Management of Superficial Venous Disease

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Happy Pi Day

Disclosures

- I have no financial disclosures

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Introduction

- Terminology/anatomy
- Pathophysiology
- Epidemiology
- Management
  - Non operative
  - Procedural
- Results

Terminology and Classifications

- Varicose veins
  - Palpable dilated superficial vein >3 mm in diameter
- Reticular veins
  - 1-3 mm
- Telangectasias (spider veins)
  - Less than 1 mm
Deep vs Superficial veins

- Deep venous system is deep to fascia of the muscle
- Superficial veins are superficial to the fascia
- Perforating veins form connections between two systems travelling through the fascia

Lower Extremity Truncal Veins

- Greater Saphenous vein (GSV)
- Runs from ankle to groin
- Drains into common femoral vein at saphenofemoral junction (SFJ)
- Illustrated with varicose veins
- Anterior accessory saphenous vein comes off SFJ
Lower Extremity Truncal Veins

- **Small Saphenous Vein (SSV)**
- Runs from ankle to knee
- Drains into popliteal vein at saphenopopliteal junction (SPJ)
- Illustrated with varicose veins

Venous physiology/hemodynamics

- Normal flow should be unidirectional
- Gravity is biggest source of increased pressure (weight of column of blood)
- Counteracted by presence of valves (makes large column into smaller columns)
Causes of venous hypertension

- Venous obstruction
  - DVT, SVT, venous compression, venous injury
- Venous incompetence
  - Failure of valves
- Pump failure
  - Immobility, paralysis

Calf muscle pump
Venous valves

Venous valves
Pathophysiology

- Normal flow should be unidirectional
- Incompetent veins lead to increased venous pressures and potentially bidirectional flow

Pathophysiology

- Venous hypertension leads to inflammation
- Inflammation leads to skin changes
- Skin changes can lead to ulceration
- What can start out as a vein problem can become a skin/wound problem
Epidemiology

- Edinburgh vein study (1566 subjects examined)
- Varicose veins
  - 40% men
  - 32% women

Epidemiology

- San Diego study
- Overall incidence:
  - Varicose Veins 24%
  - Telangiectasias 51%
  - Skin changes 6.3%
- Increasing incidence with age
- Ethnicity
  - White 25%
  - Hispanic 27%
  - African American 21%
  - Asian 19%
Diagnosis

- History
- Physical Exam
- Diagnostic imaging
  - Mainly duplex US to evaluate valvular function (Venous insufficiency US)
  - Air plethysmography
  - CT venogram
  - Venogram +/- Intravascular US

Venous symptoms

- Aching
- Pain
- Fullness
- Swelling
- Burning
- Itching
- Heaviness
- Cramping

- Throbbing
- Restless legs
- Tiredness
- Tingling
Venous Symptoms

- Exacerbate symptoms
  - Heat (hot or warm weather)
  - Increased activity
  - Increased dependency
- Improve symptoms
  - Exercise
  - Elevation
  - Compression

CEAP scores

Reporting standards in venous disease: An update

John M. Porter, MD,* Gregory L. Minetta, MD, and An International Consensus Committee on Chronic Venous Disease

Journal of Vascular Surgery
April 1996
### CEAP Classification system for chronic venous disease

<table>
<thead>
<tr>
<th>C: Clinical Classification</th>
<th>E: Etiology</th>
<th>A: Anatomic</th>
<th>P: Pathophysiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>C0: no disease</td>
<td>Congenital, primary or secondary</td>
<td>superficial, perforator or deep veins</td>
<td>reflux, obstructive, or combined</td>
</tr>
<tr>
<td>C1: telangectasias or reticular veins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2: Varicose Veins</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>C3: Edema</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>C4: skin changes</td>
<td></td>
<td></td>
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<tr>
<td>C5: healed ulcer</td>
<td></td>
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<tr>
<td>C6: Active ulcer</td>
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</tbody>
</table>

#### CEAP C4

- C4a: Pigmentation
  - eczema
- C4b: Lipodermatosclerosis
  - Atrophic blanche

- C4a: Pigmentation
- C4b: Eczema
- C4b: Atrophie blanche
- C4b: Lipodermatosclerosis
Venous ulcers

- Typically on distal lower leg (more common medial, but can be lateral)
- Full thickness
- Painful
- Slow to non healing

US

- Best initial test
- Majority of Venous disease is primary, superficial and reflux
- If concern for obstruction or proximal (pelvic source) CT venography and venography often useful
Venous Insufficiency US

- Uses a pressure cuff to inflate distal
- This causes blood to pushed centrally
- Retrograde flow (back toward the foot) is measured

CT Venogram

- Allows imaging of central deep veins, evaluate for pelvic varicosities, large gonadal veins
- May Thurner anatomy (compression of left common iliac vein between right common iliac artery and vertebral body)
- Prior DVTs
- Venous anomalies (IVC atresia)
Treatment

- Conservative measures
  - Compression
  - Elevation
  - Exercise
  - Weight Loss
  - Horse Chestnut extract
  - NSAIDs
- Procedural interventions

Compression

- Graduated compression stockings (although other types)
  - Multiple options for compression and size
  - Provide external compression (when worn)
  - Good evidence for improved wound healing
  - Some evidence for preventing Ulcer recurrence
  - Weak evidence for other use...
Evidence for Compression

• 2011 Cochrane review
  - “Authors' conclusions:
    - There is insufficient, high quality evidence to determine whether or not compression stockings are effective as the sole and initial treatment of varicose veins in people \textit{without} healed or active venous ulceration, or whether any type of stocking is superior to any other type.”
  - This is in part due to limitations of the data
  - Subjectively seem to improve symptoms for most pt although compliance is poor


Elevation

• Reduces orthostatic pressure
• Improves edema
• Improves wound healing
• Frequently improves symptoms
• Not a durable remedy
Exercise

- Walking (calf activation) promotes venous return, lowers venous pressures
- Improves wound healing in conjunction with compression
- Frequently limited by comorbidities or by pain from ulcers

Weight Loss

- No good evidence
- Poor compliance
- Weight loss can make varicose veins more prominent due to loss of surrounding subcutaneous tissue
Horse chestnut seed extract

- Phlebotonics
  - Multiple available as dietary supplements
  - Not well studied
  - No long term safety studies
- May improve venous tone, capillary hyperpermeability
- Similar results to compression in short term studies 2-16 weeks

Insurance Approval

- Most insurance companies require at least 3 months of failure of conservative measures
- Insurance approval is frequently the biggest barrier for intervention on varicose veins
Interventions

- Surgical
  - Stripping
  - Phlebectomy
- Endovenous Thermal Ablation
  - Laser
  - Radiofrequency ablation
- Chemical ablation
  - Sclerotherapy
  - Adhesive sealing
  - Pharmacomechanical

Surgical treatment

- Main goal is to remove source of varicose veins
- Frequently incompetent truncal veins or incompetent perforating veins
- Secondary goal is to remove or ablate symptomatic veins
Vein Stripping

- Gold standard, although mainly historic
- Requires general anesthesia, two incisions
- More painful, longer recovery
- Recurrence from neo vascularization

Endovenous thermal ablation

- Less invasive than stripping
- Can be done with only local and tumescent anesthetic
- Two energy sources
  - RadioFrequency Ablation (RFA)
  - Laser (EVLT)
- Similar outcomes have been reported
- I prefer RFA (less pain, more consistent measurable energy delivery, similar outcomes)
Tumescent anesthetic

- Mixture of Normal saline, lidocaine, epinephrine and sodium bicarbonate
- Typical to administer at least a few hundred mls
- Tumescent anesthetic:
  - Provides anesthesia
  - Causes vasospasm
  - Creates a heat sink around vein to protect surrounding tissues
- Injected under US guidance around the vein

Endovenous Thermal Ablation

- Risks of thermal ablation
  - Endovenous heat induced thrombosis EHIT
    - 4 Types of EHIT depending on extent
    - Type 4 is DVT
  - Nerve injury
  - Recannalization
  - Recurrence
Non Thermal (non tumescent)

- 3 approved for treatment of truncal veins
  - Mechanicochemical Ablation (MOCA)
  - Chemical adhesive with cyanoacrylate
  - Polidocanol Endovenous Microfoam (PEM)
- Advantages no thermal energy delivery so less risk of injuring surrounding tissue
- Less invasive as do not need injection

Adhesive ablation

- Single access
- No tumescent anesthetic
- Risk of allergic reaction to glue
- Glue is permanent implant
- Risk of glue extension/thrombosis similar to EVLT and RFA
MOCA

- Mechanicochemical Ablation
- Uses a spinning wire to disperse sclerosant (polidochanol or sodium tetradecyl) and mechanically injure vein endothelium and induce vasospasm

Polidocanol Endovenous Microfoam

- Uses foam sclerosant to ablate truncal veins
- Commercially available
Treatment of varicose veins

- Surgical Phlebectomy (I prefer for larger veins)
- Duplex guided sclerotherapy (preferable for smaller veins)
- For telangectasias surface laser or visual sclerotherapy

Pheblectomies

- Multiple names (stab, micro)
- Tumescent anesthesia
- 16 or 18 gauge needle used to make incision in the skin
- Vein removed through blunt dissection
Sclerotherapy

- Historically hypertonic saline used
- Now mainly sodium tetradecyl or polidochanol
- Liquid but frequently mixed with air to make foam
- Air bubbles of foam can be observed during injection on US

Perforator Veins

- Historically ligation was method of treatment
- Subfascial Endoscopic Perforator Surgery (SEPS)
- My approach is Duplex guided sclerotherapy
- EVLT and RFA devices are available
Comparison of Techniques

<table>
<thead>
<tr>
<th>Treated vein</th>
<th>Technique</th>
<th>Adverse Reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFA</td>
<td>GSV, SSV, AASV, IPV</td>
<td>Thermal ablation</td>
</tr>
<tr>
<td></td>
<td>Non-tortuous veins</td>
<td>Tumescence</td>
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<tr>
<td></td>
<td>Non-tortuous veins</td>
<td>Tumescence</td>
</tr>
<tr>
<td>Cyanoacrylate Glue</td>
<td>GSV, SSV, AASV (&lt;10 mm)</td>
<td>Glue (foreign body)</td>
</tr>
<tr>
<td></td>
<td>Non-tortuous veins</td>
<td>No tumescence</td>
</tr>
<tr>
<td>MOCA</td>
<td>Veins &lt;12 mm</td>
<td>Sclero may diffuse in branches</td>
</tr>
<tr>
<td></td>
<td>Non-tortuous veins</td>
<td>No tumescence</td>
</tr>
<tr>
<td>PEM (1% polidocanol)</td>
<td>Veins &lt;10 mm</td>
<td>Sclero may diffuse into branches</td>
</tr>
<tr>
<td></td>
<td>Tortuous and partially thrombosed veins</td>
<td>No tumescence</td>
</tr>
<tr>
<td></td>
<td>Non-tortuous veins</td>
<td></td>
</tr>
</tbody>
</table>

Indications for Treatment

- Symptomatic varicose veins not responsive to conservative measures (CEAP C2) for symptom improvement
- Venous ulcerations CEAP C6 or healed venous ulcers CEAP C5 to prevent recurrence
- Wound healing?
- Venous stasis skin changes?
Wound Healing

- ESCHAR trial
- Randomized 500 pts to surgery (stripping) or compression
- No difference in wound healing
- Lower rate of recurrence

Wound healing

- EVRA trial showed benefit to early intervention (mix of treatment modalities)
- 20 centers in UK
- 450 patients randomized to early or delayed intervention
- Median time to ulcer healing
  - 56 days for early intervention
  - 82 days for delayed intervention

<table>
<thead>
<tr>
<th>Table 2: Timing and Type of Intervention Interventions</th>
<th>Number of Patients</th>
<th>Mean Time to Ulcer Healing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>Early intervention</td>
<td>Delayed intervention</td>
</tr>
<tr>
<td>Early intervention</td>
<td>Early intervention</td>
<td>56 (4.8)</td>
</tr>
<tr>
<td>Early intervention</td>
<td>Delayed intervention</td>
<td>3.2 (0.8)</td>
</tr>
<tr>
<td>Early intervention</td>
<td>No treatment</td>
<td>6.6 (0.9)</td>
</tr>
</tbody>
</table>

### Summary of Pivotal Studies

<table>
<thead>
<tr>
<th>Technique</th>
<th>Study</th>
<th>Endpoint</th>
<th>Closure Rate</th>
<th>Adverse Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFA</td>
<td>Probstle et al</td>
<td>6 months</td>
<td>99.6%</td>
<td>DVT 0% Paresthesia 3-3.2 % Phlebitis 0.8%-3%</td>
</tr>
<tr>
<td></td>
<td>VcClose (vs glue)</td>
<td>3 months</td>
<td>96%</td>
<td></td>
</tr>
<tr>
<td>EVLT</td>
<td>Min et al</td>
<td>2 years</td>
<td>93.4%</td>
<td>DVT 0% Paresthesia 1.1%</td>
</tr>
<tr>
<td>Cyanoacrylate glue</td>
<td>VcClose (vs RFA)</td>
<td>3 months</td>
<td>99%</td>
<td>DVT 0% Paresthesia 3% Phlebitis 4%</td>
</tr>
<tr>
<td>MOCA</td>
<td>Elias et al</td>
<td>6 months</td>
<td>96.7%</td>
<td>No PE or CVA</td>
</tr>
<tr>
<td>PEM (1% polidocanol)</td>
<td>VANISH-1 and 2</td>
<td>8 weeks</td>
<td>80.4-86.2%</td>
<td>DVT 1.9% Phlebitis 7.7%</td>
</tr>
</tbody>
</table>

### Outcome Comparison (CRT)

<table>
<thead>
<tr>
<th></th>
<th>Immediate occlusion %</th>
<th>Recanalization at 3 years %</th>
<th>New veins at 3 years %</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVLT</td>
<td>94</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>RFA</td>
<td>95</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Foam</td>
<td>80</td>
<td>26</td>
<td>19</td>
</tr>
<tr>
<td>Stripping</td>
<td>96</td>
<td>7</td>
<td>20</td>
</tr>
</tbody>
</table>

*Br J Surg 2011: 98:1079*
Summary

• Variable treatment options
• I tend to combine RFA and stab phlebectomies if large varicose veins
• Cyanoacrylate ablation if ulcers or reason to avoid tumescent anesthesia
• Sclerotherapy for recurrent varicose veins
Referring Practitioners

- If asymptomatic varicose veins nothing
- If symptomatic refer and prescribe compression stockings (20-30 mmHg)
  - Some societies recommendations are for only referral based on poor evidence for compression, but this does not factor in insurance approval
- If more advanced signs of venous insufficiency (skin changes, ulcers) refer