Management of Chronic Thoracic Outlet Syndrome

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Outline – 7 Minutes

- Diagnosis of neurogenic TOS
  - vTOS and aTOS non controversial
- Anterior approach
- Trans-axillary approach

Disclosures: Speaker honorarium for W.L. Gore and Associates, 9/2015.
Clinical Presentations

- **Neurogenic** 90-95%
- **Venous** 2-8%
- **Arterial** 1-2%

Nomenclature is misleading – combined sx may be present.

No single pathognomonic symptom or finding. Clinical diagnosis.

Diagnosis most often is a process of exclusion and clinically appropriate symptoms / findings.

Diagnosis nTOS

Positional - Stress Testing

- Abduction External Rotation (AER)
- Upper Extremity Limb Tension Test (UELTT)
- Roos Elevated Arm Stress Test (EAST)

Neurogenic TOS

Physical Findings

- AER Testing 100%
- Upper Limb Tension 98%
- Scalene tenderness 94%
- Scalene pressure radiation 92%
- Neck rotation 90%
- Head tilt 90%

Sanders JVS 2007
Neurogenic TOS: Diagnostic Testing

- Exclusion
  - C-spine MRI
  - EMG / NCV

- Inclusion
  - C-SPINE X-RAY
  - TOS MR study (MRI/MRA/MRV)
  - SSEP or MAC SNP
  - Anterior Scalene Muscle Block

MRI Diagnosis of nTOS

- **Thoracic Outlet: Assessment with MR Imaging in Asymptomatic and Symptomatic Populations**
  - 35 healthy volunteers and 54 patients with clinical symptoms of thoracic outlet syndrome (TOS)
  - Patients were included in the study when at least two provocative clinical tests reproduced the symptoms.

- **MRI Diagnosis of nTOS**
  - 54 patients with TOS:
    - Smaller costoclavicular distance (P < .001),
    - Thicker subclavius muscle (P < .001),
    - Wider retropectoralis minor space (P < .001) than did volunteers.
  - Vascular or nerve compression in 44 (81%).
    - Arterial compression in 72% of TOS patients.
    - Nerve compression in 7% of TOS patients.
  - No arterial or nerve compression seen in volunteers.
  - No standardized criteria

ELECTRODIAGNOSTIC TESTING

EMG
NCV
SSEP
MAC

Neurogenic TOS

Nerve Conduction Studies
(EMG / NCV)

- R/O Peripheral N Compression
  - Carpal Tunnel Syndrome
  - Cubital Tunnel Syndrome

- Peripheral Neuropathy
- Cervical Radiculopathy

CA WORKER’S S COMP
Guidelines

- Electro Diagnostic Testing “is reliable” for diagnosis TOS

- Must Have all three:
  - Median Motor Amplitude reduced 50% vs contralateral arm
  - Ulnar Sensory Amplitude reduced 60%
  - Denervation of lower trunk muscles

Defines “True Neurogenic” TOS – less than 5% of all.

SSEP Improved Post-Op

Of 80 TOS patients 59 (74%) with Abnormal SSEP
51 (86%) improved with surgery
8 (14%) showed no improvement
Post-op SSEP correlated with outcome (pos or neg) in 92%

Somatosensory Evoked Potentials (SSEP) in the Assessment of Thoracic Outlet Compression Syndrome

Anterior Scalene Muscle Block

- U/S-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.

Diagnosis of Thoracic Outlet Syndrome Using Electrophysiologically Guided Anterior Scalene Blocks

- 122 Patients evaluated for TOS
- 122 underwent ASMB
- 102 patients diagnosed with TOS
- 20 patients diagnosed with other condition
  - 1 had Positive ASMB = 5% false negative

Conclusions

Exclude other causes
Clinical findings
Combined tests
Individual patient…

Guided Anterior Scalene Blocks

- Positive ASMB 32 patients 30 (94%) improved.
- Negative ASMB 6 patients 3 (50%) improved.

Observation: This is the only test which directly relates anatomy and symptoms.
Thoracic Outlet Decompression

Surgical Approaches

- Scalenectomy (supra-clavicular)
- Posterior rib resection
- Claviculectomy
- Trans-axillary rib and scalene muscle resection
- Supra-clavicular Scalene and rib resection
- Anterior Infra-clavicular

Supra-Clavicular Scalene Muscle and 1st Rib Resection

Supra-Clavicular Scalene Muscle and Rib
Supra-Clavicular Scalene Muscle and Rib

Dorsal Scapular Nerve

Long Thoracic Nerve

Brachial Plexus C5, C6, C7

Phrenic Nerve

Raney rongeur
Supra-Clavicular Scalene Muscle and Rib

Limitations: The anterior portion of the first rib is not accessible.

This alone may be inadequate for decompression of TOS.

Possibly increased risk of nerve injuries.
Arterial TOS

Advantage: working beneath nerves.

Division of Anterior Scalene

Trans-Axillary Rib Resection
Neurogenic TOS

Results

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<thead>
<tr>
<th></th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
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<tbody>
<tr>
<td>Scalene</td>
<td>56%</td>
<td>13%</td>
<td>31%</td>
</tr>
<tr>
<td>Supra Rib</td>
<td>83%</td>
<td>13%</td>
<td>4%</td>
</tr>
<tr>
<td>Trans Ax Rib</td>
<td>83%</td>
<td>5%</td>
<td>12%</td>
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</tbody>
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Surgical Complications

686 operations in 491 patients

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<tr>
<th></th>
<th>Trans Ax</th>
<th>Scalene</th>
<th>Supra</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>111 (16%)</td>
<td>279 (41%)</td>
<td>278 (41%)</td>
</tr>
<tr>
<td>Br Plexus</td>
<td>3 (2%)</td>
<td>0</td>
<td>7 (2.5%)</td>
</tr>
<tr>
<td>Phrenic</td>
<td>1 (1)</td>
<td>19 (7%)</td>
<td>6 (2.1)</td>
</tr>
<tr>
<td>Scapula</td>
<td>2 (2)</td>
<td>0</td>
<td>1 (.04)</td>
</tr>
<tr>
<td>Artery</td>
<td>0</td>
<td>0</td>
<td>1 (.04)</td>
</tr>
<tr>
<td>Vein</td>
<td>2 (2)</td>
<td>1</td>
<td>3 (1.1)</td>
</tr>
<tr>
<td>Pleura</td>
<td>44 (40)</td>
<td>5 (2)</td>
<td>46 (17)</td>
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Conclusions

Different approaches for different situations

Key to all is understanding the anatomy and pathophysiology.