

**Botox Injections In The Treatment Of Neurogenic TOS: How Does It Work, When To Do It, How To Do It And Results**

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Vascular Surgery

**Difficulty of nTOS diagnosis**

- Patients with nTOS present with vague symptomatology and objective diagnostic criteria are not clearly defined.
- SVS guidelines have been developed to produce consistency in diagnosis, treatment and outcomes.

**Reporting standards of the Society for Vascular Surgery for thoracic outlet syndrome**

Karl A. Illig, MD,<sup>1</sup> Dean Donahue, MD,<sup>2</sup> Audra Duncan, MD,<sup>3</sup> Julie Freischlag, MD,<sup>4</sup> Hugh Gelabert, MD,<sup>5</sup> Kaj Johansen, MD,<sup>6</sup> Sheldon Jordan, MD,<sup>7</sup> Richard Sanders, MD,<sup>8</sup> and Robert Thompson, MD,<sup>9</sup> Tampa, Fla; Boston, Mass; London, Ontario, Canada; Sacramento and Los Angeles, Calif; Seattle, Wash; Aurora, Colo; and St. Louis, Mo

Stanford MEDICINE

From the Western Vascular Society

**Thoracic outlet syndrome in high-performance athletes**

Venita Chandra, MD, Christine Little, and Jason T. Lee, MD, Stanford, Calif

*Objective:* Repetitive upper extremity use in high-performance athletes is associated with the development of neurogenic and vascular thoracic outlet syndrome (TOS). Surgical therapy in appropriately selected patients can provide relief of pain in competitive athletes.

TOS Patients 2000-2012 n=170

Category	Count	Percentage
nTOS	119	69%
PSL	27	16%
Athletes	41	24%
ATOS	2	1%
nTOS	27	66%
PSL	14	34%

**Distribution of Sports**

Sport	Percentage
Swimming	22%
Baseball	33%
Softball	~1%
Volleyball	~1%
Rowing	~1%
Fencing	~1%
Water polo	~1%
Weight lifting	~1%
Wrestling	~1%
Other	~1%

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**Mean QuickDaSH Scores for nTOS Athletes**

Time Point	Surgical	Non-Operative
Initial	43.4	37.4
Post-PT	34.1	30.3
6 month Post-Op	11.7	-
Follow-up Survey	5.5	9.9

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**How to decide who does well with nTOS**

- Botulinum toxin injection (BTI)
  - muscular paralysis from temporary chemodeneration
  - decreased brachial plexus compression
- Can be therapeutic and diagnostic

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## Some studies demonstrate improvement with BTI as a diagnostic and therapeutic modality...

**The Efficacy of Scalene Injection in Thoracic Outlet Syndrome**

Guo Wei Lee, M.D., Young Ho Kwon, M.D., An Ho Jung, M.D., Jang Won Kim, M.D., and Jang Won Kim, M.D.

**Lessons Learned in the Surgical Treatment of Neurogenic Thoracic Outlet Syndrome Over 10 Years**

Kanishk C. Laha, MD,\* Pragna S. Suresh Hiral, Anur Colan, PhD, Yung Wu Lam, MD, and John A. Dean, M.D.

**Sonographically guided botulinum toxin injections in patients with neurogenic thoracic outlet syndrome: correlation with surgical outcomes**

Dean M. Donahue<sup>1</sup>, Ivan R. B. Godoy<sup>1</sup>, Rajiv Gupta<sup>1</sup>, Julie A. Donahue<sup>1</sup>, Martin Terziet<sup>1</sup>

## while others show no difference in outcomes...

Botulinum toxin injection for management of thoracic outlet syndrome: A double-blind, randomized, controlled trial

Heather C. Finlayson<sup>a,b\*</sup>, Russell J. O'Connor<sup>a,b</sup>, Penelope M.A. Brasher<sup>c</sup>, Andrew Travlos<sup>a,b</sup>

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**Impact of Scalene Muscle Botulinum Toxin Injection With and Without Surgery in Neurogenic Thoracic Outlet Syndrome**

Anish Fomporosi, MD, MS, MRELS,\* Yu T. Ho, MD, MS,\* Emily Miller Olson, MD,1 Pragna Dnyk, DO,1 Taylor Harris, BS,1 Anish Kuzman, MD,1 Eugene Park, MD,1 and Jason T. Lee, MD\*

**Abstract**  
**Objective:** Scalene muscle are part of both the diagnostic and treatment algorithm for patients presenting with neurogenic thoracic outlet syndrome (NTOS). However, there is a paucity of data on the utility of scalene botulinum toxin (BTX) before surgical decompression. We sought to determine the impact of BTX with and without surgery at a tertiary center. **Design:** Retrospective cohort study. **Setting:** Single tertiary tertiary academic center. **Patients:** Consecutive patients with NTOS. **Interventions:** Scalene muscle BTX for NTOS with or without surgery.

**Neurogenic Thoracic Outlet Syndrome in Division 1 Collegiate Athletes: Presentation, Diagnosis, and Treatment**

Emily Miller Olson, MD,\* Pragna Dnyk, DO,\* Taylor Harris, BS,1 Anish Fomporosi, MD, MS, MRELS,1 Jason T. Lee, MD,1 Anish Kuzman, MD,1 and Eugene Park, MD\*

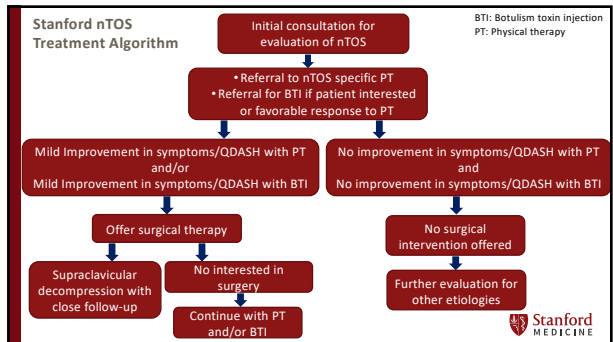
**Abstract**  
**Objective:** Athletes who engage in repetitive upper extremity activities are susceptible to neurogenic thoracic outlet syndrome (NTOS). We sought to identify typical presenting symptoms and common findings on diagnostic workup in a cohort of Division 1 collegiate athletes. **Design:** Retrospective cohort study. **Setting:** Tertiary academic center. **Participants:** Medical records of Division 1 athletes containing the diagnosis of NTOS between the years 2010-2018. Athletes with either an anterior thoracic outlet syndrome were excluded. **Independent Variables:**

After rib removal and ROTC Air Force training, Rachel Heck returns to Women's Amateur with new perspective

**Impact of Scalene Muscle Botulinum Toxin Injection With and Without Surgery in Neurogenic Thoracic Outlet Syndrome**

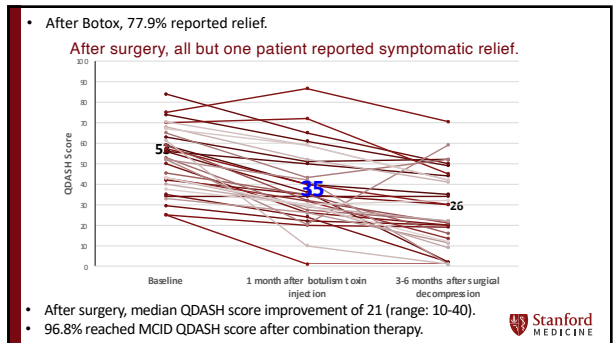
Anish Fomporosi, MD, MS, MRELS,\* Yu T. Ho, MD, MS,\* Emily Miller Olson, MD,1 Pragna Dnyk, DO,1 Taylor Harris, BS,1 Anish Kuzman, MD,1 Eugene Park, MD,1 and Jason T. Lee, MD\*

- Review of consecutive patients who had scalene muscle botox injection for nTOS from 2000-2020.
- Botox injections done by Sports Medicine
  - Ultrasound guided injection of 50 units of botox to anterior scalene muscles.
- Surgical decompression via supraclavicular approach



**Positive physical Exam Findings**

i.e. elevated arm stress (EAST), Roos test, and modified upper limb tension test of Elvey



**Botox+Surgery more likely to have relief after initial Botox and overall relief & MCID QDASH improvement**

Variable	BTI (N=46)	BTI + Surgery (N=31)	P-value	
Relief after initial Botox	69.6% (32/46)	90.3% (28/31)	<b>0.03*</b>	
MCID* QDASH change after BTI	78.3% (18/23)	80.6% (26/31)	0.6	
Overall relief	69.6% (32/46)	96.8% (30/31)	<b>0.003*</b>	
Overall MCID* QDASH Improvement	78.3% (18/23)	96.8% (30/31)	<b>0.032*</b>	
Overall QDASH change (median, IQR)	16 (-6-32)	21 (10-40)	0.258	
Overall degree of relief	Mild	14.6% (6)	10% (3)	0.803
	Moderate	22% (9)	20% (6)	
	Significant	63.4% (26)	70% (21)	

\*MCID: Minimal Clinically Important Difference



**Predictors of relief following Botulinum toxin injection**

Variables	Odds ratio	95% CI	P-value
<b>Symptom relief after BTI</b>			
Gender (female)	6.6	1.01 - 43.49	0.049*
Positive physical exam finding	8.97	1.24 - 64.97	0.030*
<b>MCID change in QDASH after BTI</b>			
Longer symptom duration	0.5	0.22 - 1.13	0.094
<b>Significant degree of relief after BTI</b>			
Gender (female)	3.22	0.90 - 11.57	0.073



**Summary**

- In our experience of Botox scalene injection in nTOS patients, BTI is helpful in alleviating symptoms prior to definitive surgical decompression
  - Reassures patients of diagnosis
- In appropriately selected patients, Botox followed by first rib resection provides additional symptom improvement over Botox alone
  - Nearly all reporting relief and reaching clinically important differences in QDASH score after combination therapy.

