Disclosure

Nicos Labropoulos, PhD, RVT

I disclose the following financial relationship(s):

• Speaker/Honoraria: Cook;
• Consultant/Advisory Board: Cook, Covidien
Continuous Wave Doppler
Primary evaluation at the clinic

Plethysmography
Screening
Severity of CVD
Evaluate treatment

**Duplex scanning**
Method of choice for most patients
Distribution and extent of CVD
Guide and evaluate treatment

Phlebography
Deep venous reconstruction
Endovenous procedures
Area of testing

Quite, spacious room
- Able to maneuver machine, bed and chair
- Room sufficiently dark to see better the screen

Adjustable bed and chair
- Allows different patient and examiner positioning
- More ergonomic

Frame with large base or steps
- Optimal for testing in the standing position
Patient and examiner positioning

Different positions are used depending on the test

**Patient**

- Supine with or without head or torso elevation
- Lateral decubitus, limb elevation
- Sitting with or without limb extension
- Standing

**Examiner**

- Sit at the correct height
- Do not overstretch
- Back support
- Support elbow to minimize stress on wrist and shoulder
Ultrasound machine settings

**B-mode**
- Set gain with the normal vein lumen appearing dark
- Place focus at the area of interest
- Adjust transducer pressure according to depth

**Spectral Doppler**
- Adjust sample volume according to the area of imaging
- Reduce Doppler again to have a dark background
- Optimize scale by using PRF and baseline

**Color imaging**
- Usually a small color box
- Optimize color gain and PRF to have luminal flow only
- Increase gain and decrease PRF with increasing depth
Inspect patient limbs on all sides and place the patient in the appropriate position.
Superficial veins
  - GSV
  - SSV
  - Saphenous tributaries
  - Nonsaphenous veins

Perforator veins
  - Thigh, knee, calf, ankle, foot

Deep veins
  - Axial
  - Muscular
Reflux cut-off values

Superficial veins  >500ms

Perforator veins  >350ms

Calf veins + Deep femoral  >500ms

Femoropopliteal veins  >1000ms
Superficial vein reflux is the most common abnormality in patients with chronic venous disease.

Reflux in the saphenous veins and their tributaries has the highest prevalence.
Patient Characteristics

CVD is seen in all decades of life

Prevalence
- 25-33% of females
- 10-20% of males

Incidence
- 2.6% per year females
- 1.9% per year males

CVD classes 0-3 47y
CVI classes 4-6 58y

p<0.0001
Clinical, etiologic, anatomic and pathophysiologic data (n= 250 limbs)

Clinical
- Telangiectases: 16.8%
- Prominent veins: 3.6%
- Varicose veins: 86.8%
- Edema: 23.2%
- Skin changes: 25.2%
- Healed Ulcer: 5.2%
- Active Ulcer: 7.2%

Etiologic
- Primary: 64%
- Secondary: 27.6%
- Primary + Secondary: 7.6%
- Congenital: 0.8%

Anatomic
- Superficial: 92.4%
- Perforating: 22.8%
- Deep: 29.6%

Pathophysiologic
- Reflux: 81.2%
- Obstruction: 2%
- Reflux + obstruction: 16.8%
Normal SFJ
Normal GSV in the lower thigh
GSV reflux
GSV reflux distal thigh
GSV reflux post-thrombotic
Patterns of reflux in the SSV system

<table>
<thead>
<tr>
<th>Pattern of reflux</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giac</td>
<td>7</td>
<td>3.1</td>
</tr>
<tr>
<td>Giac+SSV</td>
<td>10</td>
<td>4.4</td>
</tr>
<tr>
<td>Giac+SPJ+SSV</td>
<td>20</td>
<td>8.8</td>
</tr>
<tr>
<td>Giac+SPJ+SSV+Gastro</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>SPJ</td>
<td>4</td>
<td>1.8</td>
</tr>
<tr>
<td>SPJ+SSV</td>
<td>112</td>
<td>50</td>
</tr>
<tr>
<td>SPJ+Gastro</td>
<td>4</td>
<td>1.8</td>
</tr>
<tr>
<td>SPJ+SSV+Gastro</td>
<td>5</td>
<td>2.2</td>
</tr>
<tr>
<td>SSV</td>
<td>34</td>
<td>15</td>
</tr>
<tr>
<td>SSV+Gastro</td>
<td>4</td>
<td>1.8</td>
</tr>
<tr>
<td>Gastro</td>
<td>8</td>
<td>3.5</td>
</tr>
<tr>
<td>TRBs</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>nonSSV</td>
<td>7</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>226</td>
<td>100</td>
</tr>
</tbody>
</table>

SPJ+SSV vs any other pattern, \( p<0.0001 \)
SPJ reflux
SSV reflux
Upper cal to popliteal fossa

SSV + MGV reflux
SSV reflux
SSV and sural nerve
Reflux may involve the saphenous tributaries alone and/or nonsaphenous superficial veins.

62 patients 84 limbs

Male: 24 (39%)

Female: 38 (61%)

Mean Age: 41±12 years

Range: 18 - 77 years
## Prevalence of reflux in the different tributaries

<table>
<thead>
<tr>
<th>Tributary</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior accessory vein</td>
<td>30</td>
<td>18</td>
</tr>
<tr>
<td>Medial accessory vein</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>Middle thigh tributaries</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Lower thigh tributaries</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Posterior calf arch vein</td>
<td>46</td>
<td>27</td>
</tr>
<tr>
<td>Anterior arch vein</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>Upper calf tributaries</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Middle calf tributaries</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td>Lower calf tributaries</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Nonsaphenous veins</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>171</td>
<td>100</td>
</tr>
</tbody>
</table>

Posterior arch vein vs anterior accessory vein, \( p=0.051 \)
Posterior arch vein or anterior accessory vein vs any other tributary \( p<0.04 \)
## Prevalence of saphenous and nonsaphenous tributary reflux

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSV</td>
<td>111*</td>
<td>65</td>
</tr>
<tr>
<td>SSV</td>
<td>33</td>
<td>19</td>
</tr>
<tr>
<td>GSV+SSV</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Nonsaphenous veins</td>
<td>15</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>171</td>
<td>100</td>
</tr>
</tbody>
</table>

*p<0.0001 for all comparisons*
Superficial nonsaphenous vein reflux

Number of pregnancies
Mean and 95% CI

Nonsaphenous 3.2 3.1-3.3

Saphenous 2.2 2.14-2.26

(100 randomly selected females)
## Prevalence of Reflux

<table>
<thead>
<tr>
<th>Location</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterolateral thigh</td>
<td>42</td>
<td>47</td>
</tr>
<tr>
<td>Vulvar</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Gluteal</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Sciatic nerve</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Popliteal fossa</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Knee</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Gluteal  
L P thigh  
Sciatic N  
PLTP
Experience with ultrasound
Know the anatomy and pathology
Perform vein mapping
Offer complete management of venous disease