Venous Insufficiency

The under diagnosed, under treated disease

Venous Insufficiency

- Is a multi-factorial disorder
- Abnormal circulatory condition characterized by decreased return of the venous blood from the legs to the trunk of the body manifested by edema, pain, varicosities and skin changes

Objectives:

- Improved understanding of venous insufficiency disease
- Implications to quality of life and patient care
- Improved identification of venous pathologies
- Current treatment recommendations and options
The earliest known depiction of varicose veins is this sculpture on the west side of the Acropolis in Athens, from the 4th Century B.C.

### Venous Insufficiency Prevalence

<table>
<thead>
<tr>
<th>Disease</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venous Reflux Disease</td>
<td>20%</td>
</tr>
<tr>
<td>Coronary Heart Disease</td>
<td>15%</td>
</tr>
<tr>
<td>Peripheral Arterial Disease</td>
<td>10%</td>
</tr>
<tr>
<td>Congestive Heart Failure</td>
<td>5%</td>
</tr>
<tr>
<td>Stroke</td>
<td>2%</td>
</tr>
<tr>
<td>Cardiac Arrhythmias</td>
<td>1%</td>
</tr>
<tr>
<td>Heart Valve Disease</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

### Risk factors for venous insufficiency
- Family History
- Female (40%) vs. Male (25%)
- Advancing Age
- Venous Malformations
- History of clotting disorders or thrombus
- Trauma/Surgery
- Pregnancy/Multi-parity
- Occupation (standing or sedentary)
- Hormonal therapies including birth control
- Obesity
- Smoking
Venous Insufficiency = Impaired Venous Return.....
- Calf Muscle Pump
- Thoracic Excursion & Cardiac Function
- Intravenous Valves
- Intra-abdominal Pressure
- Neurohormonal Influence
- Increased Intravascular Volume
- Vein Wall Integrity
- Venous Obstruction
- Gravity

Calf Muscle Pump
- Heel strike
- Gastrocnemius muscle contraction
- Failure can result from
  - Neuromuscular disorders
  - Muscle wasting
  - Absent/fallen foot arch
  - Ankle fusion
  - Sedentary lifestyle (sitting or standing)
  - High heels
  - Prolonged immobility
  - Corrective casting

Thoracic & Cardiac Implications
- Diaphragmatic excursion
- Preload/Afterload
- Systemic Arterial Pressure
- Pressure gradient
- Congestive Heart Failure
Intravenous valves

- Prevents blood from refluxing in the opposite direction of venous return
- No valves in portal, hepatic and internal jugular veins.
- Valve failure
  - Increased intravenous pressures
  - Venous dilation
  - Valve leaflet weakening
  - Valve leaflet failure
  - Injury from thrombus
  - Injury from trauma
- Congenitally missing or defective valves

Intra-abdominal Pressure

- Pregnancy
- Parity
- Obesity
- Ascites
- Chronic Constipation

Neurohormonal Influence

- Neuro (Sympathetic)
  - Cardiac output
  - Peripheral resistance
- Hormonal
  - Progesterone
    - Pregnancy
    - Normal menstrual cycles
    - Obesity - stores in adipose
    - Decreases smooth muscle contractility
Increased Intravascular Volume

- 30% more during pregnancy
- Congestive Heart Failure
- Renal Failure
- Medication side effects

- The venous system normally contains 64% of the total body blood volume

Vein Wall Integrity

- Generally oval
- Intima
  - thin layer of endothelial cells and deep fenestrated basement membrane
  - fragmented elastic lamina
  - contain small micro-villi
  - tremendous ability to regenerate
- Media
  - 3 layer of muscle bundles separated by loose connective tissue and elastic fibers
  - variability in the amount of muscle in the vein walls
- Adventitia
  - thickest portion of the vein wall composed of collagen with interlacing fibers in longitudinal, spiral and circular fashions

Vein Wall Integrity

**Vein segment volume is three times greater and compliance is 30 times greater than that of an arterial segment**
Age related vein wall changes
- Intima thickens
- disorientation of elastin fibers
- Media
  - hypertrophy of the outer muscular layer
  - elastic fibers become more irregular and dystrophic
- Adventitia
  - increasingly fibrous

Vein Obstruction
- Intrinsic
  - Thrombus
  - Arterial Compression
  - Phlebitis
  - Tumors
- Extrinsic
  - Restrictive clothing
  - Positioning
  - Travel

Gravity
- 20 mmHg venous pressure when supine
- 100 mmHg venous pressure when erect
Increased dermal capillary hypertension

Vasodilation
Increased Capillary Permeability
WBC Activation
Venous rupture

Venous Reflux
Increased lymph edema
Venous & nutrient loss into interstitial compartment

Fibrin Accumulation
Sclerosis
Decreased microvascular transport

Ischemia
Ulceration
Infection
Inflammation

CEAP Classification
• C = Clinical Signs
  • Co = No clinical signs
• E = Etiology
• A = Anatomy
• P = Physiology
C1 – Telangiectasia & Reticular veins

C2 – Varicose Veins

C3 – Edema
C₄a - Venous pigmentation or dermatitis

C₄b - Lipodermatosclerosis or atrophie blanche

C₅ - Healed Ulcer
C6 – Active Ulcer

Before & After......

CEAP Classifications
E=Etiology

- Ec – Congenital
  - Strong family history
- Ep – Primary
  - No family history but no causative factors identified
- Es – Secondary
  - Post thrombotic syndrome
  - Post trauma
- Deep vein thrombosis
  - Precipitating event
    - Immobility
    - Trauma
    - Hypocoagulable state
    - Hormonal therapy
    - Pregnancy
    - Hereditary disorders

Post thrombotic syndrome: edema, skin changes, healed or active ulcer

- Post Thrombotic Syndrome
  - 30% to 70% will have within 3 years
  - 50% to 100% will have within 5 to 10 years

CEAP Classifications

A = Anatomic Classification

- As – Superficial venous system
  - SSV, GSV, AAGSV, PAGSV, Vein of Giacomini, A/P circumflex veins of the thigh & calf, tributaries, reticular and telangectasia
- Ap – perforator veins
  - Connect the superficial system to the deep system
- Ad – Deep venous system
  - Peroneal, Soleus, Gastrocnemius, Posterior Tibial, Anterior Tibial, Popliteal, Femoral, Common Femoral, External & Internal Iliac, Pudendal, Gluteal, Obturator, Common Iliac, Inferior Vena Cava
- Ao – Failure to identify
Perforating Veins

CEAP Classifications
P = Pathophysiology
- Pr – Reflux
  - Pathologic > 0.5 seconds, symptomatic
- Po – Obstruction
  - Thrombus
  - Anatomical Occlusion
    - May-Thurner syndrome
    - Outflow obstruction – obesity, pregnancy
- Pro – Reflux & Obstruction
- Pn – No identifiable cause

May-Thurner Syndrome
- Also known as iliac vein compression syndrome
- Typically presents with left leg DVT
- Caused when the high pressure right iliac artery crosses over the low pressure left iliac vein compressing it
- Treatment
  - Anticoagulation
  - Catheter directed Thrombolytic treatment
  - Angioplasty or stenting
  - IVC Filter
Klipple-Trenaunay Syndrome

- Rare congenital disorder also known as Nevus Varicosus Osteo Hypertrophicus
- Etiology unknown - theories include mesodermal abnormalities during fetal development or pathologic gene for vascular remodeling or tissue overgrowth
- Parks-Weber Syndrome is similar but with AV malformations and shunting

Lipedema Syndrome

- Waist down
- Feet & Toes spared
- Hormonal influence
- Lymphedema treatment essential
- Weight loss ineffective
- Liposuction life threatening
- No good treatment options
Clinical evaluation

- Cosmetic appearance – psychological impact and may affect quality of life
- Physical symptoms most often associated with veins meeting pathological criteria – 3 mm in size; 0.5 seconds of reflux
  - Pain
  - Edema
  - Tingling
  - Aching
  - Burning
  - Muscle cramps
  - Throbbing
  - Heaviness
  - Restless legs
  - Fatigue

Venous Clinical Severity Score

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Absent = 0</th>
<th>Mild = 1</th>
<th>Moderate = 2</th>
<th>Severe = 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>None</td>
<td>Occasional</td>
<td>Daily, moderately limiting</td>
<td>Severe, limits activities or requires regular analgesic</td>
</tr>
<tr>
<td>Varicose Veins</td>
<td>None</td>
<td>Few</td>
<td>Multiple upper or lower</td>
<td>Extensive upper and lower</td>
</tr>
<tr>
<td>Edema</td>
<td>None</td>
<td>Evening ankles</td>
<td>Afternoon above ankle</td>
<td>Morning</td>
</tr>
<tr>
<td>Pigmentation</td>
<td>None or focal</td>
<td>Diffuse but limited in area and duration</td>
<td>Diffuse, greater distribution, purple or brown</td>
<td>Wider distribution, recent changes</td>
</tr>
<tr>
<td>Inflammation</td>
<td>None</td>
<td>Mild cellulitis</td>
<td>Moderate cellulitis</td>
<td>Severe cellulitis</td>
</tr>
<tr>
<td>Induration</td>
<td>None</td>
<td>Focal</td>
<td>Medial or Lateral</td>
<td>&gt;1/3 of leg or more</td>
</tr>
<tr>
<td>Ulcer Duration</td>
<td>None</td>
<td>&lt;3 months</td>
<td>&gt;3 mo but &lt;1 yr</td>
<td>&gt;1 yr</td>
</tr>
<tr>
<td>Ulcer Size</td>
<td>None</td>
<td>&lt;2 cm</td>
<td>2-6 cm</td>
<td>&gt;6 cm</td>
</tr>
<tr>
<td>Compression Therapy</td>
<td>None or non-compliant</td>
<td>Intermittent</td>
<td>Most days</td>
<td>Full compliance</td>
</tr>
</tbody>
</table>

Diagnosis
Vein Diameter Measurements
### Duplex Ultrasound

#### RIGHT

<table>
<thead>
<tr>
<th>Size</th>
<th>Degree of Reflux</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.2mm</td>
<td>2.75sec</td>
<td>GSV at SFJ</td>
</tr>
<tr>
<td>11.3mm</td>
<td>2.75sec</td>
<td>GSV at mid thigh</td>
</tr>
<tr>
<td>10.5mm</td>
<td>2.65sec</td>
<td>GSV at knee</td>
</tr>
<tr>
<td>9.6mm</td>
<td>2.12sec</td>
<td>GSV at calf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GSV at ankle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AASV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PASV</td>
</tr>
<tr>
<td>3.9mm</td>
<td>none</td>
<td>SSV at thigh</td>
</tr>
<tr>
<td>4.4mm</td>
<td>none</td>
<td>SSV at SFJ</td>
</tr>
<tr>
<td>4.9mm</td>
<td>none</td>
<td>SSV at mid calf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SSV at ankle</td>
</tr>
</tbody>
</table>

#### LEFT

<table>
<thead>
<tr>
<th>Size</th>
<th>Degree of Reflux</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.9mm</td>
<td>1.34sec</td>
<td>GSV at SFJ</td>
</tr>
<tr>
<td>5.6mm</td>
<td>none</td>
<td>GSV at SFJ</td>
</tr>
<tr>
<td>6.4mm</td>
<td>2.12sec</td>
<td>GSV at ankle</td>
</tr>
<tr>
<td>6.4mm</td>
<td>2.97sec</td>
<td>GSV at ankle</td>
</tr>
<tr>
<td>5.8mm</td>
<td>none</td>
<td>AASV</td>
</tr>
<tr>
<td>3.9mm</td>
<td>none</td>
<td>PASV</td>
</tr>
<tr>
<td>4.9mm</td>
<td>none</td>
<td>SSV at thigh</td>
</tr>
<tr>
<td>3.9mm</td>
<td>none</td>
<td>SSV at SFJ</td>
</tr>
<tr>
<td>3.9mm</td>
<td>none</td>
<td>SSV at mid calf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SSV at ankle</td>
</tr>
<tr>
<td>RIGHT</td>
<td>Degree of Reflux</td>
<td>LEFT</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------</td>
<td>------------</td>
</tr>
<tr>
<td>SIZE</td>
<td></td>
<td>SIZE</td>
</tr>
<tr>
<td>5.5mm</td>
<td>2.96sec</td>
<td>9.8mm</td>
</tr>
<tr>
<td>7.7mm</td>
<td>3.3sec</td>
<td>8.2mm</td>
</tr>
<tr>
<td>-</td>
<td>Not seen</td>
<td>7.5mm</td>
</tr>
<tr>
<td>4.6mm</td>
<td>3.99sec</td>
<td>4.1mm</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0mm</td>
<td>1.99sec</td>
<td>6.6mm</td>
</tr>
<tr>
<td>-</td>
<td>Hx of Sclero</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>Hx of Sclero</td>
<td>Hx of Sclero</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Treatment of vein disease**

- Treat the comorbidities
  - Diabetes
  - Hypertension
  - Neuropathy
  - Lymphedema
  - Congestive heart failure
  - Fibromyalgia
  - Clotting disorders
  - Etc
Treatment of venous disease

Treatment of vein disease

- Endovenous Radiofrequency Ablation
- Endovenous Laser Ablation
- Phlebectomy
- Sclerotherapy
- Clarivein
- Verithena
- Superficial laser or radiofrequency therapy

Endovenous Laser Ablation & Radiofrequency Ablation

- Catheter based procedures
- Ultrasound guided
- Uses tumescent anesthesia
- Uses heat to ablate the diseased vein
  - Laser = 1200 centigrade
  - Radiofrequency = 120 centigrade
- Closure rates the same
- Aftercare the same
The VNUS Closure Procedure
Using the ClosureFAST™ Catheter

Catheter positioned at highest treatment point
Vein treated in 7cm vein segments

Catheter withdrawn from marker to marker
Until entire length of vein is treated

Example of Closure on US
Risks of ablation

**DVT**

Other Risks.....

- Bleeding
- Infection
- Vein fails to close
- May develop angioneogenesis surrounding the area
- May not relieve the symptoms
- Chance of permanent nerve injury
- Chance of permanent skin discoloration

Sclerotherapy

- Injection of a chemical agent into a vein to produce endothelial damage producing localized inflammation
- Relies on the body's own inflammatory response to close the vein
- Larger veins may need treated more than once
- Trapped blood resulting in superficial thrombophlebitis is common
- If foamed (off label), risk of air embolism, migraine or dyspnea
- Permanent discoloration
- Telangiectasia development
- Skin ulceration
Sclerotherapy

Cosmetic Vein Treatment

Superficial laser or radiofrequency ablation

- Veingogh, Veinwave, surface lasers
- Microscaring
- Permanent discoloration
- Telangiectasia development
- Skin ulcerations
- Results not immediate
- Considered cosmetic
ClariVein® device

**Varithena**

Varithena™ (polidocanol injectable foam) 1% is a drug/device combination that generates injectable foam for intravenous injection using ultrasound guidance.

- **Varithena™ injectable foam delivers a 1% polidocanol solution.** Each mL of Varithena™ injectable foam contains 1.3 mg of polidocanol.
- One canister of Varithena™ yields 45 mL of usable foam for injection when following instructions for use.
- Use up to 5 mL per injection and no more than 15 mL per session.
- Once activated, the canister of Varithena™ must be used within seven (7) days.
- Manufactured in accordance with FDA Current Good Manufacturing Practices (cGMPs).
- Local anesthetic may be administered prior to cannula insertion, but neither tumescent anesthesia nor patient sedation is required.

**Alternative therapies.....**

- Diosmin (Vasculara 630 mg) – Protects from microcirculatory damage
  - Naturally occurring flavonoid glycoside that is vascular protecting exhibiting anti-inflammatory, free-radical scavenging, and antimutagenic properties.
  - Half-life 26–43 hours; renal elimination
  - No known interactions
  - Appears safe long term
  - Mechanism of action:
    - Prostaglandin E2 & thromboxane A2 inhibition
    - Inhibits leukocyte activation, migration, and adhesion
    - Reduces neutrophil activation
Alternative therapies.....

- Horse Chestnut Seed Extract
  - Has been shown to decrease inflammation, thin the blood and improve vein wall integrity
  - Only recommended for short term use, long term use not adequately studied
  - Has a diuretic effect
  - Can interact with medications such as lithium, diabetes medications and anticoagulation/antiplatelet therapy
  - Precaution recommended with diabetes, liver disease, kidney disease, digestive disease
  - Not recommended for use during pregnancy & breast-feeding
  - Raw horse chestnut seed, bark, flower and leaf are unsafe and may cause death

Reference List

Reference List

- Anderson E, Hansson C and Swanbeck G. Leg and foot ulcer prevalence and investigation of the peripheral arterial and venous circulation in a randomized elderly population: An epidemiological survey and clinical investigation. Acta Derm Venereol 1993;73:57-64
- Guexx JJ. Endovenous chemical (and physical) treatments for varices: What’s new? Phlebology 2014; 29:45-48