

# Trends in Thoracic Outlet Syndrome Surgical Treatment

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## Background

The operative treatment for thoracic outlet syndrome (TOS) varies in the United States. This is partially due to differences in specialty training of the treating provider. We sought to identify which procedures are primarily performed in the U.S. by specialty.

## Research Objective

To determine the current state of thoracic outlet syndrome treatment in the United States by specialty.

## Methods

Patients treated for TOS between 2016 – 2018 were identified from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP). Patient cohorts were stratified by type of operative intervention (transthoracic rib resection vs. supraclavicular scalene division with or without rib resection vs. brachial plexus exploration) and by treating specialty (vascular surgery, cardiothoracic surgery, orthopedic surgery, general surgery, neurosurgery, and plastic surgery).

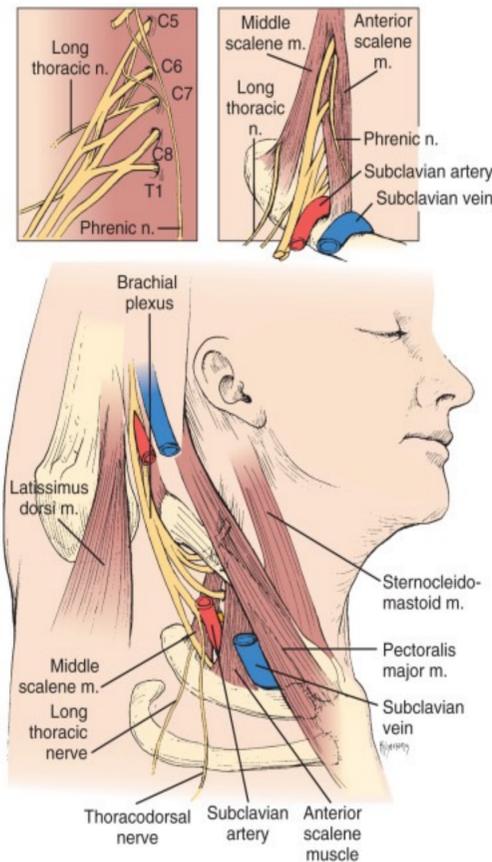


Figure 1. Anatomy of the Thoracic Outlet. Reproduced from Thompson, Robert W.. *Rutherford's Vascular Surgery and Endovascular Therapy*. Published January 1, 2019. Pages 1619-1638.e2. © 2019.

## Table 1. TOS Treatment By Primary Provider Specialty

Procedure	Vascular	Orthopedics	Thoracic	Plastics	Neurosurgery	General Surgery
Tenotomy	14	8	0	0	0	0
Extrapleural rib resection	19	0	2	1	0	0
Brachial plexus decompression	169	6	9	1	7	6
Partial Rib Excision	13	0	1	0	0	2
Rib excision w/sympathectomy	11	0	0	0	0	2
Excision 1 <sup>st</sup> or cervical rib	413	0	28	0	0	31
Scalene division w/o rib resection	29	0	1	1	4	0
Scalene division w/rib resection	225	0	12	0	2	6
<b>Total</b>	<b>893</b>	<b>14</b>	<b>53</b>	<b>3</b>	<b>13</b>	<b>47</b>

## Results

- **Vascular surgeons performed 87% of all TOS repairs.**
- **Excision of a first or cervical rib alone was the most common procedure performed for TOS relief (46.7%),** followed by division of the scalene muscles with rib resection (23.9%) and brachial plexus exploration with decompression (19.4%).
- **Brachial plexus exploration with decompression was the most time-consuming procedure (169 minutes)** and was associated with the **longest total length of hospital stay (3.3 days).**
- These procedures were associated with a **3.5% (N=36) complication rate.** The most common complications were surgical site infections and deep vein thrombosis.

## Results (cont.)

- Overall unplanned readmission rate was 2.5%. There was **no significant difference in unplanned readmission rate or complication rate** between the three most common operations ( $p = 0.25$ ).

## Conclusions

- Transthoracic first rib resection performed by vascular surgeons remains the most common surgical treatment for patients with TOS in the U.S.
- Recognition of TOS as a compressive neuropathy has led to an increase in treatment by peripheral nerve surgeons and subsequently brachial plexus exploration and direct scalene division through a supraclavicular approach
- Although most TOS symptoms are neurogenic in nature, less than 10% of operations are performed by peripheral nerve specialists

## Limitations

- NSQIP data is limited to hospitals and centers that provide data and participate in the program but may not be representative of TOS presentations at all centers nationally.
- Complication data was only reported/analyzed up to 30-days post-operatively and conclusions cannot be made regarding subacute and chronic complications/outcomes.

## Acknowledgements

- The American College of Surgeons National Surgical Quality Improvement Program and the hospitals participating in the ACS NSQIP are the source of the data used herein.