from Dr. Robert Bowers UTOSM rounds)



Consensus Recommendations for Neurogenic Thoracic Outlet Syndrome from the INTOS Workgroup

Harvey Chim, MD*
Robert R. Hagan, MD
(Representative of INTOS
Workgroup)†
INTOS Workgroup

- 21 expert hand surgeons from North America, South America, Europe, and Asia
- Plan to review these recommendations with Toronto-based experts to identify which statements are most applicable in our context.
 - Aim to integrate the consensus findings into a practical diagnostic algorithm, grounded in the most evidence-based:
 - History questions
 - Physical examination maneuvers
 - Diagnostic investigations

What is Currently Happening in Toronto? Preliminary Findings

	TORONTO GENERAL HOSPITAL	MICHAEL GARRON HOSPITAL/SUNNYBROOK
Investigations Required	EMG, neurology consult required C-Spine, Chest X-ray often done	C-Spine, Chest X-ray, Dynamic ultrasound (with hyperabduction/ER movements) are recommended
Optional Investigations	Venous/Arterial US, Venogram if suspected venous/mixed TOS, MRI brachial plexus	EMG, MRI C spine, MRA if refractory to injections or to clarify diagnosis
Botox injections	None	Yes
Trial of physiotherapy	Not required but also has affiliated physiotherapist for trial of rehabilitation	???
Preferred Physical Exam Maneuvers	Minimal, rely more heavily on imaging but physiotherapist does do nerve flossing/nerve tension tests	???
Main Surgical Indications	End organ damage e.g. significant atrophy	???

Study Design

Quality Improvement (QI) project guided by the Plan–Do–Study–Act (PDSA) model:

- **Phase 1 — PLAN (Nov 2025 – Jan 2026) – Literature synthesis/Stakeholder Discussions**
 - Consultations with physiatry and vascular surgery team
- **Phase 2 — DO (Feb – Mar 2026)**
 - Draft one-page diagnostic primer (history, exam, and investigation flow)
 - Disseminate primer to participating physicians
- **Phase 3 — STUDY (Apr – May 2026)**
 - Consider pre/post surveys on physician confidence
 - Audit changes in diagnostic accuracy and appropriateness of imaging
 - Integrate stakeholder feedback (primary care and specialist)
- **Phase 4 — ACT (Jun 2026)**
 - Finalize the one-page diagnostic pathway for local dissemination
 - Present findings at local conferences
 - Explore integration into resident MSK curriculum, SportMedSchool, The Hub

References

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