Endovenous Laser Ablation

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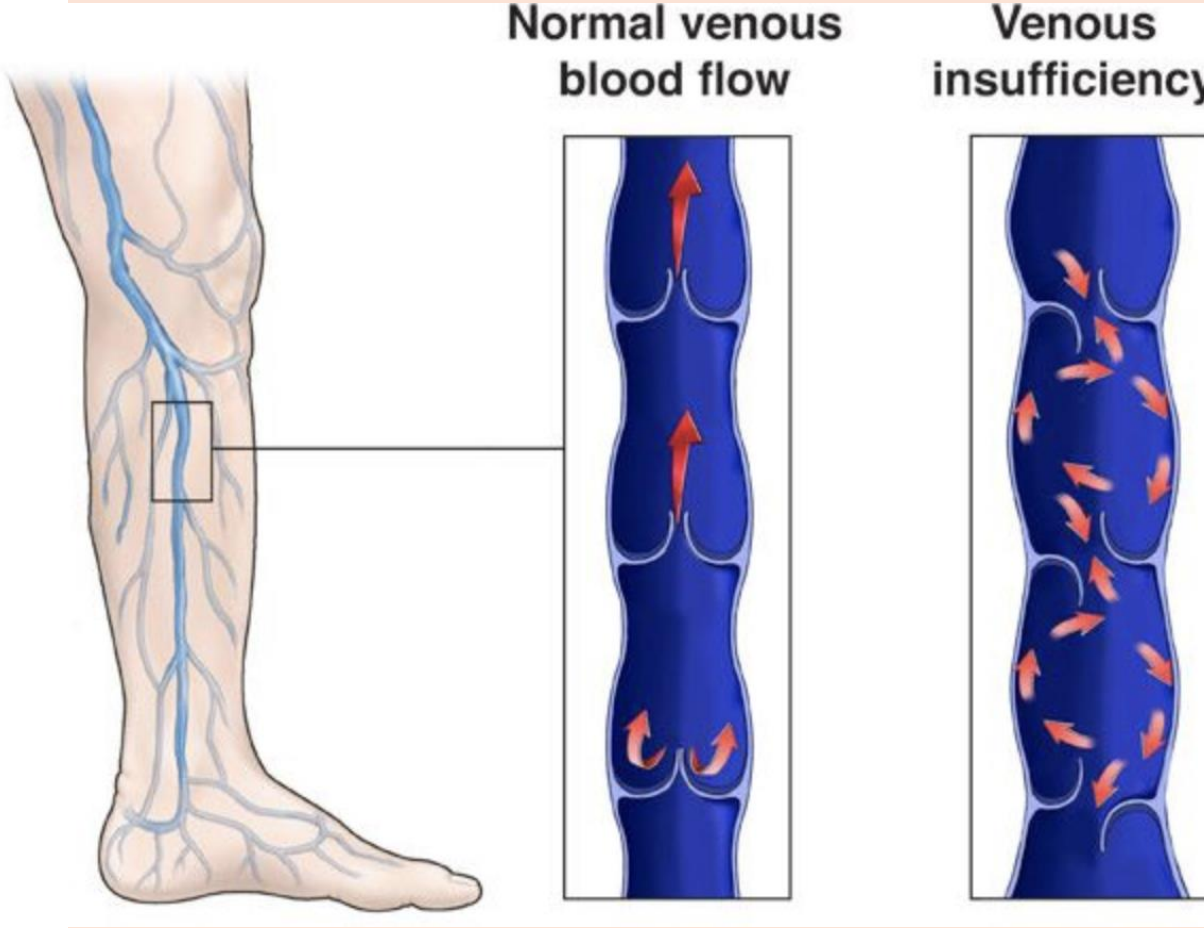
What Is Chronic Venous Insufficiency?

- Impaired blood flow to the heart from the lower extremities due to malfunction of valves in the leg veins.



Definitions

Telengiectasias – confluence of dilated intradermal venules

< 1mm

Reticular veins – dilated, bluish, subdermal veins

1-3 mm

Varicose veins – Involve saphenous and tributaries. >3 mm

Abnormal Veins

Telangiectasias

Reticular Veins

Varicose Veins

Common Questions

Are they dangerous?

How do they form?

Why does it happen?

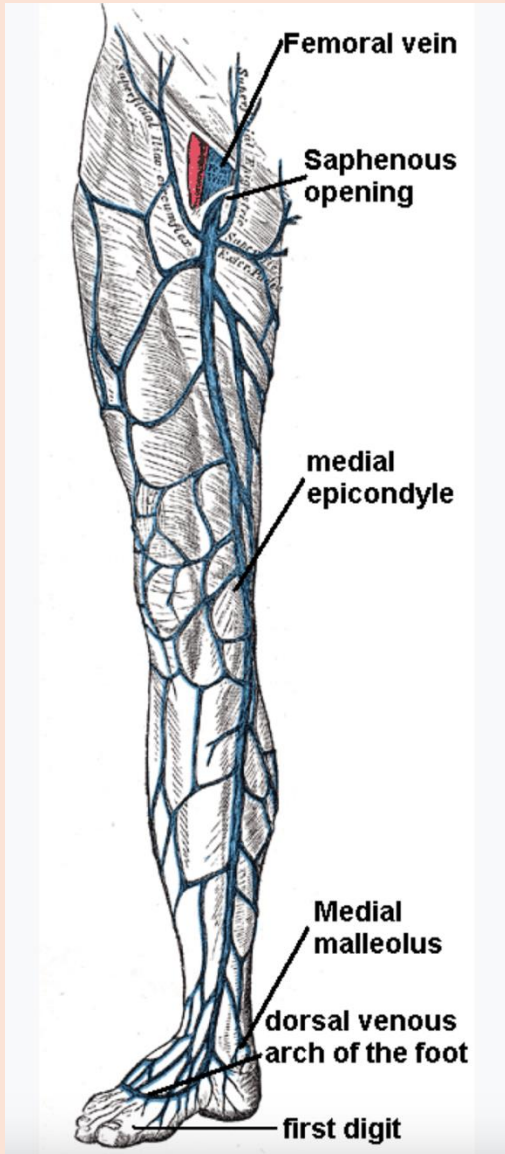
Did I inherit it?

What tests can we use?

What treatments are available?

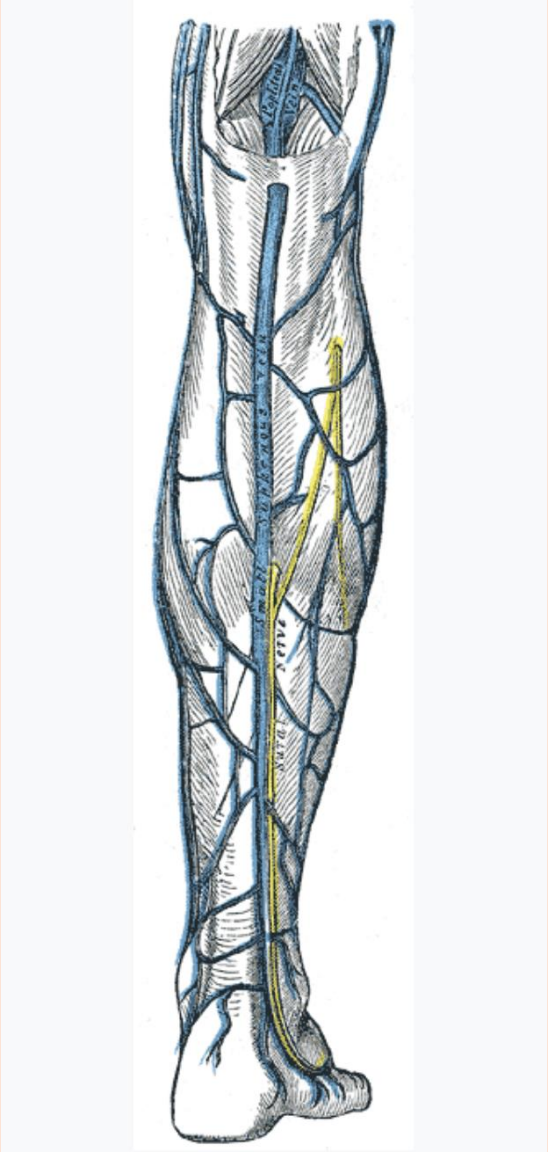
Superficial Veins: Great Saphenous

- 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.
- Freely communicates with the small saphenous vein
- Proximally, traverses the saphenous opening in the fascia to enter the femoral vein



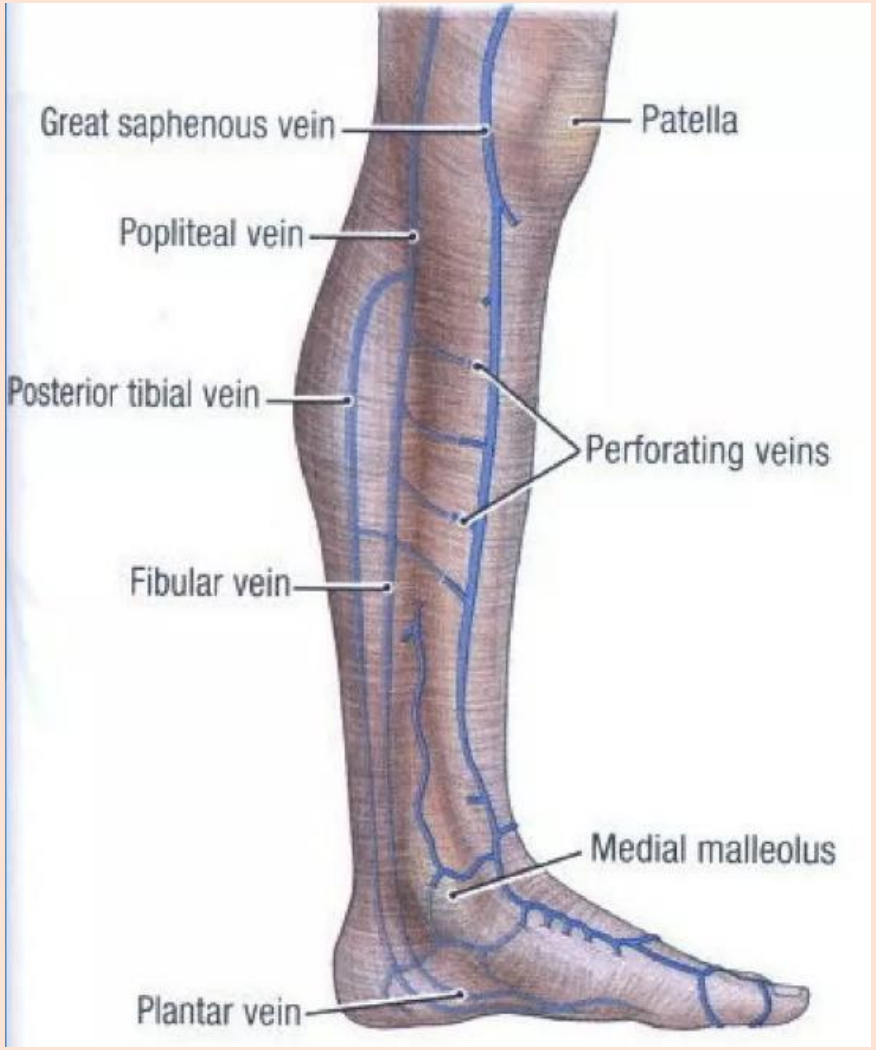
Superficial Veins: Small Saphenous

- Formed by the union of the dorsal digital vein of the fifth digit and the 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 muscles to join the popliteal vein



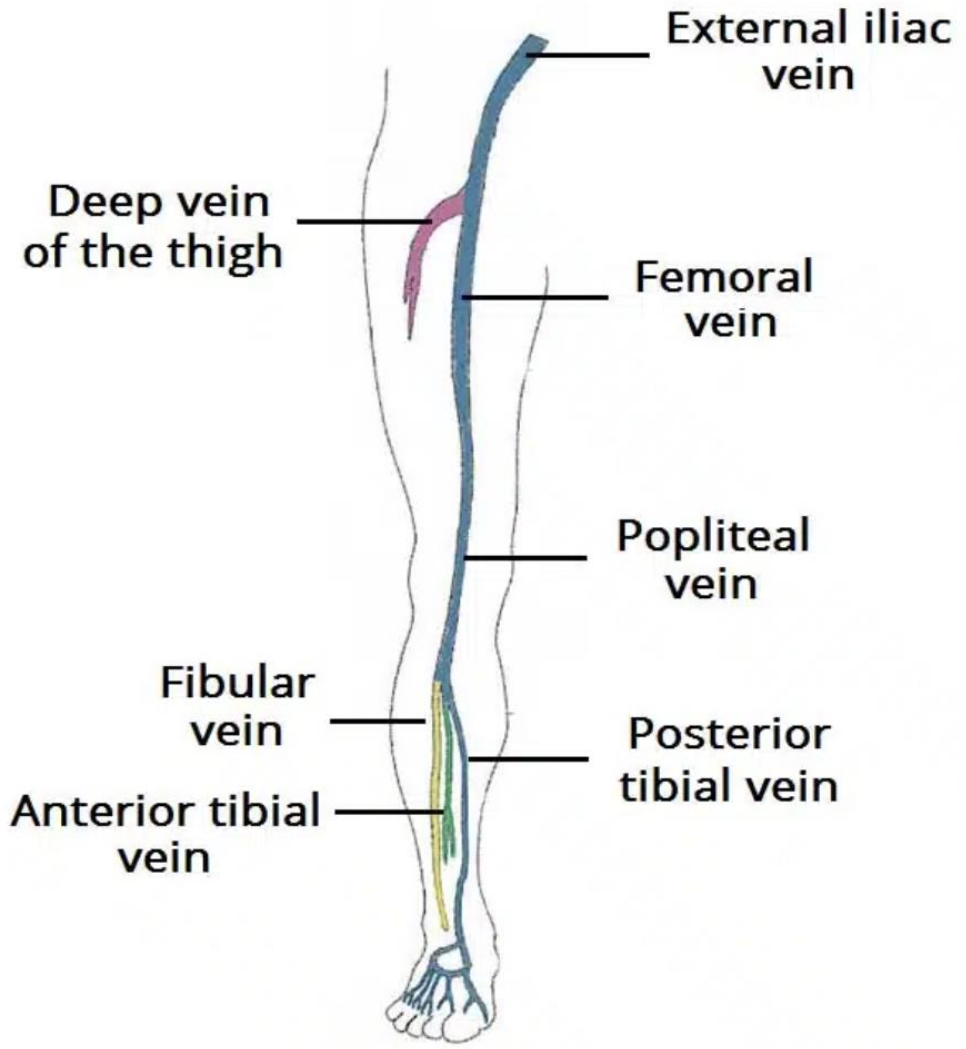
Perforating Veins

- Penetrate the deep fascia, tributaries of the saphenous veins, valves located distal to the 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, allowing arterial pulsation to force blood proximally
- Popliteal vein joins the femoral vein in the popliteal fossa
- Femoral vein is joined by the deep vein of the thigh. Femoral vein passes deep to the inguinal ligament to become the external iliac vein



Etiology

Reflux >80%

Venous obstruction 18-28%

- Resultant edema and skin changes = post thrombotic 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: Wear and tear → valves malfunction
- Sex: F > M. Hormone changes pregnancy/menopause →progesterone relaxes venous walls. OCP increases risk of varicose veins
- Genetics
- Obesity: Increases venous hypertension
- Standing: Prolonged immobile standing impairs venous return

Strong Familial Component

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

- Painful ulcers on the skin near varicose veins, particularly near ankles
- Brownish pigmentation usually precedes development of an ulcer
- Bleeding
- Superficial thrombophlebitis

Indications for EVLT or RFA: CEAP Classification

- **C**linical
  - C0: No visible or palpable signs of venous disease
  - C1: Telangiectasias or reticular veins
  - C2: Varicose veins
  - C3: Edema
  - C4: Skin changes ascribed to venous disease
    - a. Pigmentation/eczema
    - b. lipodermatosclerosis/atrophie blanche
  - C5: Skin changes as defined previously with healed ulcer
  - C6: Skin changes as defined previously with active ulcer
- **E**tiologic: Congenital, primary, secondary, or none
- **A**natomic: Superficial, perforator, deep, or none
- **P**athophysiologic: Reflux, obstruction, both or none

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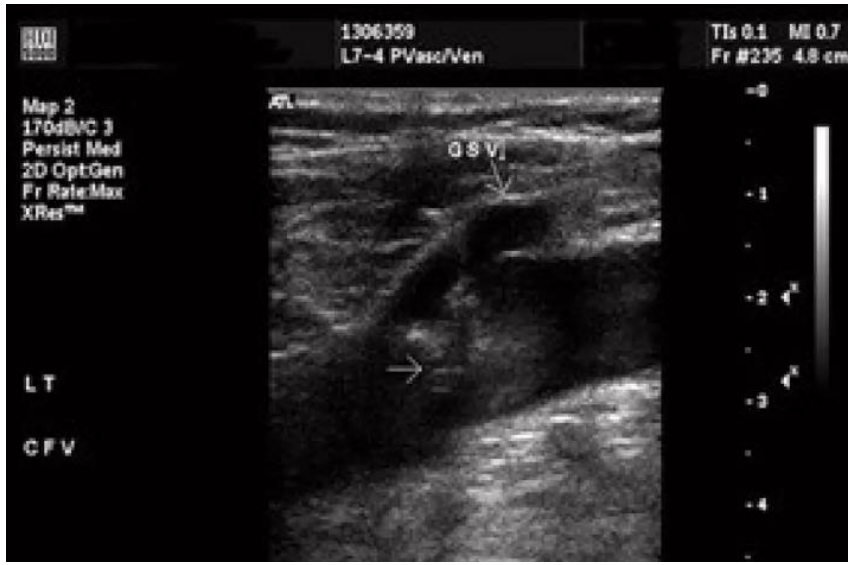
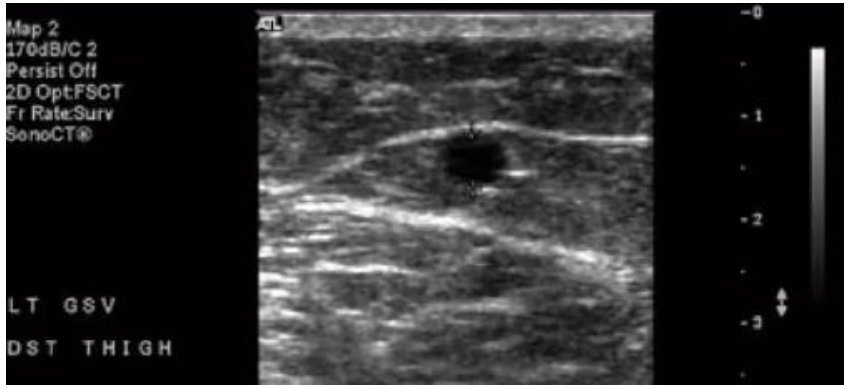
Most common

- **E**tiologic: Congenital, primary, secondary, or none
- **A**natomic: Superficial, perforator, deep, or none
- **P**athophysiologic: Reflux, obstruction, both or none

Investigation

- All get a duplex scan
- Examines
  - Deep veins
  - Superficial veins
  - Incompetence and patency
- Other tests
  - Physiological testing
  - Phlebography
  - Intravascular ultrasound





Duplex Scan

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

Treatment

- Conservative
  - Leg elevation
  - Exercise
  - Compression stockings
  - Treatment of other underlying conditions

Vein Ablation Therapies

- Classified by method of vein destruction
  - Chemical (sclerotherapy)
  - Thermal (laser or endovenous ablation)
  - Mechanical (surgical excision or stripping)

Who Gets Sclerotherapy?

- Small non-saphenous varicose veins (<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
- Polidoconol
- Monoethanolamine oleate
- Glucose combinations

- Damage endothelium leading to thrombosis of vein

Microsclerotherapy

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

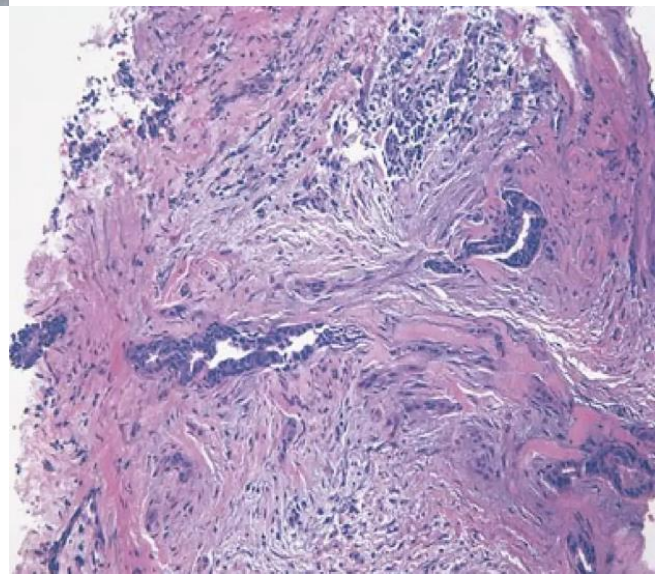
Telangiectasia

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

Foam Sclerotherapy: Results

Foam Sclerotherapy

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



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 up to 65% in 5 years, but patients can be retreated
- Large veins can be a problem

Catheter-based Treatments

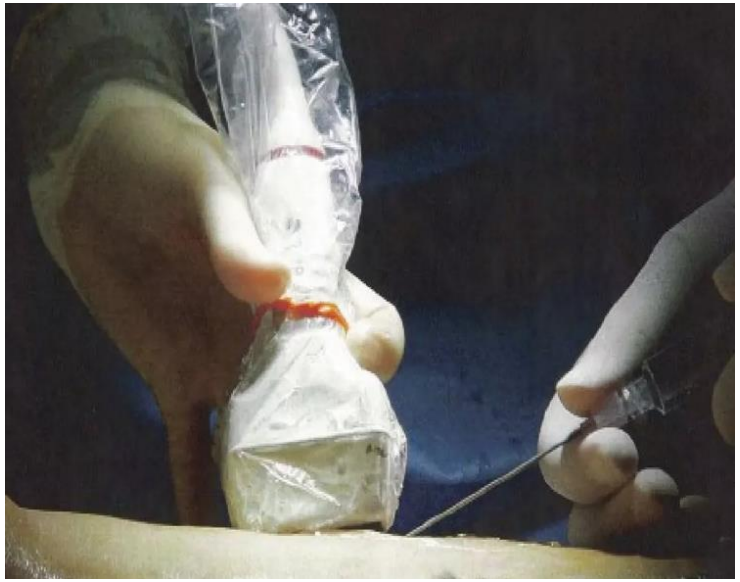
- **Endovenous laser EVLA**
- **Radiofrequency ablation RFA**
- Primarily to treat saphenous insufficiency (great or small)
- EVLA and RFA are equally efficacious and have similar recanalization rates

Radiofrequency ablation RFA

- Generate a high frequency alternating current in the radio range of the electromagnetic spectrum
- Mechanism:
  - By directing resistive RF energy through a vein, a narrow rim of tissue <1 mm is heated
  - Amount of heating is modulated using both a microprocessor and manual movement, resulting in controlled collagen contraction, thermocoagulation and absorption of the vein

Radiofrequency ablation RFA: Methods

- Percutaneous access to the great saphenous vein most commonly at the level of the knee under duplex ultrasound guidance
- A guidewire advanced to the SF junction over which the closure catheter is passed
- Catheter prongs are extruded to contract the intimal lining of the vessel wall
- RF generator allows the tip of the catheter and the prongs to attain a temperature of 85 degrees C



Endovenous Laser

Endovenous Laser

- 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 energy
- Wavelength of light is chosen based on the target structure's chromophore

Endovenous Laser: Mechanism

- Thermal reaction after laser exposure is essential
- Damages endothelial, intimal elastic lamina, and to some degree the media. Adventitia is rarely affected
- In vitro studies suggest that energy results in “boiling of blood” and generation of “steam bubbles” that indirectly, homogenously affect the varicose vein

Endovenous Laser: Methods

- GSV entered at the knee
- Guidewire passed through hollow needle into the vein, can be difficult if:
  - Tortuosity
  - Local venous spasm
  - Sclerotic fragments
- Needle removed
- Introducer sheath placed over guidewire
- Guidewire removed when at the SFJ
- Longitudinal US visualization of sheath 1-2 cm distally to the SFJ

EVLA & RFA: Methods

- Tumescent anesthesia (5 mL epi, 5 mL bicarb, 35 mL 1% lidocaine in 500 mL saline) is administered to the perivenous space resulting in:
  - Reduction of pain
  - Protection of perivenous tissue through cooling
  - Increase in surface area of laser tip and vein wall

Post – Op Care

- Graduated compression stockings are worn following the procedure
- Follow-up duplex ultrasound is performed within 1 week to evaluate for thrombus in the CFV
- Pt recovery averages 2-4 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

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Endoluminal Thermal Ablation v. Vein Stripping: Which is Better?

- Meta-analysis of recurrence of reflux
  - ES Xenos, G Bietz, DJ Minion, et. al.
- Randomized prospective clinical trials with >365 days f/u
- Analyzed outcomes including recurrence of varicosities and reflux, as documented by duplex ultrasound, and recurrence of signs and symptoms

Endoluminal Thermal Ablation v. Vein Stripping: Which is Better?

- Meta-analysis of recurrence of reflux
  - ES Xenos, G Bietz, DJ Minion, et. al.
- 8 randomized controlled trials were included
- 497 patients total
- 226 L/S
- 271 endoluminal thermal ablation
- f/u 584, SD 182 days

Endoluminal Thermal Ablation v. Vein Stripping: Which is Better?

- Meta-analysis of recurrence of reflux
  - ES Xenos, G Bietz, DJ Minion, et. al.
- Catheter-based treatments and traditional venous stripping with high ligation have similar long-term results
- Catheter-based treatments have decreased post-op pain, shorter recovery time to work and normal activity