Venous Issues in Thoracic Outlet Syndrome:
Lysis, Venoplasty, First Rib Resection; Staged Or Same Setting?

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Anatomic Basis of Venous T.O.S.

Chronic subclavian vein injury produced by repetitive
dynamic compression at the costoclavicular space

Venous T.O.S. : Treatment Algorithm

Suspicion of Axillo-subclavian vein Thrombosis

Confirm with Duplex U.S.

Immediate Heparinization

Expeditious Venogram/Thrombolysis (Max. 3 weeks?)

Successful Failure

Surgery/PTA-ASAP → Mid Term Anticoagulation

Venous T.O.S. : Treatment

1. Systemic Anticoagulation
2. Restoration of Venous Lumen
   • Catheter Directed Farmaco-mechanical thrombolysis
   • Angiojet / Infusion Catheter
   • Lyse via Brachial, Basilic and Cephalic
3. Removal of Extrinsic Compression
   • First Rib Resection or bone anomaly
4. Venous Angioplasty (never primary stenting)

TOS Decompression

First rib resection via supra & infraclav. incisions

Completion Venogram

PTA 8 to 12 mm Balloon
**Why two incisions?**
*Trans-axillary or Supraclavicular Approach*

**Does NOT** resect the parasternal 1st rib

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**Patients treated during last 13 years**

- 76 patients (51% female)
- Mean age 30 y. (Range: 14-59)
- Right side 47 (62%)
- Arm swelling/pain (100%)
- Average follow/up 12 months
- 50 (66%) treated during same admission
  - (Initial thrombolysis and rib resection)
- 26 (33%) treated in staged admissions
  - (Thrombolysis done first elsewhere)

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**Pathology**

- 72 (95%) Vein thrombosis
- 4 (5%) Vein stenosis
- 13 (17%) Hypercoagulable state
  - 6 Heterozygous Factor V Leiden
  - >8 (11%) Pulmonary embolism

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**Diagnosis and Treatment**

- Diagnostic Venography in all
- 58 (75%) pre-op thrombolysis
- 1.5 Trips to endo suite/patient (total 106)
- All underwent Rib resection & PTA
- All anti-coagulated 6 months (except hypercoagulables)

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**Anatomical Results by Ultrasound (12 m f/u)**

- 44 (57%) widely patent
- 23 (30%) partially occluding thrombus
- 5 (7%) remained occluded
- 4 (6%) lost to f/u

**Clinical Results**

- 49 (64%) Symptoms resolved
- 23 (30%) Improved

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<table>
<thead>
<tr>
<th>RESULTS</th>
<th>Widely Patent Vein</th>
<th>Residual Stenosis/Occlusion</th>
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</thead>
<tbody>
<tr>
<td>Delay to Lysis</td>
<td>6.7 days</td>
<td>11.2 days</td>
</tr>
<tr>
<td>Delay to Decompression</td>
<td>77 days</td>
<td>115 days</td>
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<tr>
<td>Post-op Thrombosis</td>
<td>6%</td>
<td>41%</td>
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<tr>
<td>Trips to Endo Suite</td>
<td>1.1</td>
<td>2.2</td>
</tr>
<tr>
<td>Mean Hospital Stay</td>
<td>3.7 days</td>
<td>6.4 days</td>
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</table>
**Results**

<table>
<thead>
<tr>
<th></th>
<th>Staged Treatment</th>
<th>Single Admission</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptom Resolution</td>
<td>75%</td>
<td>91%</td>
<td>p=0.02</td>
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<tr>
<td>Venous Patency</td>
<td>70%</td>
<td>88%</td>
<td>p=0.18</td>
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<tr>
<td>Cost</td>
<td>8,000$</td>
<td></td>
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</tbody>
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**Conclusions**

- Delay in lytic treatment and surgical decompression appears to be associated with lower venous patency rates.
- The treatment of VTOS during a single admission has higher rates of arm symptom resolution, less hospitalization and significant cost savings.
- Referral to centers where single stage treatment is feasible may improve results and reduce cost of treatment in these patients.

**Causes of Treatment Failure in Venous TOS**

- Late Diagnosis
- Late Initiation of treatment
- Incomplete Thrombus Lysis
- PTA/Stenting without T.O. decompression
- Inadequate Rib Resection
- Inadequate anticoagulation

Thank You
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