Overview of Anatomy and Physiology of Superficial Venous Insufficiency

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No disclosures
• Ebers Papyrus (1550BC): ‘serpentine windings’

Acropolis, 4th Century BC
Appreciation of Anatomy

- REVATA retrospective cohort analysis
- Post-ablation 7% had varicose vein recurrence at ~3 yrs
- Among the recurrence cases:
  - 2/3 had perforator reflux
  - 40 new AAGSV reflux
  - 24 new SSV reflux

BUSH RG et al. Factors associated with recurrence of varicose veins after thermal ablation: Results of the recurrent veins after thermal ablation study. Sci World J. 2014; 505843
**Superficial veins:**
GSV, SSV, AAGSV, PAGSV, intersaphenous, reticular

**Perforators:**
Cross fascial planes (superficial to deep)

**Communicators:**
Connect in same fascial plane

**Deep veins:**
Common femoral, femoral, popliteal, soleal, gastroc, tibial...
# Updated Vein Nomenclature

<table>
<thead>
<tr>
<th>✓</th>
<th>✗</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femoral</td>
<td>Superficial femoral</td>
</tr>
<tr>
<td>Great saphenous</td>
<td>Long saphenous</td>
</tr>
<tr>
<td>Small saphenous</td>
<td>Lesser/short saphenous,</td>
</tr>
<tr>
<td>Intersaphenous</td>
<td>Giacomini</td>
</tr>
<tr>
<td>Perforator of the femoral canal</td>
<td>Dodd’s perforator</td>
</tr>
<tr>
<td>Paratibial perforator (upper leg)</td>
<td>Boyd’s perforator</td>
</tr>
<tr>
<td>Paratibial perforator (mid leg ~24 cm)</td>
<td>Sherman’s perforator</td>
</tr>
<tr>
<td>Posterotibial perforators</td>
<td>Cockett’s perforators (I II III)</td>
</tr>
<tr>
<td>Soleal vein</td>
<td>Sural vein</td>
</tr>
</tbody>
</table>
Pointers:

• True GSV duplication (within fascia) ~2% in thigh, 25% in calf.
• GSV may exit fascia and become more superficial in distal thigh.
• Valve in SFJ 94%
• Main GSV trunk: 6+ valves
• SSV: 7-10 valves

Leu HJ et al. Basic Res Cardiol. 1979; 74: 435-444
SSV confluence:

- ~60% Popliteal vein within 8cm of knee joint
- ~20% GSV via tributaries
- ~20% femoral/deep femoral/internal iliac

Leu HJ et al. Basic Res Cardiol. 1979; 74: 435-444
Perforators

- ~64 in thigh & leg
- Often accompanied by artery
- 4 major clinical groups: thigh, medial calf, lateral calf, foot
- Many have valves.

# Calf Perforators

<table>
<thead>
<tr>
<th>Paratibial</th>
<th>GSV – posterior tibial</th>
<th>Boyd, Sherman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior tibial</td>
<td>PAGSV – posterior tibial</td>
<td>Cockett</td>
</tr>
<tr>
<td>Lateral</td>
<td></td>
<td></td>
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<tr>
<td>Anterior</td>
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</tbody>
</table>

*PAGSV = Posterior accessory great saphenous vein

*PAGSV previously named “posterior arch vein”, “Vein of Leonardo”

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GSV
Anterior Accessory GSV
Pudendal vein
Changes in ankle pressure

venous pressure mmHg

lying down  rising  standing  walking  standing

healthy limb  superficial and perforator vein dysfunction

0  1  2  3  4 minutes

0  100  80  60  40  20  0
Pathophysiology

Not fully understood

• Changes to vein wall matrix, inflammation or thrombosis involving valves

• Venous hypertension, obstruction

Zsoter T et al. Can Med Assoc J. 1966; 94: 1293
Junger M et al. Microcirculation 2000; 7: S3
Pathology Analysis of Varicose Veins

• ...intimal hypertrophy due to fibrous tissue infiltration, localized thinning of muscle layer and loss of intimal & medial smooth muscle cells.

• Loss of the normal elastin/collagen lattice network.
Ulceration

Capillary H₂O leakage

Capillary Protein leakage

Edema

Inflammation

Fibrosis = Lipodermatosclerosis

↑ Cytokine release from activated neutrophils

Recirculating O₂-poor high lactate blood

Rouleaux formation & Microthrombosis

↑ serum VEGF & TNFα

↑ TGF-β1

Bomberger A et al. Clin Capillaroscopy. 1991; NY. Hofgrefe & Huber
Summary

• Venous insufficiency a/w incompletely understood inflammatory changes.
• Significant variability in venous anatomy.
• Careful evaluation with US duplex vital for diagnosis & treatment plan.