Thoracic Outlet Surgery for Venous Disease

• Paget-Schroetter Syndrome - History
  – First two cases published independently >100 yrs ago: Paget in England, 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 began catheter-directed thrombolytic therapy

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• Paget-Schroetter Syndrome – Pathophysiology
  – Mechanical abnormality at costoclavicular portion of axillosubclavian vein
  – Most often acute thrombosis is in area of chronic compression and stricture, between hypertrophied scalene or subclavius tendon and first rib
  – Large exostosis often found at costoclavicular junction

Routine venography following transaxillary first rib resection and scalenectomy (FRRS) for chronic subclavian vein thrombosis ensures excellent outcomes and vein patency

Chang KZ, Likes K, Demos J, Black JH 3rd, Freischlag JA
Vasc Endovascular Surg.
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• 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

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• Methods
  − Patients treated with FRRS for subclavian vein thrombosis undergo routine venography postoperatively at two weeks
  − Subclavian vein is dilatated if there is >50% stenosis, those patients are anticoagulated
  − If no stenosis, anticoagulation is stopped
  − If vein is occluded, anticoagulation is continued for six months or until vein recanalizes

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• 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)

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• Results – 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)

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• Venogram of Patent Vein

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• Results – Stenotic Veins
  − 47 patients underwent dilatation
  − 3 had acute thrombus, were lysed
  − 2 thrombosed after venogram, were anticoagulated
  − Average period of anticoagulation: 2 months (1-5 months)
  − Follow-up: 18 months (2-29 months)
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• Venogram with Stenosis

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• Venogram with dilatation of subclavian vein stenosis

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• Venogram Post-Dilatation

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• 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)

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• Venogram of an Occluded Vein

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• Duplex Scan: Recanalization of Occluded Vein
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• Results
  – Symptomatic restenosis 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 dilatated group

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

• 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.

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• Kaplan Meier Curve

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Guzzo JL, Chang K, Demos J, Black JH, Freischlag JA
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• Results
  – Overall, 45 (41%) patients had a preoperative endovascular intervention prior to FRRS.
  – 65 (59%) of the total cohort were managed with anticoagulation alone prior to FRRS.

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• Results – Following FRRS
  – 43 patients completing treatment that underwent pre-operative endovascular intervention:
    • 41 are patent and without symptoms (95%)
    • 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 (96%)
    • 2 remain occluded

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• Results
  – 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

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• 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.

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• Summary
  – Optimal treatment may be anticoagulation alone prior to operative decompression via FRRS and post-op endovascular intervention.
  – Cost savings may be realized as the expense of lytic therapy may be circumvented in favor of anticoagulation prior to FRRS.
  – Multicenter, randomized trials are needed to validate this potential change in treatment.
• Methods
  – Retrospective review of a prospectively maintained database, 2003-11
  – 423 patients underwent surgical intervention for TOS
  – 143 patients with Venous Thoracic Outlet Syndrome (VTOS) presented with Paget-Schroetter 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)

• 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 – Patient Characteristics
  – Average length of symptoms: 22 months (4-72)
  – Average age: 26 years (10-44)
  – 13 females, 6 males
  – All patients had a history of chronic or repetitive use of the upper extremity
    • Ex: swimming, lacrosse, weight lifting, computer work
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• 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

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• Conclusions
  – FRRS alone was effective in relieving symptoms in 13/15 (87%) patients with McCleery Syndrome.
  – Post-operative venogram is unnecessary unless symptoms persist and dilatation 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.

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• Short Term QOL Outcomes
  – 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

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Surgical intervention for thoracic outlet syndrome improves patient’s quality of life
Chang DC, Rotellini-Colfvet LA, Mukherjee D, De Leon R, Freischlag JA
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• 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

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• Quality of Life Outcomes: Venous

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• Return to Work/Activity Post-Op
  Neurogenic vs. Venous
  - 15% patients returned to work/activity on 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

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• 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