Chronic Venous Insufficiency

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Objectives

• Make the clinical diagnosis of chronic venous insufficiency
• Recognize common complications of chronic venous insufficiency
• Understand treatment strategies for chronic venous insufficiency
Agenda

- Epidemiology
- Venous anatomy/pathophysiology
- Diagnosis
- Prognosis
- Treatment strategies
Epidemiology

- CVI is the most common vascular disorder
- 8% Americans have advanced CVD with skin changes/ulcers
- 21,000 patients receive a diagnosis of a venous ulcer annually
Prevalence of Venous Insufficiency

Venous reflux disease is 2x more prevalent than coronary heart disease (CHD) and 5x more prevalent than peripheral arterial disease (PAD)\(^1\)

Prevalence of CVI

Of the estimated 25 million people with symptomatic superficial venous reflux:
- 1.7 million seek treatment annually
- Over 23 million go untreated
CVD

- Varicose vein – 25 million
- Significant edema – 6 million
- Skin changes - 2 million
- Active ulceration – 0.5 million
Economic impact

- Associated with chronic disability, diminished quality of life, and high health care costs
- Venous ulcers cause the loss of 2 million working days and incur treatment costs of approximately $3 billion each year in the US
- 40% of employed persons experience earning capacity limitations due to the venous ulcer
- 5% lose their job

Pathophysiology of CVI

- Venous HTN
  - Obstruction to venous flow
  - Dysfunction of venous valves
  - Failure of the "venous pump"

- Increased venous pressure is directed to the superficial system
Venous System

- Venous blood flows from the capillaries to the heart
- Flow occurs against gravity
  - Muscular compression of the veins
  - Negative intrathoracic pressure
  - Calf muscle pump
- Low flow, low pressure system
Superior epigastric vein
Superior external pudendal vein
Great saphenous vein
Mid thigh (Hunterian) perforator
Popliteal vein
Dodd perforating vein
Boyd's perforating vein
Anterior tributary vein
Posterior arch vein
Posterior tibial vein
Dorsal venous arch
Common femoral vein
Anterior lateral thigh vein
Posterior medial vein
Vein of Giaconini
Intersaphenous vein
Posterior tibial vein
Great saphenous vein
Small saphenous vein
Peroneal vein
Saphenopopliteal junction
Small saphenous vein
Veins in a normal lower leg

Cross section of the lower leg depicting the deep veins surrounded by muscle.
Leg muscle contraction with normal valves

During leg muscle contraction in healthy individual

Normal valve function and blood flow during calf muscle contraction. In a healthy individual there is no flow from the superficial to the deep venous system.
Venous return to right side of heart accomplished thru the actions of the calf muscle pump and venous valves

Damaged valves

During leg muscle contraction and relaxation in a leg with damaged valves

Failure of the valves in the lower leg causes the blood to flow back down into the section of the vein below, reducing venous return to the heart. Perforator valve incompetence results in reflux into the superficial system. This prevents the normal fall in venous pressure that occurs during exercise, resulting in venous hypertension.

Imaged obtained from UrgoMedical
Manifestations of chronic venous insufficiency

Skin discolouration
Eczema
Induration
Venous ulcers
Varicose vein rupture
Leg swelling

Mechanism of varicose vein formation

Incompetent venous valve
- blood flows backward away from the heart and into the superficial system causing venous congestion and high pressures within the superficial veins

Competent venous valve
- ensures the forward flow of blood by preventing reflux of blood during the relaxation phase of the calf muscles

Effects of Venous Hypertension

• Pressures can reach 60 to 90 mm Hg
  – Endothelial damage
  – Altered vessel anatomy
  – Valvular damage

• Microcirculation abnormalities
  – Tissue hypoxia
  – Leaky capillaries
  – Fibrin deposition
  – Leukocyte activation

Leukocyte Activation

• Leukocytes aggregate and adhere to the damaged endothelium and become activated
  – Abnormal vascular permeability and edema
  – Proteolytic enzymes facilitate the formation cutaneous ulcers
  – TGF-β1 fibrogenic cytokine release increases production of collagen

• Extravasated and degraded erythrocytes produce characteristic brown hyperpigmentation

Figure 4: Changes in pressure (measured at the ankle) in the venous system in legs with healthy and defective venous valves during lying, rising, standing and exercise.

Adapted from ref²
### Risk Factors of Venous Insufficiency:
- Gender
- Age
- Heredity
- Pregnancy
- Standing occupation
- Obesity
- Prior injury or surgery
- Sedentary lifestyle

### Symptoms of Venous Insufficiency:
- Leg pain, aching, or cramping
- Burning or itching of the skin
- Leg or ankle swelling
- "Heavy" feeling in legs
- Skin discoloration or texture changes
- Open wounds or sores
- Restless legs
- Varicose Veins
Manifestations of Venous Disease

Superficial venous reflux is progressive and if left untreated, may worsen over time. Below are manifestations of the disease.\(^5\)

- Varicose Veins
- Swollen Legs
- Skin Changes
- Skin Ulcers

- 20+ million
- 2 to 6 million
- 500,000
• **Telangiectasias:** Dilated intradermal and subdermal veins, usually < 1mm in diameter. Also known as “spider veins.”

• **Reticular veins:** 1-3mm in diameter, intradermal, with bluish appear

• **Varicose veins:** subcutaneous, tortuous, and >3mm in diameter

CEAP Classification of CVI

http://www.urgo.co.uk/268-clinical-signs-of-venous-disease#c2
Clinical*

- \( C_0 \) - No clinical signs
- \( C_1 \) - Small varicose veins
- \( C_2 \) - Large varicose veins
- \( C_3 \) - Edema
- \( C_4 \) - Skin changes without ulceration
- \( C_5 \) - Skin changes with healed ulceration
- \( C_6 \) - Skin changes with active ulceration

Etiology*

- \( E_c \) - Congenital
- \( E_p \) - Primary
- \( E_s \) - Secondary
  (usually due to prior DVT)

Anatomy*

- \( A_s \) - Superficial veins
- \( A_d \) - Deep veins
- \( A_p \) - Perforating veins

Pathophysiology*

- \( P_r \) - Reflux
- \( P_o \) - Obstruction

“Early application of compression should be performed to correct swelling and progressive scarring and to initiate the healing process by improving the venous microcirculation.”

Kistner R. Specific Steps to Effective Management of Venous Ulceration. Supplement to Wounds June 2010.

C1

Presence of telangiectasia or reticular veins.
Development of varicose veins
C3

- Presence of venous edema
CVI-Related Edema

• Venous abnormalities -- Hyperpigmentation present
• Subsides with recumbency (*chronic lymphatic obstruction does not*)
• Normal CVP
• Poor or adverse response to diuretics
CVI-related Edema

- Dependent ankle edema
- Progress over time to include the calf region
- May be present only at the end of the day but eventually is persistent
- Often unilateral (L > R) (particularly early)
C4

Trophic changes of venous origin

Atrophie blanche

Varicose eczema

Pigmented purpuric dermatitis
Hemosiderin deposition

- Most prominent at the medial ankle
- Can evolve to involve foot and lower leg
- May predispose to lipodermatosclerosis
Fibrosing panniculitis

- Involves subcutaneous tissue
- Firm area of induration at medial ankle
- Entire leg can become circumferentially involved
- May impede venous and lymphatic flow
- Prone to repeated bouts of cellulitis

C5

Healed ulcer with trophic changes
C6

Presence of 1 or more active venous ulcers
Venous ulceration

• CVI is the **most common cause of leg ulcers**
• Medial ankle
• Multiple or single
• Painful, shallow, exudative with a granulation base
• Can extend circumferentially around the leg

# Venous Ulcers

<table>
<thead>
<tr>
<th></th>
<th>Arterial</th>
<th>Venous</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Site (commonly)</strong></td>
<td>Toes, foot and ankle</td>
<td>Medial gaiter region</td>
</tr>
<tr>
<td><strong>Edges</strong></td>
<td>Sloping and gradual</td>
<td></td>
</tr>
<tr>
<td><strong>Wound bed appearance</strong></td>
<td></td>
<td>Covered with slough</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td></td>
<td>Large</td>
</tr>
<tr>
<td><strong>Exudate level</strong></td>
<td></td>
<td>High</td>
</tr>
<tr>
<td><strong>Pain</strong></td>
<td>Yes</td>
<td>Minimal</td>
</tr>
</tbody>
</table>

![Diagram showing comparison between arteral and venous ulcers](image)
Stasis Dermatitis

- Common and early complication of CVI
- Inflammatory process causing an eczematous rash
- Itching, erythema, inflammatory papules, scaling, weeping, erosions, and crusting
- Excoriations from itching
- Acute stasis dermatitis often mistaken for cellulitis (pseudocellulitis)
Noninvasive Diagnostics

• Severity of symptoms and signs of venous disease correlate with reflux as identified by duplex ultrasound with retrograde flow.
<table>
<thead>
<tr>
<th>Grade</th>
<th>Reflux duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal valve function</td>
<td>Reflux duration of $&lt; 0.5$ sec</td>
</tr>
<tr>
<td></td>
<td>Rapid closure of venous valves</td>
</tr>
<tr>
<td>Moderate reflux</td>
<td>Reflux duration of $0.5 - 1$ sec</td>
</tr>
<tr>
<td></td>
<td>Mild to moderate retrograde flow</td>
</tr>
<tr>
<td>Significant reflux</td>
<td>Reflux duration of $&gt; 1$ sec</td>
</tr>
<tr>
<td></td>
<td>Large volume of retrograde flow</td>
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Treatment Strategy

Reduce Venous Hypertension

• Leg elevation (30 min 3-4 x daily)
• Exercise
• +/- diuretics (typically don’t help)
• Compression stockings
  – Contraindicated in setting severe PAD, acute cellulitis
• Skin Care
  – daily cleansing, use of emollients, and application of barrier protection
  – In setting of itching, mid potency topical steroid
Static Compression Therapy

• Essential component
• Rapid symptomatic improvement (observational data)
• Evidence-based effectiveness for venous ulcers
  — Improved ulcer healing rates
  — Improve rates of secondary prevention
• Hosiery or bandages

Mechanics of Compression Therapy

- Creates pressure gradient from distal to proximal
- Increases deep venous flow velocity and venous return
- Improves lymphatic flow and cutaneous microcirculation
- Decreases ambulatory venous pressure

Compression hose

- Prescription must include size, length, and grade of compression
- **Variations available**: knee-high versus thigh-high, open toe, zippered or fastener based stockings
- Should be put on in the morning after dressings for any ulcer and removed at night
- Compliance relatively low (<50%)
Jobst Relief Compression Pantyhose Firm Support 20-30mmHg - Large Beige Closed Toe
from DiscountSurgical.com
⭐⭐⭐⭐⭐ 40 product reviews

Jobst Relief Compression Pantyhose CLOSED TOE 20-30 mmHg Beige Large Each Jobst Relief Compression Pantyhose CLOSED TOE 20-30 mmHg are great stockings for compression therapy... more »

Size: L : Shop all sizes

$53.40
Free shipping. No tax.

DiscountSurgical.com
⭐⭐⭐⭐⭐ (2,794)

$54.99 Ames Walker
$49.99 ForYourLlegs.com
$49.84 VitalityMedical.com

Compare prices from 10+ stores

Reviews
Tips for Compliance

- Silk liner
- Stockings with a zipper
- Leggings with Velcro fastening bands
- Donning devices
- Lower grade compression stockings (<20mmHg) more beneficial than nothing
- Can be worn over a simple dressing covering an ulcer
Surgical Intervention

• Reduces venous volume in the limb and thereby the effects of venous HTN

• Classified according the method of vein destruction
  – Chemical – irritant agent
  – Thermal – heat through RF or laser
  – Mechanical – removal (vein stripping or stab phlebectomy)
Catheter-based Thermal Treatments

- Radiofrequency ablation (RFA)
- Endovenous laser (EVLA)
- Primarily to treat saphenous insufficiency (great or small), and perforators
- EVLA and RFA, are equally efficacious & have similar recanalization rates
# Rasmussen Randomized Clinical Trial

<table>
<thead>
<tr>
<th></th>
<th>RF Ablation (n=124*)</th>
<th>Endovenous Laser Ablation (n=124*)</th>
<th>Ultrasound-Guided Foam Sclerotherapy (n=123*)</th>
<th>Vein Stripping (n=123*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficacy at 1 year</td>
<td>95.2%</td>
<td>94.2%</td>
<td>83.7% (p&lt;0.001)</td>
<td>95.2%</td>
</tr>
<tr>
<td>(reflux-free rate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Post Intervention Pain</td>
<td>1.21 (p&lt;0.001)</td>
<td>2.58</td>
<td>1.60 (p&lt;0.001)</td>
<td>2.25</td>
</tr>
<tr>
<td>Scores** (1 – 10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to return to normal</td>
<td>1 (p&lt;0.001)</td>
<td>2</td>
<td>1 (p&lt;0.001)</td>
<td>4</td>
</tr>
<tr>
<td>activities (days)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to resume work</td>
<td>2.9 (p&lt;0.001)</td>
<td>3.6</td>
<td>2.9 (p&lt;0.001)</td>
<td>4.3</td>
</tr>
<tr>
<td>(days)</td>
<td></td>
<td></td>
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</table>

*n is the number of patients who returned for follow-up **In the 10-day period post-procedure Note: The ClosureFastTM Catheter was used in this study

Chemical Ablation: Sclerotherapy

Most commonly used for tributaries and reticular veins.

Sodium tetradecyl sulfate, polidocanol, and hypertonic saline most commonly used agents.

Endothelial damage the result of either osmotic action or protein denaturation.
Foam Sclerotherapy: Complications

- Phlebitis
- Skin staining
- Residual lumps
- Embolus (CVA) via PFO
- DVT
- Ulceration (rare)
- Anaphylaxis (very rare)
Foam Sclerotherapy: Outcomes

- Variable depending on series
- Long-term recurrence rates are as high as 65% in five years, however, patients can also be retreated when veins recur
- Large veins can be a problem
- “Part of the arsenal”
The VNUS Closure® System

- The VNUS Closure System is a minimally invasive treatment alternative for patients with symptomatic superficial venous reflux and varicose veins.

- Using a catheter-based approach, the VNUS ClosureFAST™ catheter delivers radiofrequency (RF) energy to the vein wall.

- RF energy creates conductive heating that contracts the vein wall collagen, thereby occluding the vein.
Radiofrequency closure (VNUS Closure System)
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

5. Introducing the ClosureFAST catheter
Efficacy of the ClosureFAST™ Catheter

The ClosureFAST™ catheter ablates the vein in 7cm segments with 20-second treatment cycles, resulting in vein shrinkage and occlusion.

Interim data from a multicenter prospective study have shown 97.4% vein occlusion 1 year post-treatment.⁶
Post-Procedure Instructions

- Ambulate frequently, a minimum of 30 minutes daily
- Avoid heavy/strenuous exercise for a few days
- Avoid prolonged sitting or standing
- Wear compression stockings for up to 2 weeks
- Patient should return for duplex scan within 72 hours

VNUS Closure®
Visual Results

Pre-treatment

One week post-treatment*
Catheter based thermal treatment

- **Contraindications**
  - No reflux on US
  - Pregnancy
  - Acute superficial or deep vein thrombosis
  - Severe PAD

- **Complications**
  - Superficial thrombophlebitis
  - DVT
  - Nerve injury
Benefits

• Improvement in symptoms and appearance of varicose veins as reflected by venous clinical severity scores
• Improved healing and a reduction in venous ulcer recurrence rate
RECOVERY Trial: Venous Clinical Severity Score (VCSS)

RECOVERY Trial: Better Quality of Life

Conclusions

• Symptomatic pts with visibly dilated lower extremity veins should undergo evaluation for venous reflux
• Symptomatic pts with reflux should be referred to a specialist for evaluation and management
• Initial treatment includes leg elevation, exercise, compression therapy
• Pts with persistent symptoms refractory to medical therapy are candidates for invasive treatments
Thank you!