Deep Venous Insufficiency

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Size of the Problem

- Prevalence of severe skin changes are 0.1-17% (roughly 1%)
- Increases to 4%–5% in patients older than age 80
- In USA, there are 6–7 million patients with cutaneous changes and 400,000–500,000 patients with ulcers.

48 y/o with skin discoloration and chronic calf pain. No history of DVT.
Saphenous Ultrasound

GSV only slightly enlarged. Could not elicit reflux
Enlarged Perforators in Calf
Objectives

- Deep vein anatomy and function
- Etiology of venous insufficiency
- Symptoms of chronic lower extremity venous insufficiency
- Clinical diagnosis
- Surgical and percutaneous treatment
Normal Valve Anatomy

- Femoral vein valve above the saphenofemoral junction: 67-93%
- 3-cm-length of the femoral vein below the profundofemoral junction—90-100%
- SFV has average of 2.9 valves

Venous Anatomy—Deep System

- The deep and superficial veins are separated by the fascia overlying the muscles.
- The deep veins within the calf muscle converge to form the popliteal vein.
- They carry 80% of the leg blood return.
Valve Function

- Four consistent phases
- Cycle lasts about 3 seconds
- Function disrupted by leaflet thickening or vein enlargement

Vein Physiology

- The superficial compartment is a low pressure system
- The deep compartment is a high pressure chamber
- The calf muscles pump deep vein blood like a heart
  - The heart muscle is the gastrocnemius and soleus
  - The chamber is a network of sinuses within these muscles
- Perforator veins pierce the fascia and connect the deep veins to the superficial venous system.
  - The valves make sure this is only one way flow
  - Upon contraction of the calf muscles (muscular systole), the valves of the perforating veins close to keep the high pressure of the deep veins from being transmitted to the superficial veins.
  - When the calf muscle relaxes (muscular diastole) the pressure in the deep veins is lower than the pressure in the superficial venous system. Blood then flows from the superficial veins to the deep veins
The Broken Eye Dropper
Signs and Symptoms of Deep Venous Disease

- **Symptoms**
  - Pain
  - Heaviness
  - Swelling
  - Itching
  - Cramps
  - Paresthesias
  - Worsened with standing

- **Signs**
  - Edema
  - Peri-malleolar telangiectasias
  - Venous ectasia
  - Hyperpigmentation
  - Redness
  - Dependent cyanosis
  - Lipodermatosclerosis
  - Healed or open ulcers

Lipodermatosclerosis and Ulceration

- Lipodermatosclerosis is characterized clinically by induration and pigmentation of the skin
- Occurs in the medial malleolar region
- Biopsies show changes are in vein wall and subcutaneous fat

Herrick SE. Int J Low Extrem Wounds. 2002;1:80-6
Classification of Chronic Lower Extremity Venous Disease

- Clinical signs 0-6 (A for asymptomatic, S for symptomatic)
- Etiology (Congenital, Primary disease, and Secondary disease)
- Anatomic Definition (Superficial, Deep, Perforators)
- Pathophysiology (Reflux or Obstruction)

Causes of Chronic Venous Insufficiency

- Primary valve disease
  - Primary reflux is the result of structural abnormalities in the vein wall (too large) or the valve itself
  - Roughly half of all patients presenting with CVI do not have a documented history of a previous DVT
- Secondary valve disease
Venous Insufficiency

Secondary Venous Insufficiency

- Usually present months to years after DVT
- Iliac vein occlusions or stenoses can be treated with PTA and stents
- 33%–75% of all cases of venous ulcerations
- Afflicting as many as two thirds of all patients in whom DVT develops (range, 35%–70%)

Deep Venous Obstruction Presenting as CVI
Chronic Venous Obstruction

- Valve dysfunction
- Segmental occlusions and partial recanalizations
- Collaterals
Superficial Venous Reflux in Deep Vein Insufficiency

- Can be secondary to preexisting deep disease or isolated incompetent perforator veins
- Superficial veins readily visible (varicose vein)
- Usually carry 20% of the venous return from the legs but increased in deep vein disease
Importance of Perforators in CVI

- Incompetent perforator veins observed as often in patients with no skin changes (C0-C3, 78%) as in patients with skin changes (C4-C6, 83%)
- Reflux in all three systems (superficial, deep, perforator) in 46%
- Presence of deep venous reflux increased significantly with prevalence of skin changes or ulcer (C4-C6); odds ratio 2.7
- Prevalence of skin changes or ulcer was twice as high in patients with axial deep vein incompetence compared with patients with segmental deep vein incompetence

The Two Systems are Inseparable

- In patients with severe CVI,
  - venous valvular reflux involves deep vein as an isolated abnormality in less than 10%
  - CVI is associated with superficial reflux or/and perforator incompetence in 46%

When Should You Do a Work-up for Chronic Deep Venous Disease

- Patients with a high clinical score (4-6)
- Patients with history of DVT or possible DVT
- Symptomatic patients without superficial insufficiency
- Anyone under consideration for stripping or ablation
36-year-old female with history of left ankle venous stasis ulcer
Ultrasound Borderline Abnormal

- 0.5 second of reflux in GSV
- No large or incompetent perforators
Chronic DVT Missed on Duplex
Diagnosis of Chronic Venous Insufficiency

- History and physical
- Imaging:
  - Duplex U/S
  - Venography
  - Phlebography
Reflux Venogram
Venography Findings in CVI

- Descending phlebography findings
  - Reflux in the superficial femoral vein (51%)
  - Combined reflux in the superficial femoral and the deep femoral veins (44%)
  - Isolated deep femoral vein reflux in 5%
- Ascending phlebography findings
  - Dilated popliteal vein
  - Filling of profunda vein
  - Decreased valve count

Duplex Ultrasound

- Duplex scanning provides both hemodynamic and anatomic information
Upright or supine?

- Reflux in the upper thigh veins is similarly demonstrated by cuff deflation and 15 degree reverse Trendelenburg valsalva techniques.
- Upright testing necessary for duplex below the knee

Treatment for Deep Venous Insufficiency

- Conservative measures
- Laser or RF treatment of superficial veins
- Sclerotherapy, endoscopic closure, thermal ablation, or phlebectomy of incompetent perforators
- Internal and external revision of valves
- Artificial valves
Conservative Management

- Class III 30-40 mm Hg Support stockings (most use Class II for superficial disease)
  - Calf height, thigh height or panty height
  - Screen for arterial disease prior to prescribing these stockings
- Unna Boot (impregnated with a non-hardening zinc oxide paste)
- Pentoxifylline (Trental)
- Elevation

Surgical Indications

- Recommend surgery in patients with severe disease (grade C4-6)
- Secondary deep venous reflux (mainly post-thrombotic syndrome) treated after failure of conservative management are not convincing.
Percutaneous Bovine Valve Insertion

Lyophilized Small Intestinal Submucosa on Z stent

Treat GSV in Combined Deep- Superficial Reflux?

- Superficial and perforating vein incompetence accounts for a substantial and correctable component of venous insufficiency in limbs with combined deep and superficial vein reflux and venous ulceration
- Surgical correction of this component significantly improves clinical symptoms and venous hemodynamics

Treating Superficial Reflux in Deep Reflux Patients

- Several studies have shown benefit
- 40 limbs with C4-6 treated with superficial vein stripping despite signs of perforator or deep system insufficiency
  - Only one worsening symptoms
  - 70% of ulcers healed

Treatment of Perforators

- Difficult to treat percutaneously
  - Sclerotherapy
  - RF or laser ablation
- May be inadequate response
52 y/o women with painful swelling and healed ulceration
Diagnosis

- Evaluated deep and superficial system with duplex ultrasound
  - Enlarged incompetent GSV
  - No deep system reflux in femoral or popliteal
  - Several large incompetent perforators in calf
Management

- Treated enlarged incompetent GSV
  - Puncture site was made peripheral as possible to exclude perforators
- Sclerotherapy was performed on residual varicose veins
Follow-up

- Visible veins were successfully removed
- One year follow-up--no recurrent ulcers and pain gone
- Presence of incompetent perforators and deep system insufficiency may make varicose veins persist after endovenous ablation of an abnormal saphenous vein
- Treat residual superficial veins and incompetent perforators with sclerotherapy or phlebectomy
Conclusions

- Complete duplex examination is recommended prior to any treatment
- Majority of chronic deep venous insufficiency is not related to prior DVT
- Treatment of superficial varicices may prevent recurrence of venous ulcers
- Early results with percutaneous valves are encouraging