Disclosures

- None
Thoracic Outlet

- The anatomical region defined by the first rib, bilaterally in association with the manubrium and vertebra.
Neuro-Vascular Structures Crossing the Thoracic Outlet

BRACHIAL PLEXUS

SUBCLAVIAN ARTERY

SUBCLAVIAN VEIN
Thoracic Outlet Syndrome

- A group of related symptoms, findings which are associated with compression of the neuro-vascular structures crossing the thoracic outlet.
First Rib
Muscle Attachments

- Subclavius
- Scalenus anterior (scalene tubercle)
- Scalenus medius
First Rib: Two Triangles

- **Anterior Scalene m.**
  - separates artery / vein
  - forms 2 triangles

- **Venous Triangle:**
  "Costo-Clavicular Space’
  Subcalvius m.
  Anterior Scalene m.

- **Inter-Scalene Triangle:**
  Subclavian artery
  Brachial plexus
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# Clinical Presentations of TOS

<table>
<thead>
<tr>
<th>NEURAL</th>
<th>ARTERIAL</th>
<th>VENOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nerve Compression</td>
<td>Arterial Emboli / Clot</td>
<td>Venous Thrombosis</td>
</tr>
<tr>
<td>Pain</td>
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<td>Congestion</td>
</tr>
<tr>
<td>Paresthesia</td>
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<td>Swelling</td>
</tr>
<tr>
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</tr>
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<td></td>
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- **NERMAL**: Nerve Compression
- **ARTERIAL**: Arterial Emboli / Clot
- **VENOUS**: Venous Thrombosis

- Pain
- Paresthesia
- Weakness
- Raynaud’s
- Atrophy
- Congestion
- Swelling
- Discoloration
- Collateral veins
Neurogenic TOS

Syndrome of Pain and Paresthesia in the upper extremity attributed to compression of the brachial plexus at the thoracic outlet.
Anterior Scalene Muscle Block

- **Guided** Injection of Lidocaine into Anterior Scalene muscle.

- Results in relaxation of anterior scalene muscle.
- No anesthesia.
- No paralysis.
- (Not an inter-scalene block.)

- Positive: Greater than 50% reduction of symptoms.
Neurogenic TOS

Management

- Eliminate Cause / Ergonomic Eval / Rest
- Physical Modalities: PT / Massage
- Medication
- Blocks - Botox
- Surgical Decompression
Thoracic Outlet Decompression

Surgical Approaches

- Trans-axillary rib and scalene muscle resection

- Supra-clavicular scalene muscle and rib resection
Trans-Axiallary First Rib Resection

Advantage: working beneath nerves.
Division of Anterior Scalene
Trans-Axillary Rib Resection
Trans-Axillary Rib Resection
Venous TOS

- Extrinsic compression of the axillo-subclavian vein at the thoracic outlet,
- often resulting in thrombosis
- symptoms of congestion, edema, pain and disability.

Illig, JVS 2010
Venous TOS

Presentations:
- Acute DVT (PSS)
- Acute on Chronic
- Chronic occlusion
- Chronic post phlebitic
- Intermittent non-occlusive
Venous TOS

Presentation

Venous Congestion

- Cyanosis
- Swelling
- Venous Distension
Venous TOS

Evaluation:
- U/S
- CT Venogram
- Catheter Venogram
Management: Anticoagulation

48 pts. managed with **anticoagulation** 6.6 year follow-up

- **Occluded Venogram**: 91%
- **Persistent Symptoms**: 74%
- **Recurrent Thrombosis**: 17%
Paget Schroetter Syndrome Management

Long Term Thrombotic Recurrence after Non-operative Management of Paget-Schroetters
JT Lee, JK Karwowski, EJ Harris, JS Haukoos, C Olcott

- Thrombolysis followed by selective decompression for residual sx’s and/or high grade compression
- Post-lytic anticoagulation 3-6mo

✓ Only half of patients Rx’d non-operatively
✓ 20% of these failed this approach

Lee JT, et al., JVS 2006
UCLA Approach to Management of Paget-Schroetter’s

✓ Brachial approach to subclavian vein
✓ Thrombolysis of venous thrombus - immediate
✓ Anticoagulation - days to months
✓ Repeat duplex ultrasound for patency - days to months
✓ Transaxillary removal of 1st rib + division of subclavius tendon + removal of cervical rib in rare cases - days to months
✓ Repeat venogram with stress if needed - after surgery of extrinsic compression
✓ Correct the residual stenosis – days to months
  • Balloon angioplasty
  • IJ turndown/endovenorrhaphy

• Never stent PS before decompression (and rarely after decompression either) due to high risk of stent occlusion !!!!!
Endovascular Management of Axillosubclavian Thrombosis
Usually cross with 0.35 hydrophilic wire and Glidecath, but occasionally need a low profile Quick-Cross
Endovascular Management of Axillosubclavian Thrombosis
Endovascular Management of Axillosubclavian Thrombosis
Endovascular Management of Axillosubclavian Thrombosis
UCLA Surgical Approach
Postoperative Venography
Arterial TOS

■ Definition

■ Compression of the axillo-subclavian artery at the thoracic outlet
■ Arterial occlusion or Aneurysm
■ Distal embolization

■ Unusual problem
■ Younger patients
■ Sports-related injuries
■ Sudden onset
■ Frequently missed
Cervical Rib and Subclavian Artery

- Subclavian artery compression
- Post-stenotic dilatation
- Aneurysm
- Embolization to the hand and fingers
- Often accompanied by neurogenic TOS symptoms
Arterial TOS

Initial Management

Goal:

- Relieve the ischemic insult
- Define the arterial problem

- Thrombolysis vs Thrombectomy
- Anticoagulation
- Angiography, Ultrasonography
Arterial TOS

- Interventions (23 pts):
  - thrombolysis 6
  - thoracic decompression 22
  - cervical rib resection 8
  - arterial reconstruction 8
  - sympathectomy 7

Arterial TOS

Surgical Approach

- First and Cervical Rib resection
- Arterial Reconstruction
  - Aneurysm Resection (>2cm)
  - Vein Bypass Graft
  - Stent Graft
- Sympathectomy
Management in 4 Steps:

✓ Immediate Thrombectomy / Lysis
✓ Imaging to define arterial pathology
✓ Surgical Decompression
✓ Arterial Reconstruction
  • Aneurysm resection
  • Vein bypass
  • Stent graft
✓ Sympathectomy
Conclusions:

- The most common error of management is failure to appreciate the significance of thoracic outlet compression.

- Arterial reconstruction prior to decompression of thoracic outlet leads to early graft occlusion.
Neurogenic TOS

- Pain, Paresthesia
- Pos PE
- Pos Scalene Block

Conserv Rx

- Do Nothing
  - Improved
  - Sx Persist
- Surgery

Improved
Sx Persist
Paget Schroetter Syndrome

Cyanosis

Pain

Arm Edema

Distended Veins

Venogram

+ +

Lytic Therapy

Anticoagulate

Re-Assess

High Grade Stenosis or Persistent Sx

Rib Resection
Arterial TOS

- Ischemia, Emboli
- Pulse Deficit
- Angiogram

+ High Grade Stenosis
  - Revascularize
+ Aneurysm
  - Decompress
+ Thrombus
  - Reconstruct