Venous Thoracic Outlet Syndrome: Our Approach and Results

Julie A. Freischlag, M.D.
Vice Chancellor for Human Health Sciences
Dean of the School of Medicine
University of California, Davis
April 3, 2014

Disclosures

- No relevant financial relationships with commercial interests

Venous Thoracic Outlet Syndrome

Paget Schroetter Syndrome

- History
  - 1st two cases published independently over 100 years ago by Paget in England and Von Schroetter in Germany
  - Hughes in 1949 analyzed 320 cases of spontaneous thrombosis of the upper extremity venous system and coined the term
  - Initially, treatment was surgical thrombectomy
  - 1980’s is when catheter-directed thrombolytic therapy began

Pathophysiology

- Mechanical abnormality at the costoclavicular portion of the axillosubclavian vein
- Most often acute thrombosis is in an area of chronic compression and stricture - between the hypertrophied scalene or subclavius tendon and the first rib
- A large exostosis is often found at the costoclavicular junction
Routine Venography Following Transaxillary First Rib Resection and Scalenectomy (FRRS) for Subclavian Vein Thrombosis Ensures Excellent Outcomes and Vein Patency

**Objective**
- Assess the role of routine postoperative venography in patients who have undergone FRRS for subclavian vein thromboses by evaluating long-term vein patency using imaging by duplex scan

**Methods**
- Patients treated with FRRS for subclavian vein thrombosis undergo routine venography postoperatively at two weeks
- The subclavian vein is dilated if there is a >50% stenosis and those patients are anticoagulated
- If no stenosis is seen, anticoagulation is stopped
- If the vein is occluded, anticoagulation is continued for six months or until the vein recanalizes
Results

Demographics
- 84 patients (42M & 42F)
- FRRS between 12/03 and 11/09
- Average age: 32 years old (16–71 y.o.)
- Average time from thrombosis to FRRS: 6 months (1 week–2 years)

Patent Veins
- 21 patients had widely patent veins by venography
- All remained patent in postoperative period and long-term follow-up
- Follow-up: 18 months (2-57 months)

Stenotic Veins
- 47 patients underwent dilatation
- 3 had acute thrombus and were lysed
- 2 thrombosed after venogram and were anticoagulated.
- Average period of anticoagulation: 2 months (1-5 months)
- Follow-up: 18 months (2-29 months)
Venous Thoracic Outlet Syndrome

Venogram with Stenosis

Venous Thoracic Outlet Syndrome

Venogram with dilatation of subclavian vein stenosis

Venous Thoracic Outlet Syndrome

Venogram Post-Dilatation

Venous Thoracic Outlet Syndrome

Results

- Occluded Veins
  - 16 patients had chronically occluded veins by venogram
  - All 16 received anticoagulation
  - Average period of anticoagulation: 3 months (1-8 months)
  - 14 recanalized in first 6 months
  - Follow-up: 15 months (2-25 months)
**Venous Thoracic Outlet Syndrome**

## Venogram of an Occluded Vein

- Duplex Scan: Recanalization of an Occluded Vein

## Results

- Symptomatic restenosis seen in 3 patients at 27, 34, 54 months
  - All 3 patients received venoplasty
- 2 patients had late occlusions
  - 1 symptomatic at 23 months
  - 1 asymptomatic at 63 months
- All 5 were in the dilated group

## Kaplan Meier Curve

- Kaplan Meier Curve showing Subclavian Vein Occlusion over time.
Conclusions

- Routine venography directs individual treatment plans for the patient which includes vein dilatation, anticoagulation and duplex scanning only within the first year.
- Long term patency was achieved in nearly all patients (>90%) using this protocol.

Preoperative Thrombolysis and Venoplasty Affords No Benefit in Patency Following First Rib Resection and Scaleneectomy for Subclavian Vein Thrombosis

Question

- Given the success with FRRS, anticoagulation, and post-operative venogram/venoplasty, what role does invasive pre-operative intervention have on axillosubclavian vein patency?
- We hypothesized that preoperative endovascular intervention with thrombolysis with or without venoplasty does not improve patency following operative decompression with FRRS.

Results

- 100 patients identified with venous TOS
- 110 FRRS were performed
  - 53 men, 50 women
  - 7 patients had contralateral venous TOS
- Average age 31 years (range 16-54)
- Eight (8%) documented hypercoagulable states
  - Factor V Leiden in 3 patients
Results

- Overall, 45 (41%) patients had a preoperative endovascular intervention prior to FRRS at our institution.
- 65 (59%) of the total cohort were managed with anticoagulation alone prior to FRRS.

Comparing need for venoplasty after FRRS:

- 21 of 43 (49%) in the pre-op endovascular intervention group required venoplasty at two week follow up study.
- 36 of 61 (59%) in anticoagulation group required venoplasty.
- Pre-operative thrombolysis did not have a meaningful impact on the need for further venoplasty s/p FRRS.

Results

Following FRRS:

- 43 patients completing treatment that underwent pre-operative endovascular intervention:
  - 41 are patent and without symptoms (91%) 
  - 1 remains occluded 
  - 1 lost to follow up 
- 61 patients maintained on anticoagulation alone prior to FRRS and completing treatment:
  - 59 are patent and without symptoms (91%) 
  - 2 remain occluded.

Summary

Pre-operative endovascular intervention offered no benefit over anticoagulation alone prior to FRRS since the use of thrombolysis before elective operative decompression, regardless of need for post-op venoplasty, had little impact on overall rates of patency and patient symptom relief.
Summary

- The optimal treatment may be anticoagulation alone prior to operative decompression via FRRS and post-op endovascular intervention.
- A cost savings may be realized as the expense of lytic therapy may be circumvented in favor of anticoagulation prior to FRRS.
- Multicenter, randomized trials will be needed to validate this potential change in treatment.

Methods

- Retrospective review of a prospectively maintained database from 2003-11
- 423 patients underwent surgical intervention for TOS
- 143 patients with Venous Thoracic Outlet Syndrome (VTOS) presented with Paget-Schroetter’s syndrome
- TOS diagnosed by UE Duplex and/or Venogram
- Hypercoagulable disorder diagnosed by verified laboratory testing
- 55 of these patients underwent hypercoagulable testing
- 14 of the patients who were tested were found to carry a thrombophilic condition (n=14)

Females with Subclavian Vein Thrombosis Have an Increased Risk of Hypercoagulability

Methods

Subclavian Vein Status at 2-week Post-operative Venogram

143 Paget-Schroetter Patients

+ HC

- HC

Unknown

Long Term Patency
Hypercoagulable - 14/14 (100%) at mean follow-up of 15.6 months
Non-hypercoagulable - 38/41 (93%) at mean follow-up of 25.2 months
Conclusions

- Patients with hypercoagulability do as well with FRRS for SVT as those without.
- Hypercoagulability is a rare finding in those patients who present with Paget-Schroetter syndrome.
- The possibility of a hypercoagulability disorder should be considered in younger patients who present with lack of activity leading to the thrombosis, especially if they are female, to identify the need for long-term anticoagulation.
- Consideration of this condition as well as judicious testing may yield improved outcomes and prevent future venous thromboembolic events in this subset of patients.

Methods

- Retrospective review of a prospectively maintained database from 2003-11
- 423 patients underwent surgical intervention for TOS
- TOS diagnosed by UE Duplex and/or Venogram
- 171 Patients presented with Venous TOS (VTOS)
- 19 (11%) VTOS patients with intermittent arm swelling
Results

- Duplex scan revealed chronic thrombus in 3 patients
- One patient had bilateral symptoms
- 10 showed significant compression of the subclavian vein on abduction as seen by recording velocities on duplex scan

Conclusions

- FRRS alone was effective in relieving symptoms in 13/15 (87%) patients with McCleery’s Syndrome
- Post-operative venogram is unnecessary unless symptoms persist and dilation resulted in improvement in 2 additional patients
- Patients can present with intermittent compression if an acute episode of subclavian vein thrombosis is not aggressively treated
- Routine venography following FRRS at 2 weeks is indicated in patients presenting with chronic thrombus

Quality of Life Following Surgical Intervention for Neurogenic Thoracic Outlet Syndrome
Short Term QOL Outcomes

- Chang et al.
- Study population
  - 44 NTOS patients age ≥18 years
  - Failed physical therapy, treated by FRRS
- Methods
  - Prospective observational study using SF-12 and DASH instruments between 2/2008 and 3/2008
  - Survey intervals: pre-operative, 3, 6, 12, and 24 months postoperative

Results: Baseline PCS and MCS - Neurogenic vs. Venous

Results: baseline
DASH: similar to rotator cuff tear (50.2)

SF-12 PCS: similar to chronic heart failure (33.8)
SF-12 MCS (44.5)

Quality of Life Outcomes: Neurogenic

- Results: postoperative
  - DASH: improved 0.85 points per month
  - SF-12 PCS: improved 0.24 points per month
  - SF-12 MCS: improved 0.15 points per month

Quality of Life Outcomes: Venous

- Results: postoperative
  - DASH: improved 0.85 points per month
  - SF-12 PCS: improved 0.24 points per month
  - SF-12 MCS: improved 0.15 points per month
Return to Work/Activity Post-Op

**Neurogenic** vs. **Venous**

- 15% patients returned to work/activity on a part-time basis at an average of 3.5 months
- 67% patients returned to full-time work/activity at an average of 4 months
- 35.9% patients remained disabled or unemployed

- 57% patients returned to work/activity on a part-time basis at an average of 2.24 months
- 87% patients returned to full-time work/activity at an average of 4.5 months

Conclusions

1. Need a successful algorithm to ensure vein patency
2. Patients do well following FRRS
3. Follow up should include imaging of vein

"Only those who dare to fail greatly can ever achieve greatly."

- Robert F. Kennedy