Optimal Management of Venous TOS

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UCSF Vascular Symposium
April 9-11, 2011

Disclosures
None relevant to this presentation

Venous TOS (VTOS)

• Mechanical compression or occlusion of the subclavian vein
  – Thrombotic or non-thrombotic
  – Aka Paget-Schroetter Syndrome, Effort Thrombosis
• Costoclavicular space pathology
  – Between the clavicle and 1st rib
  – Between the anterior scalene muscle and the subclavious muscle

Venous TOS (VTOS): Epidemiology

• 3000 to 6000 cases/year in US
• 1-4% of all episodes of DVT
• Likely under-recognized by non-specialists
• Mean patient age early 30's
• Male:female ratio 2:1
• 60-80% of patients report association with vigorous exercise or activity
Venous TOS (VTOS): Presentation

- Non-occlusive:
  - Intermittent, positional arm discoloration, swelling, and aching
  - Elicited by exercise or arm elevation
- Thrombotic (Most common):
  - Sudden onset
  - Aching, swelling, heaviness, bluish discoloration
  - History of vigorous exercise/activity
  - Visible superficial collateral veins shoulder/chest wall

Venous TOS (VTOS): Diagnosis

- Duplex ultrasound
- Venography
  - Diagnostic & therapeutic
- Axial imaging (CT & MR) less useful

VTOS Clinical Goals

- Eliminate symptoms
- Prevent long-term disability
- Avoid need for long-term anticoagulation
Contemporary Treatment of VTOS—Acute Subclavian Vein Thrombosis

1. Restoration of venous patency
   • Thrombolysis

2. Elimination of extrinsic venous compression
   • First rib resection & venolysis

3. Correction of venous stenosis
   • Balloon angioplasty
   • Stents
   • Surgical vein reconstruction

Anticoagulation Alone

• Original standard of care
• Poor outcomes
  – Persistent vein occlusion 78%
  – Persistent symptoms 41-91%
  – Permanent disability 39-68%


• 54 pts treated with anticoagulation alone
• Mean F/U 5 years, retrospective review
• Symptoms:
  – 47% “nil or negligible”
  – 41% “mild or moderate”
  – 13% “severe or intolerable”
• Conclusion: Anticoagulation, alone remains 1st line treatment of choice.

Other Non-Operative Approaches

• Thrombolytic therapy without TOD
  – Rethrombosis and persistent symptoms > 50%
    (Zimmerman, 1981)
  – 23% of patients rethrombosis within an average of 13 months
    (Lee, 2006)

• PTA or stenting without TOD
  – High rates of rethrombosis
  – Stent fractures
    (Glanz, 1987; Meier, 1996)
Contemporary Treatment of VTOS

Consensus that most patients are best treated with a combination of early thrombolysis, surgical decompression, correction of vein stenosis, and a variable period of post-operative anticoagulation.

Ongoing Controversies: Timing of Surgery

- Immediate or delayed
- Delayed to allow resolution of inflammation
  - Rethrombosis rate of 6% to 18% during waiting period
    (Adams, 1971; Machleder 1993; Hurlbert 1995)
- Immediate operative decompression safe and effective
  (Angle 2001; Schneider 2004; Melby 2008)

Ongoing Controversies: Surgical Techniques

- Operative approach
  - Transaxillary, paraclavicular, or infraclavicular
- Optimal management of subclavian vein stenosis
  - Surgical or endovascular

Contemporary Results of First Rib Resection for VTOS

<table>
<thead>
<tr>
<th>#</th>
<th>Approach</th>
<th>Patency</th>
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<tbody>
<tr>
<td>Johnston 2011 (submitted)</td>
<td>21* IC</td>
<td>94% (PP)</td>
</tr>
<tr>
<td>Molina 2007</td>
<td>97* IC</td>
<td>100% (PA)</td>
</tr>
<tr>
<td>Schneider 2004</td>
<td>25 PC</td>
<td>92% (PP)</td>
</tr>
<tr>
<td>Azakie 1998</td>
<td>20* SC</td>
<td>100% (Clinical)</td>
</tr>
<tr>
<td>deLeon 2009</td>
<td>67 TA</td>
<td>96% (PP)</td>
</tr>
<tr>
<td>Urschel 2000</td>
<td>199 TA</td>
<td>95% (Clinical)</td>
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Combination treatment of venous thoracic outlet syndrome: Open surgical decompression and intraoperative angioplasty

JVS 2004

- VTOS with acute subclavian vein thrombosis
- Intraoperative venogram +/- PTA
- Residual venous stenosis identified 16/25 (64%)
- PTA technically successful 16/16 (100%)
- 1 year primary patency 92%
- 1 year secondary patency 96%

Preoperative Venogram

Focusing the Surgical Approach to TOS

- Supraclavicular Paraclavicular
- NTOS
- Arterial TOS
- Infraclavicular
- VTOS
Potential Advantages of Infraclavicular Approach

- Direct access (to vein within the costoclavicular space)
- Focused approach (minimize exposure of brachial plexus and subclavian artery)
- Preserve supraclavicular and axillary venous collateral pathways
- Ability to access the central veins using transmanubrial extension for vein reconstruction

Infraclavicular First Rib Resection for VTOS
UCSF Experience

- 34 Consecutive patients treated from 2005 - 2010
  - Venous TOS
  - Excluded Arterial TOS, neurogenic TOS, & combined TOS
- Grouped patients according to time interval between the onset of symptoms and the date of catheter-directed thrombolysis (CDT):
  - Acute ≤14 days > Chronic thrombosis

Time to CDT

- Acute median 2 days (0-8 days)
- Chronic median 26 days (15-92 days)
  - N = 6 with no CDT
Adjunctive endovascular procedures

- Intraoperative venography (100%)
  - Balloon angioplasty
    - Acute: 23/34 (68%)
    - Chronic: 11/13 (85%)
  - Stent placement
    - Acute: 1/34 (3%)

- N=4 chronic vein occlusion
  - Transmanubrial extension
    - Acute: 4/13 (31%)
  - Saphenous patch angioplasty
  - Cryopreserved aortic homograft interposition
  - Radialcephalic AVF

Primary Patency

- Doppler ultrasound
- 6 months
  - Acute: 94%
  - Chronic: 31%
- p = 0.001

Secondary Patency

- Doppler ultrasound
- 6 months
  - Acute: 100%
  - Chronic: 67%
- p = 0.15
• 65 patients with subacute and chronic subclavian vein thrombosis treated with 1st rib resection and post-op anticoagulation (no lysis or vein reconstruction)
• Post-op venogram +/- PTA
• 91% patent & symptom free at mean f/u 14.5 mos

Rib resection benefits patients with symptomatic chronic thrombosis and by relieving venous compression may facilitate recanalization

Conclusions

• Early identification and treatment leads to the best outcomes.
• Patients with subacute or chronic thrombosis have worse outcomes, but may still benefit from 1st rib resection and anticoagulation

Conclusions

• Thrombolysis followed by 1st rib resection is the current standard of care for patients with VTOS and acute subclavian vein thrombosis (although proof of effectiveness is needed)
• Focused infraclavicular 1st rib resection is safe, effective, and provides potential advantages for the treatment of VTOS