Update on Chronic Venous Disease Treatment

By: Gabriel Bietz
Chronic venous disease

- Most common vascular disorder
- 3 Billion US dollars spent a year for treatment
- 3 % of the total Heath care Budget
- 2 million USA work days lost per year
Definition

- **Telangiectasias** - are a confluence of dilated intradermal venules less than one millimeter in diameter.

- **Reticular veins** - are dilated bluish subdermal veins, one to three millimeters in diameter. Usually tortuous.

- **Varicose veins** - are subcutaneous dilated veins three millimeters or greater in size. They may involve the saphenous veins, saphenous tributaries, or nonsaphenous superficial leg veins.
Abnormal Veins

Telangiectasias

Reticular veins

Varicose vein
Common Questions

- Are they dangerous?
- How do they form?
- Why does it happen?
- Did I inherit it?
- What tests can we use?
- What treatments are available?
Fascia, Veins and Cutaneous nerves of the LE

- The subcutaneous tissue of the hip & thigh is continuous with that of the inferior abdominal wall and buttock.
- At the knee the subcutaneous tissue loses its fat and blends with the deep fascia.
- Deep fascia: strong & inelastic it invests the LE; it limits outward expansion of the contracting musculature, the increased pressure “pumps” the blood proximally through the veins.
Deep fascia of the thigh (fascia lata)

The fascia lata attaches to and is continuous with:

1. The inguinal ligament, pubic arch, body of the pubis and pubic tubercle.
2. Scarpa’s fascia of the inferior abdominal wall attaches to deep LE fascia inferior to the inguinal ligament.
3. Iliac crest (lateral & posterior).
4. Sacrum, coccyx, sacrotuberous ligament, ischial tuberosity posteriorly.
5. Exposed parts of bones at the knee & deep fascia of the leg.
LE Compartments

- Anterior & Posterior intermuscular septa – pass from the deep crural fascia to attach to the margins of the fibula.
- Interosseous membrane traverses from tibia to fibula
- (4) compartments created.
  - Anterior - dorsiflexors
  - Lateral - fibular (everter) compartment
  - Posterior – plantarflexor compartment
  - The transverse intermuscular septum divides this into a deep & superficial compartment.
Crural fascia

- Deep fascia to the leg – continuous with the fascia lata, attaches to the anterior & medial borders of the tibia; it is continuous with the periosteum.

- Thinner distally but thickens to form an extensor/flexor retinaculum both anterior & posterior to the ankle.
Superficial veins

**Great saphenous** – formed by the union of the dorsal digital vein of the great toe and the dorsal venous arch.

- Ascends anterior to the medial malleolus, posterior to the medial condyle of the femur. It freely communicates with the small saphenous vein.
- Proximally it traverses the saphenous opening in the fascia to enter the femoral vein.
Saphenous opening

- **NAVEL**
- This is a gap in the fascia lata infero-lateral to the inguinal ligament, lateral to the pubic tubercle.
- Medial margin is smooth
- Lateral margin is sharp forming the falciform ligament
- Cribiform fossa – a sleeve like membrane covering the saphenous opening
Small saphenous vein

- Formed by the union of the dorsal digital vein of the 5th digit and distal venous arch.
- Runs posterior to the lateral malleolus, lateral to the calcaneal tendon.
- Runs superiorly medial to the fibula and penetrates the deep fascia of the popliteal fossa, ascends between the heads of the gastrocnemius muscle to join the popliteal vein.
Perforating veins

- Penetrate the deep fascia, tributaries of the saphenous veins, valves are located just distal to penetration of the deep fascia.
- Veins cross the deep fascia obliquely
- Muscle contraction causes the valves to close prior to venous compression so blood is forced proximally (musculo-venous pump).
Deep Veins

- Usually paired with named arteries inside a vascular sheath, this allows arterial pulsation to force blood proximally.
- The popliteal vein joins the femoral vein in the popliteal fossa.
- Femoral vein is joined by the deep vein of the thigh. The femoral vein passes deep to the inguinal ligament to become the external iliac vein.
Lymphatic drainage of LE

Superficial Lymphatics
- Superficial lymphatic vessels accompany the saphenous veins (great & small)
- Superficial lymphatics end at the superficial inguinal nodes; most of this lymph drains to the external iliac nodes, some drains to the deep inguinal nodes.
- Small lymphatics drain to the popliteal nodes

Deep Lymphatics
- Deep lymphatics drain to the popliteal nodes which then drain to the inguinal nodes then to the external iliac nodes.
- Both deep & superficial drain into the lumbar lymphatics.
Varicose veins are a common condition in the United States, affecting up to 15 percent of men and up to 25 percent of women.

For many people, varicose veins and spider veins — a common, mild and medically insignificant variation of varicose veins — are simply a cosmetic concern.

For other people, varicose veins can cause aching pain and discomfort.

Sometimes the condition leads to more serious problems.

Varicose veins may also signal a higher risk of other disorders of the circulatory system.

Etiology

- Reflux 80%
- Venous obstruction 18-28%
  - Resultant edema and skin changes = Postthrombotic syndrome
- Muscle Pump Dysfunction
Stasis Pathophysiology

- Usually associated with venous incompetence
- Primary and secondary reflux
- Edema
- Vein wall dilatation
- Inflammation/Pigmentation (Hemosiderin deposits)
- “Fibrin cuffing”
- Ulceration
Risk factors

- **Age:** Aging causes wear and tear. Eventually, that wear causes the valves to malfunction.

- **Sex:** Women > Men. Hormonal changes during pregnancy or menopause. Progesterone relaxes venous walls. HRT / OCP may increase the risk of varicose veins.

- **Genetics**

- **Obesity:** Increases venous HTN.

- **Standing for long periods of time.** Prolonged immobile standing impairs venous return.

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Strong familial component

- Not well studied
- Twin studies 75% identical, 52% non identical
- If both parents VVS - 90% of children VVs
- If one parent was affected 25 percent for men and 62 percent for women

Symptoms

- Achy or heavy feeling, burning, throbbing, muscle cramping and swelling.
- Prolonged sitting or standing tends to intensify symptoms.
- Pruritis
- Painful skin ulcers
Complications

- Extremely painful ulcers may form on the skin near varicose veins, particularly near the ankles.
- Brownish pigmentation usually precedes the development of an ulcer.
- Occasionally, veins deep become enlarged.
- Bleeding
- Superficial thrombophlebitis
## CEAP classification

<table>
<thead>
<tr>
<th>Clinical signs</th>
<th>Class 0</th>
<th>No visible or palpable signs of venous disease</th>
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<tbody>
<tr>
<td>Class 1</td>
<td>Teleangiectases or reticular veins</td>
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<td>Class 5</td>
<td>Skin changes as defined above with healed ulceration</td>
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<td>Class 6</td>
<td>Leg ulceration, skin changes as defined above</td>
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| Etiologic classification     | Congenital, primary, secondary |
| Anatomic distribution        | Superficial, deep, or perforator, alone or in combination |
| Pathophysiologic dysfunction | Reflux or obstruction, alone or in combination |
Patient Assessment

- **History**
  - History of symptoms and onset
  - History of venous complications
  - Desire for treatment
  - Comorbidities
  - Rule out secondary cause including DVT and HEART Failure

- **Examination**
  - Patient in general
  - Pedal pulses
  - Groins
  - Veins
    - Trendelenburg Test
    - Venous claudication
Investigation

- All get a Duplex scan
- Examines
  - Deep veins
  - Superficial veins
  - Incompetence and patency

Other Tests
Physiologic testing
Phlebography
Intravascular Ultrasound
**Duplex scan**

- Vast majority have superficial incompetence only.
- Sensitivity 95% for identifying the competence of the saphenofemoral and saphenopopliteal junctions.
- Less sensitive for identifying incompetent perforators (40 to 60 percent)


Treatment

- Conservative
  - Leg elevation
  - Exercise
  - Compression stockings
  - Treatment of other underlying conditions
  - Nothing
Vein ablation therapies

Classified by method of vein destruction:

1. Chemical (sclerotherapy)
2. Thermal (laser or endovenous ablation)
3. Mechanical (surgical excision or stripping)
Who gets sclerotherapy

- Small non-saphenous varicose veins (less than 5 mm),
- Perforator veins
- Residual or recurrent varicosities following surgery
- Telangiectasia
- Reticular veins
Who gets Sclerotherapy

Who else

– Good control with Trendelenburg
– Recurrent veins
– Frail with resistant/healed ulcers


Sclerosing Agents

- Sodium tetradecyl sulfate
- Hypertonic Saline
- Polidocanol
- Monoethanolamine oleate
- Glucose combinations

- Damage endothelium leading to thrombosis of the vein.
- Pressure to try and reduce the amount of thrombus.

Microsclerotherapy

- 30 g butterfly needle
- 0.2% STS
- Several courses required

benefit compression
Telangiectasias
Foam Sclerotherapy

- 1:4 Sclerosant (1% or 3%): Air
- Why foam?
  - Induces spasm
  - Disperses further
  - Enhanced sclerosis

Spider veins
Foam Sclerotherapy: Complications

- Phlebitis
- Skin staining
- Failure
- Residual lumps
- Matting
- Embolus (CVA)
- DVT
- Ulceration (rare)
- Anaphylaxis (very rare)
Foam Sclerotherapy Results

- Variable depending on series
- Long-term recurrence rates are as high as 65 percent in five years, however, patients can also be retreated when veins recur
- Large veins can be a problem
- Currently randomized trial
- Part of the arsenal

Catheter-based Treatments

- Endovenous laser EVLA
- Radiofrequency ablation RFA
- Primarily to treat saphenous insufficiency (great or small)
- EVLA and RFA, are equally efficacious & have similar recanalization rates.

Radiofrequency ablation devices (ClosureFast™, RFiTT®, ClosureRFS™) generate a high frequency alternating current in the radio range of frequency.


Radiofrequency ablation

Heats the tissue surrounding the catheter electrode to a specified temperature. Radiofrequency works well on tissue composed primarily of collagen.

Special probes have been designed for the radiofrequency device to manage non-saphenous and perforator veins.
Varicose veins
Endovenous Laser
Endovenous Laser

- Devices (EVLT®, ClosurePlus™)
- Use a bare tipped optical fiber which applies laser light energy to the vein.
- Therapy based on photothermolysis (light induced thermal damage).
- Laser light heats the target tissue inducing thermal injury.
- Wavelength of light is chosen based on the target structure's chromophore.

Wavelengths of light used for venous laser therapy

Surface laser therapy

- Telangiectasias, reticular veins and small varicose veins <5mm
- Not used for larger varicose veins
Post op care

- Graduated compression stockings are worn following the procedure.
- F/U duplex ultrasound is performed within one week to evaluate for thrombus in the common femoral vein.
- Pt recovery averages two and four days, significantly shorter interval than is seen with surgical ligation and stripping.

Endovenous complications

- Pain, bruising, hematoma
- Skin changes: burns, induration, pigmentation, matting, dysesthesia, & superficial thrombophlebitis.
- Nerve injury
- DVT
- Wound infection


Surgery

- Thermal ablation techniques are limited by an upper limit of vein diameter (>1.5 cm)
- Procedure is performed under general or spinal anesthesia
- Indications include management of superficial thrombophlebitis, and venous hemorrhage

Surgery

Saphenous vein stripping
- Cryostripping
- High saphenous ligation
- Ambulatory phlebectomy
- Stab/avulsion phlebectomy
- Transilluminated phlebectomy TIPP
- Perforator ligation
- Subfascial endoscopic perforator vein ligation (SEPS)

Saphenous vein stripping

- Traditional surgical approach
- Involves first ligation then division of either the great saphenous (incision in the groin) or small saphenous vein.
- Duplex ultrasound to identify the saphenopopliteal junction.
Cryostripping

- Variation of traditional saphenous stripping
- Limited to Great Saphenous vein
- Vein freezes adhering to the device and the vein is stripped
- Less postoperative bruising than conventional stripping
- Requires specialized instrumentation
High saphenous ligation

- Ligation of the saphenous vein at the saphenofemoral junction only
- Uncommonly performed in treating saphenous incompetence b/c of higher varicose vein recurrence rates.
- Technique for patients who develop superficial phlebitis (idiopathic or iatrogenic from endovenous therapies) w/ extension of clot to the saphenofemoral junction
- Performed if PT cannot be anticoagulated
Other Techniques

- Ambulatory phlebectomy
- Stab/avulsion phlebectomy
- Transilluminated phlebectomy TIPP
- Perforator ligation
- Subfascial endoscopic perforator vein ligation (SEPS)
Subfascial endoscopic perforator vein ligation (SEPS)

- Indicated for pts with refractory symptoms, ulceration, recurrent ulceration. Pt who failed Cath based treatment
- Two ports each placed subfascially
- Perforators divided electrocautery, harmonic scalpel or clipped
- 20 studies involving 1140 limbs in total, found overall ulcer healing in 88 percent of treated limbs
- Repeat SEPS if perforators persist

Subfascial endoscopic perforator vein ligation (SEPS)
Contraindications

- Systemic illness
- Tortuous vein
- Hypercoagulable state
- Pregnancy
- Obstructed Deep veins
Which is Better ???

- Endoluminal thermal ablation versus stripping of the saphenous vein: Meta-analysis of recurrence of reflux.
- ES Xenos, G Bietz, DJ Minion, et al
Endoluminal thermal ablation versus stripping of the saphenous vein: Meta-analysis of recurrence of reflux.

Method: Systematic search of Medline/Pubmed, OVID, EMBASE, CINAHL, Clinicaltrials.gov and Cochrane central register

- 1966-2009 in all languages
Method

- Randomized prospective clinical trials with > 365 days f/u.
- Analyzed outcomes included recurrence of varicosities and reflux, as documented by duplex ultrasound, and recurrence of signs and symptoms.
Results

- 8 randomized controlled trials were included
- 497 patients total
- 226 L/S
- 271 endoluminal thermal ablation
- F/U 584 SD182 days.
Conclusion

- Catheter-based treatments and traditional venous stripping with high ligation have similar long-term results.
- Catheter-based treatments have a decreased post op pain, shorter recovery time to work and normal activity.
- Poster Presented at American Venous Form 21st Annual Meeting Phoenix, Arizona Feb 2009
Questions ?
Which is Better ???

- RFA & laser ablation are highly successful in achieving vein closure and have high patient satisfaction rates as well.
- Laser > RFA treating perforator veins.
- A meta analysis evaluating stripping, foam sclerotherapy, and endovenous therapies in the treatment of the saphenous vein concluded that minimally invasive therapies were as effective as surgical stripping with long term success rates of 78 to 84 percent [72].
- Endovenous laser therapy was found to be significantly more effective than stripping, foam sclerotherapy and radiofrequency ablation. However, the early technical success rates for radiofrequency ablation were inferior to laser ablation and newer radiofrequency catheter technology (ClosureFast®) achieving higher temperatures has achieved improved results [77].
- Endovenous ablation (EVLA, RFA) is associated with less perioperative pain compared to surgical vein stripping, with patients requiring fewer days out of work and less pain medication [67-69]. Radiofrequency ablation compared to laser ablation is associated with greater improvement in these periprocedural recovery parameters [77]. Laser ablation is consistently associated with more pain and bruising than radiofrequency ablation and continued evaluation of varying
EVLA

- The key to success with EVLA is making the correct diagnosis and careful patient selection.
- The straighter the vein the easier it will be to pass the laser fibre across the length of the segment which requires therapy.
- Large diameter veins
Discussion thoughts

- For both the radiofrequency and endovenous devices, the endovenous catheter is placed percutaneously with local anesthesia via a sheath typically placed at the level of the knee and advanced with ultrasound guidance to the proximal vein. After additional local anesthesia is injected along the vein, the device is activated. Energy transferred to the blood and vein wall results in immediate intimal loss and subsequent thrombosis of the vein [69]. Vein wall thickening, inflammatory change and ultimately fibrotic closure of the vein occurs over time.

- Saphenous vein stripping - The traditional surgical approach involves first ligation then division of either the great saphenous (incision in the groin) or small saphenous vein (incision based upon duplex ultrasound to identify the saphenopopliteal junction). The procedure is performed under general or spinal anesthesia, and the patient typically goes home the same day [78].

- Cryostripping is a variation of traditional saphenous stripping and is limited to the treatment of the great saphenous vein. It involves the placement of a special instrument to the level of the previously ligated and divided saphenous junction and supercooled. The vein freezes, adhering to the device and the vein is stripped. The advantage of this method is less postoperative bruising compared to conventional stripping but it requires specialized instrumentation [79].

- High saphenous ligation - Ligation of the saphenous vein at the saphenofemoral junction alone without additional treatment of the saphenous vein is uncommonly performed in treating saphenous incompetence because of higher varicose vein recurrence rates.
Efficacy of endovenous techniques — Both radiofrequency and laser ablation are highly successful in achieving vein closure and have high patient satisfaction rates as well [60-62,74,75,76]. Success rates in treating perforator veins (RFA) are worse compared to the treatment of the saphenous vein [76].

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- Laser ablation is consistently associated with more pain and bruising than radiofrequency ablation and continued evaluation of varying laser parameters (wavelength, fluence) is needed to determine the optimal settings.

- Surgery — Surgical methods have largely been supplanted by the lesser invasive ablation therapies discussed above. However, patients with very large veins are best treated with surgical therapy. Thermal ablation therapies are limited by an upper limit of vein diameter (>1.5 cm) that can be treated effectively and endovenous treatment of these large veins is associated with a higher incidence of venous thromboembolism. Surgical options are limited in patients with a high risk for anesthesia.

- Additional indications for surgical management include management of superficial thrombophlebitis, and venous hemorrhage. (See “Varicose vein complications” above).

- Several surgical techniques are available and are chosen based upon the location, size, and extent of the patient’s varicosities and reflex.

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- High ligation - Ligation of the saphenous vein at the saphenofemoral junction alone without additional treatment of the saphenous vein is uncommonly performed in treating saphenous incompetence because of higher varicose vein recurrence rates.

- Some advocate this technique for patients who develop superficial phlebitis (idiopathic or iatrogenic from endovenous therapies) with extension of clot to the saphenofemoral junction, and who cannot be adequately treated with Foam sclerotherapy and laser ablation.

- Ambulatory phlebectomy - Various methods of vein excision and/or ligation are applied to non-saphenous veins.

- Stab/avulsion phlebectomy removes varicose vein segments through very small (<5 mm) incisions often with the use of special fine surgical hooks (eg, Muller). Incisions (only as long as needed to remove the vein) are made along its course. The veins are avulsed and removed and pressure is applied to the incision site to control bleeding. This technique is used to treat non-saphenous varicose veins or residual varicose veins following saphenous ablation.

- Transilluminated powered phlebectomy (TIPP) is a minimally invasive technique which uses an illuminator (light source) placed subcutaneously through a stab incision enhancing the visualization of the veins. Non-saphenous veins targeted for removal are suction aspirated with a separate device with rotating blade and suction port [80,81]. The only advantage identified with this technique is the need for fewer incisions [80,81].

- Perforator ligation - Endovenous perforator ablation and subfascial perforator ligation are preferred over a direct incisional technique.

- Open perforator ligation is uncommonly used in the treatment of severe venous skin changes or ulcer because it necessitates placing an incision in a region of venous stasis. The surgical wound is often a source of secondary ulceration if perforator ligation is not successful in reducing venous pressures in the skin. (See “Liquid and foam sclerotherapy” above and see “Endovenous catheter ablation” above).

- Subfascial endoscopic perforator vein ligation (SEPS) - Subfascial endoscopic perforator vein ligation is indicated for patients with refractory symptoms or ulceration, or those with venous insufficiency with venous incompetence involving perforator veins [67,68,82].

- SEPS is performed through two ports each placed subfascially via skin incisions in a location away from areas of active skin change or ulceration [83]. Insufflation with carbon dioxide and balloon dissection of the subfascial space helps visualize calf perforators, which are divided (electrocautery, harmonic scalpel) or clipped.

- A systematic review of 20 studies involving 1140 limbs in total, found overall ulcer healing in 88 percent of treated limbs, with a 13 percent recurrence rate at a mean of 21 months [86]. Risk factors for nonhealing and ulcer recurrence were similar and included the presence of postoperative incompetent perforators, larger ulcer size (>2 cm), and secondary venous insufficiency (eg, postthrombotic).

- Patients with recurrent ulcers following SEPS should have a duplex scan and repeat SEPS if perforators persist [87].

- Postoperative care and complications — Postoperative pain is common and typically relieved with acetaminophen with codeine. Patients are encouraged to ambulate immediately after surgery along the treatment pathway, which can last for up to six weeks following surgery. Regardless of the surgical method used, the application of compression therapy in the form of elastic wraps (eg, Ace) or graduated compression stockings helps limit bruising and swelling (show table 3). (See “Medical management of lower extremity chronic venous disease”, section on Compression stockings).

- Time off work varies between one and three weeks depending upon the patient’s job requirements and the magnitude of the operation.

- The most common complications of vein ablation surgery are bruising and hematoma formation. The use of a tourniquet during surgery helps to limit blood loss [88]. Other complications include wound infection, hyperpigmentation, telangiectatic matting, phlebitis (superficial or deep) and saphenous nerve injury (frequency 10 percent) [89].

- Post-surgical telangiectatic matting and hyperpigmentation typically improve over time, however, can be treated with surface laser therapy if persistent [90].

- Efficacy of surgery — Surgical therapy is the standard to which the more minimally invasive techniques are compared.

- Surgical intervention improves symptoms, and the overwhelming majority of patients are satisfied with their procedure. As an example, 150 symptomatic patients who underwent varicose vein surgery in Britain were found at six months after surgery to have significant improvements in pain, energy, physical function, and mental health compared with preoperative levels [18]. Symptoms resolved completely in 22 percent and most patients felt their surgery was successful (64 percent). Disease-specific and general quality of life improvements persisted for at least two years [91].

- The traditional surgical technique is associated with vein recurrence rates of at least 20 percent [26] and is even higher if great saphenous ablation is not performed [89].