Lower Extremity Venous Disease and Ulcers: Back to the Basics

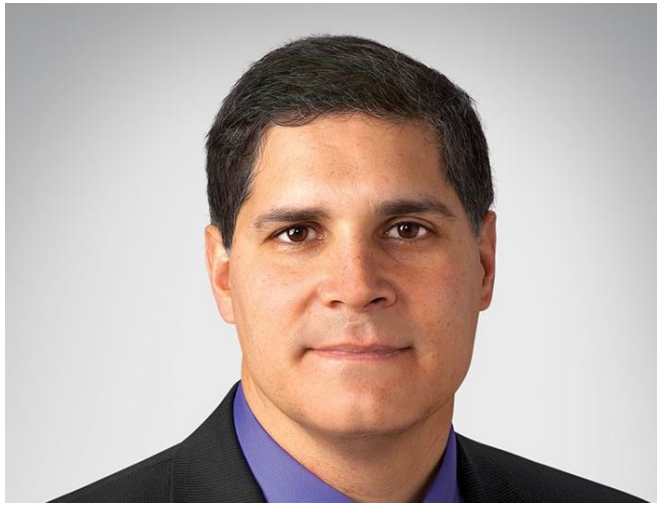
Catherine Go, MD

UPMC Vascular Surgery

September 23, 2022

Disclosures

- None



Disclosures

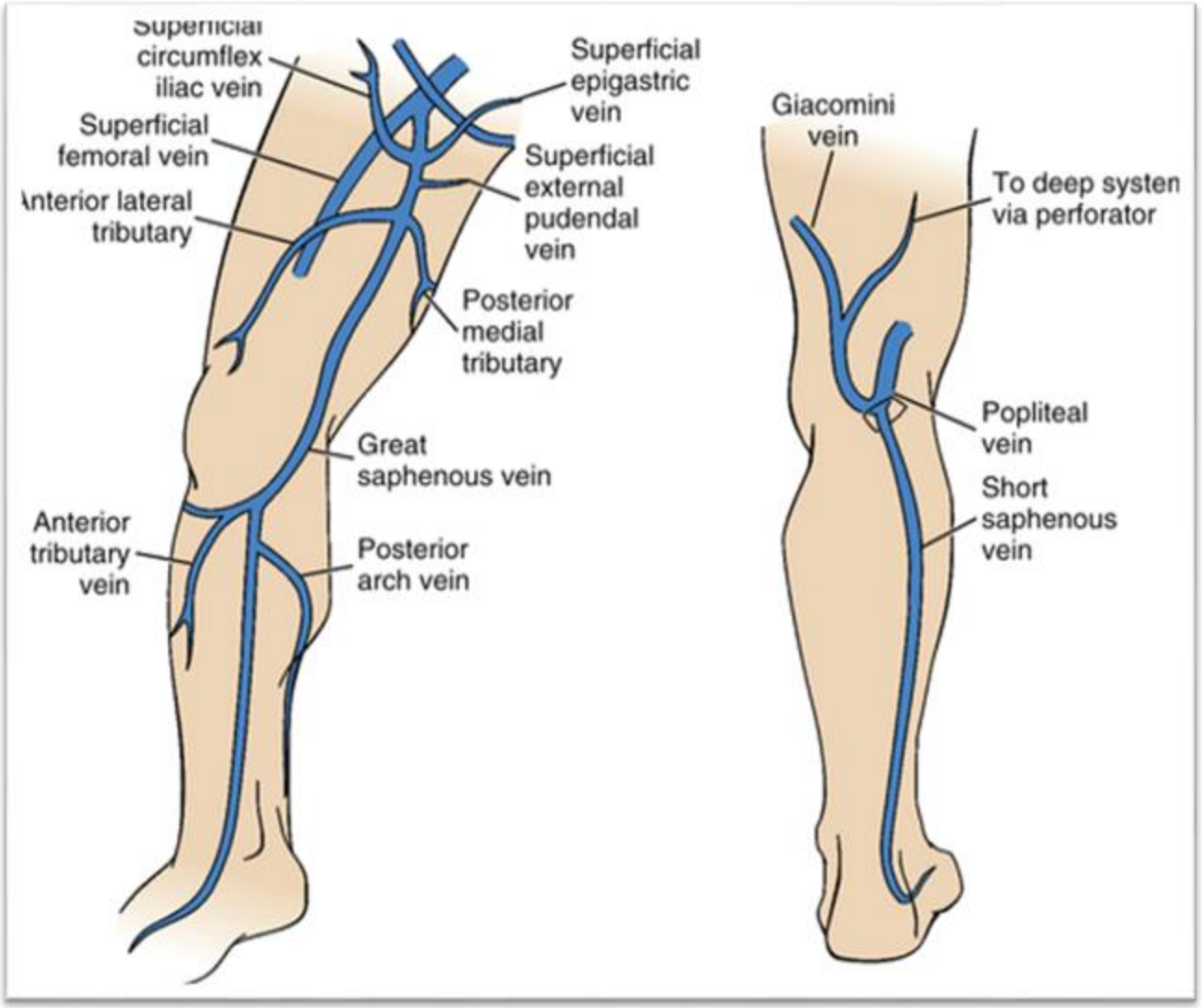
- None

Outline

- Anatomy
- Physiology
- Epidemiology
- Pathophysiology
- Classification
- Treatment

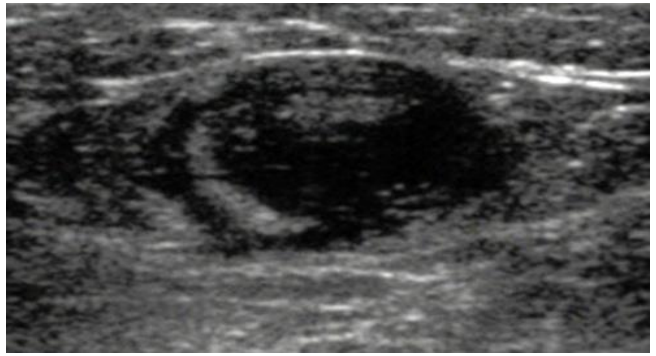
Anatomy

- Superficial system



Great Saphenous Vein

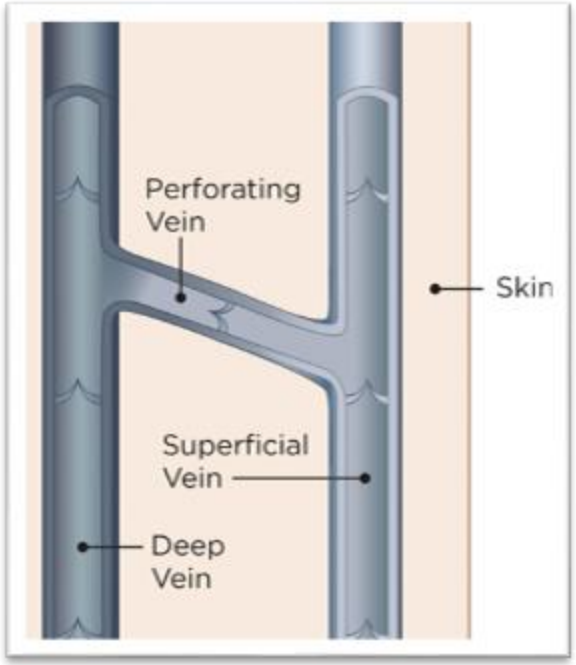
- Often runs a superficial subcutaneous course from mid thigh-knee
- May enter and exit the saphenous sheath at various locations
- Closely associated with saphenous nerve below mid-calf
- Saphenofemoral junction (SFJ): convergence of inguinal veins - numerous normal variants

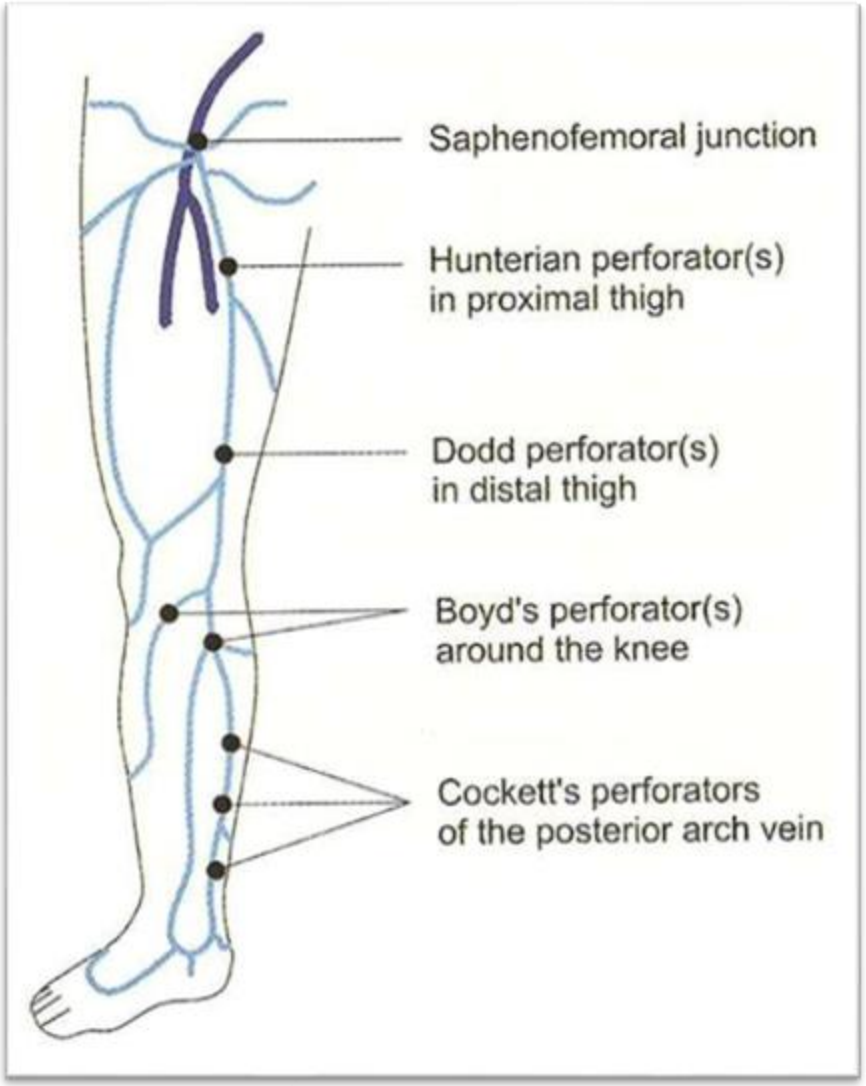


(Gloviczki, P. (Ed.) (2009). Handbook of Venous Disorders. (3rd ed.). London:Hodder Arnold)

Anatomy

- Perforators

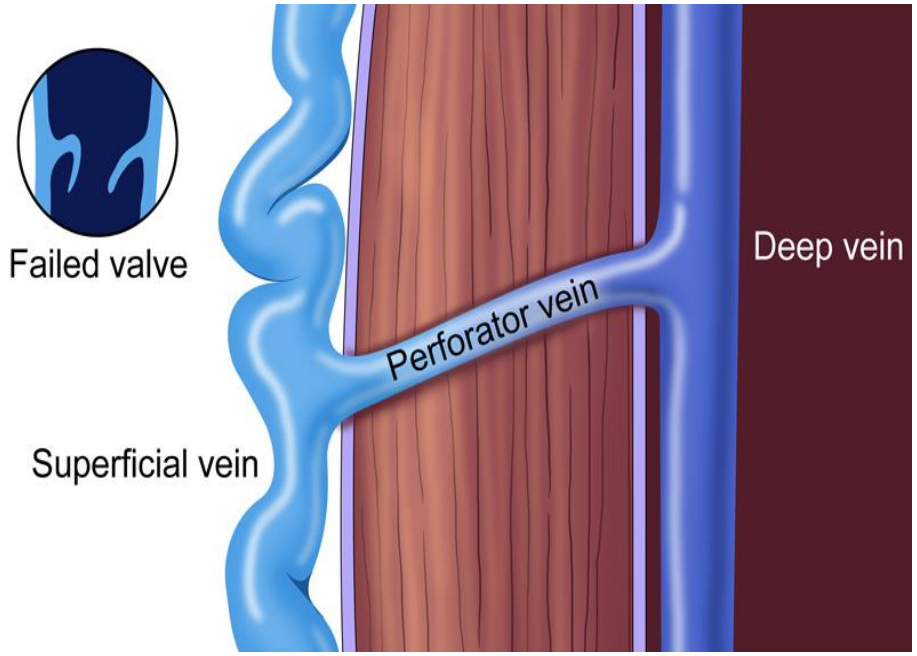




Pathologic Perforator Veins

Current SVS guidelines

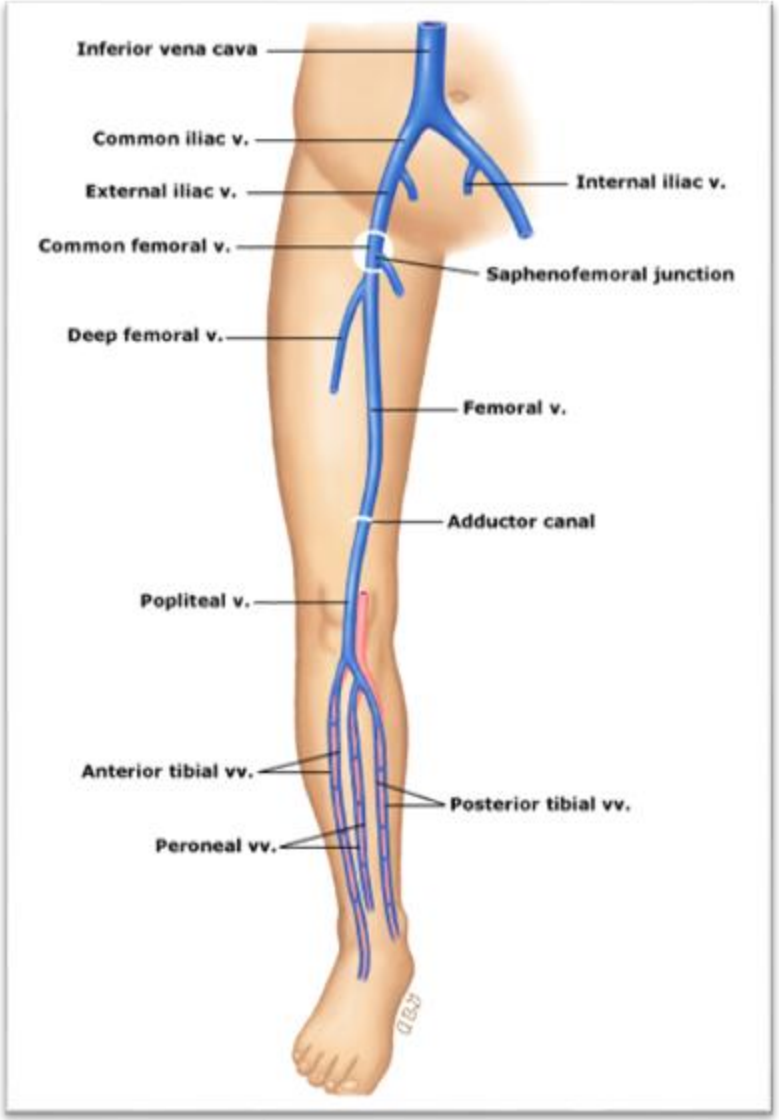
- ✓ ≥3.5mm in size,
- ✓ Retrograde flow ≥500 ms duration, and
- ✓ located beneath chronic venous stasis skin changes/ulcer (C4b-6)



Gloviczki. P., Comerota, A.J., Dalsing, M.C., Eklof, Bo. G., Gillespie, D.L., Gloviczki, M, et al. (2011). *J Vasc Surg; 53, Number 16S, page 38S.*

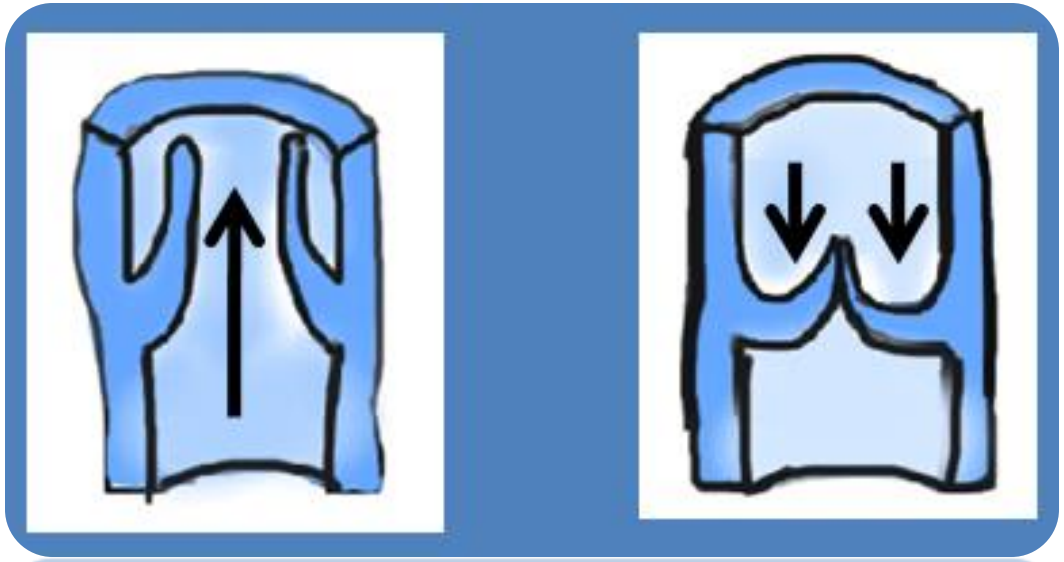
Anatomy

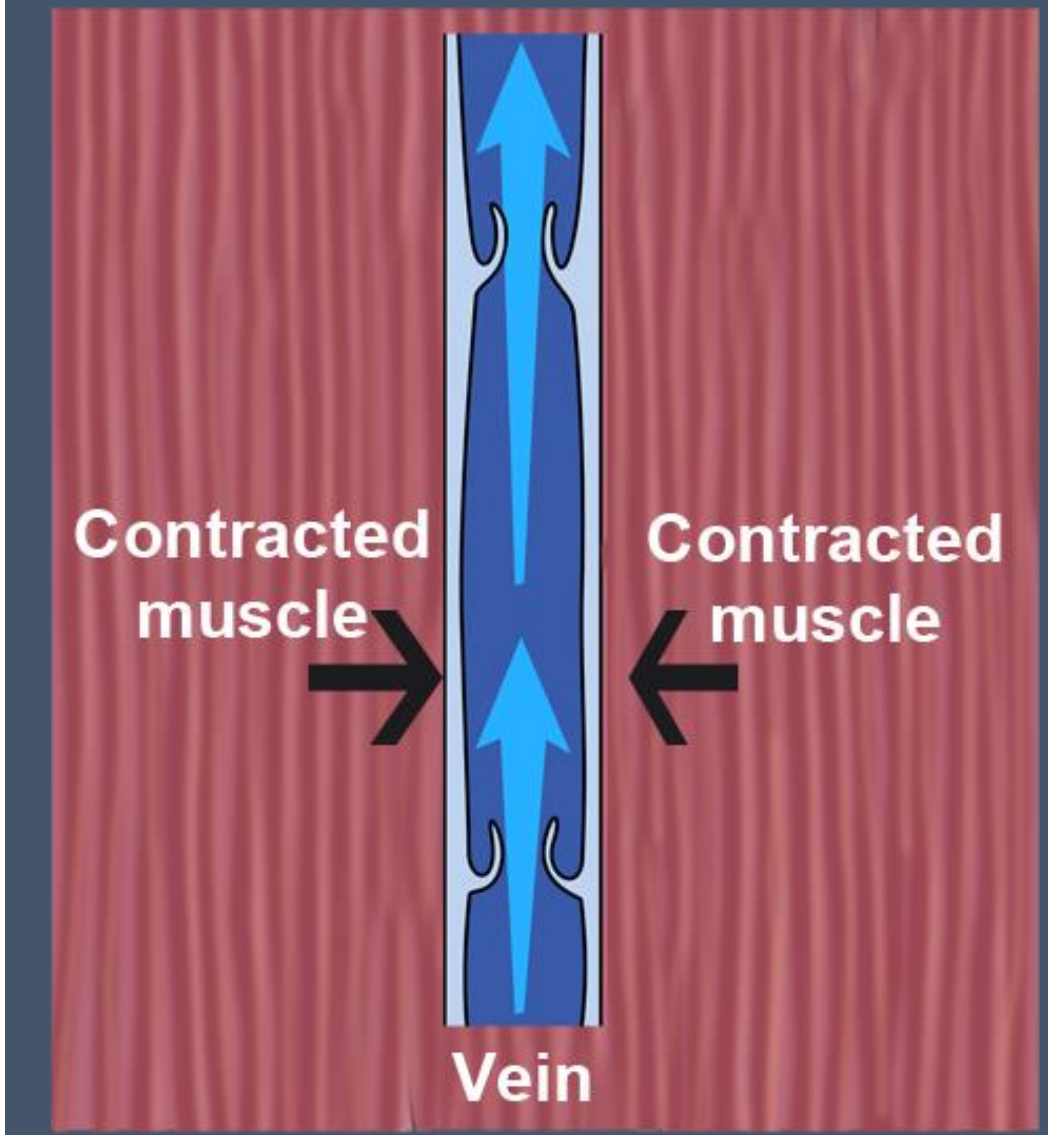
- Deep system

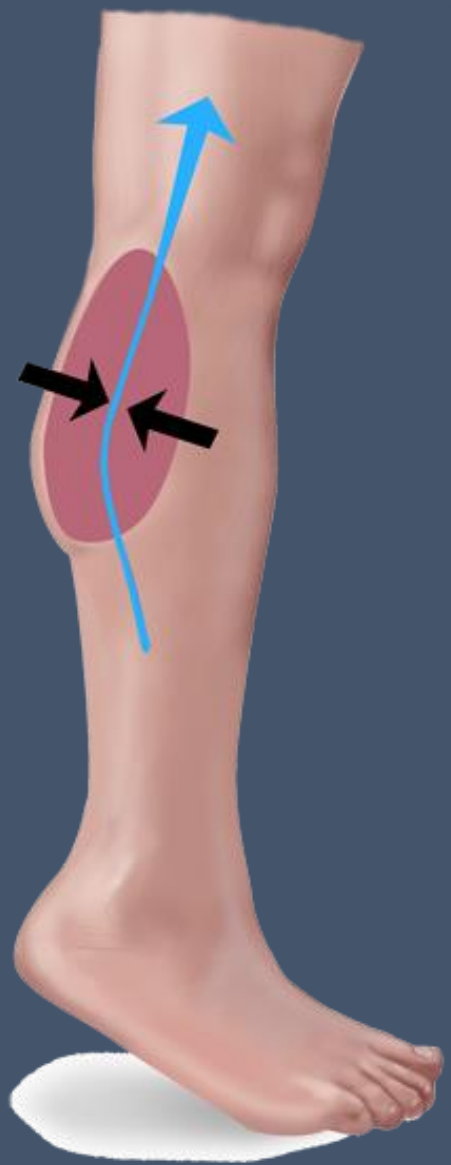


Physiology

- Normal venous pressure ranges between 12-18 mmHg
- Dependent extremity 30-100 mmHg
- Walking 10 steps can reduce to 22 mm Hg
- Valves compartmentalize blood







Calf muscle contracts forcing venous blood toward heart

Physiology

To move blood effectively and overcome hydrostatic and intra-abdominal pressures, veins must:

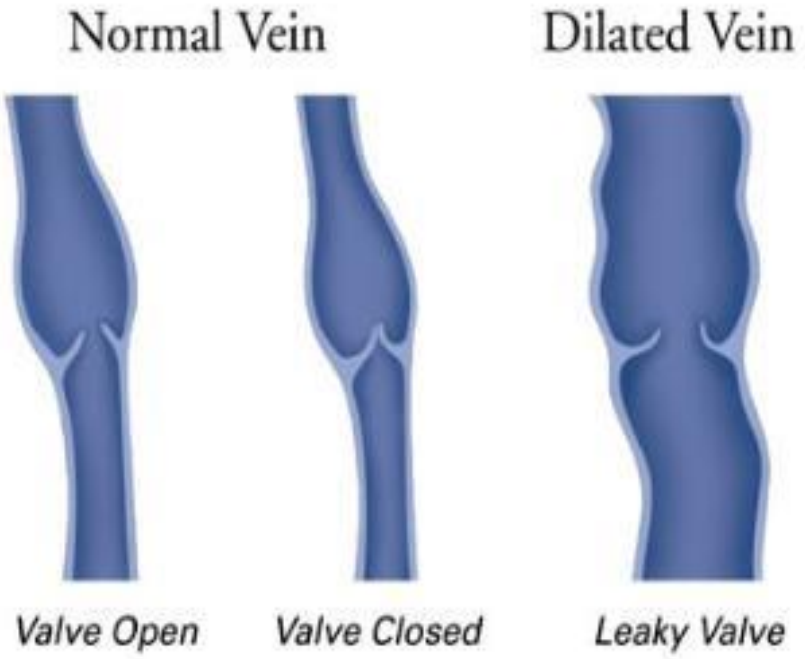
- Be unobstructed
- Have functional valves
- Be supported by effective muscle pumps

Chronic Venous Insufficiency (CVI)

- Signs and symptoms due to functional abnormalities of the venous system
- Over 12 million patients in U.S.
- More than 40% of women have abnormal veins by age 50
- Symptoms: heaviness, swelling, aching, itching, and ulceration

Pathophysiology

- Valvular dysfunction reduces emptying and leads to hypertension
- Incompetent valves in perforators can increase pressure in superficial system

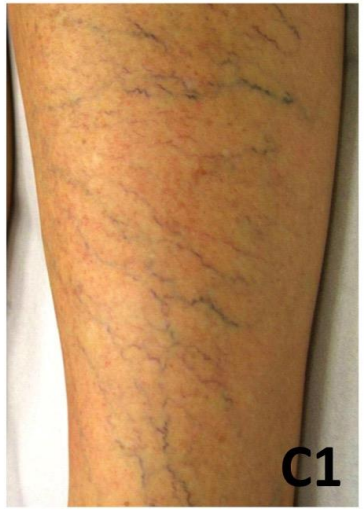


Venous Hypertension

- Precipitating factor for all venous disease
- **C**EAP classification by severity of **C**linical Manifestations

Clinical Class	Characteristics
0	No visible signs of venous disease
1	Telangiectasias or reticular veins
2	Varicose veins (> 3mm diameter)
3	Edema
4a	Eczema or pigmentation
4b	Lipodermatosclerosis or atrophie blanche
5	Healed venous ulcer
6	Active venous ulcer

CEAP



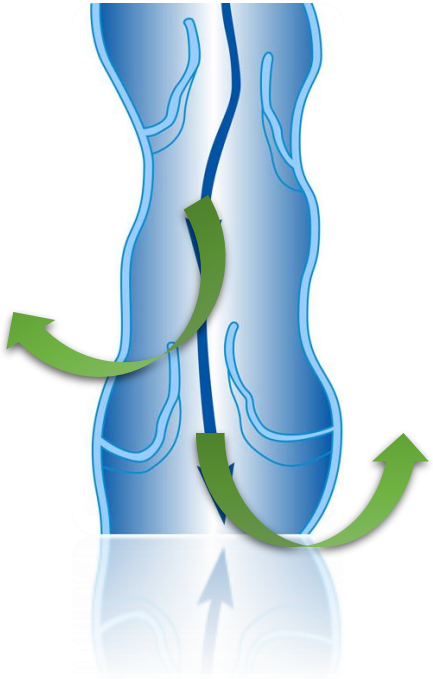
C1 and C2

- Spider telangiectasias

- Varicose veins

C3

- Edema
- Venous hypertension causes fluid accumulation in subcutaneous tissue



C4

- Hemosiderosis
  - Extravasation of RBC and heme oxidation
- Lipodermatosclerosis
  - Chronic inflammation/scarring due to fibrin deposition
- Atrophie Blanche
  - Smooth, white avascular, sclerotic areas prone to ulceration

C5 and C6

- C5 - healed ulcer
- C6 - active ulceration

Venous Ulcers

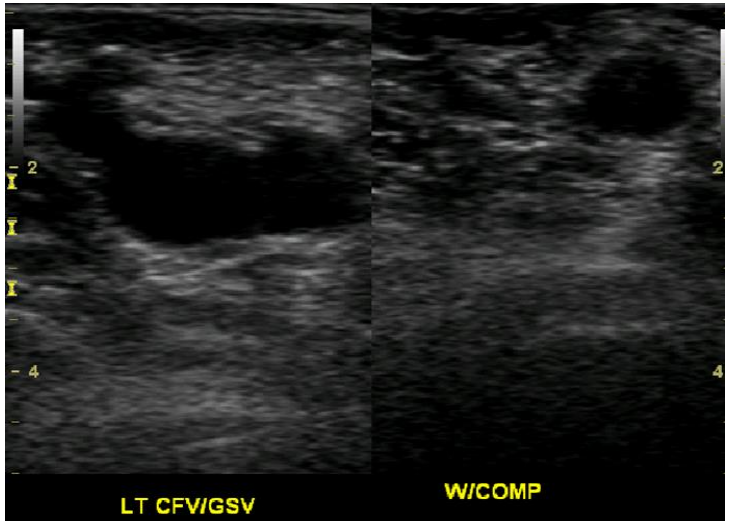
- Defined by American Venous Forum: *open skin lesion that occurs in an area affected by venous hypertension*
- US prevalence of 1%
- 41% of all wounds seen in wound clinics are venous
- Average time to healing 22 months costing $2500/month

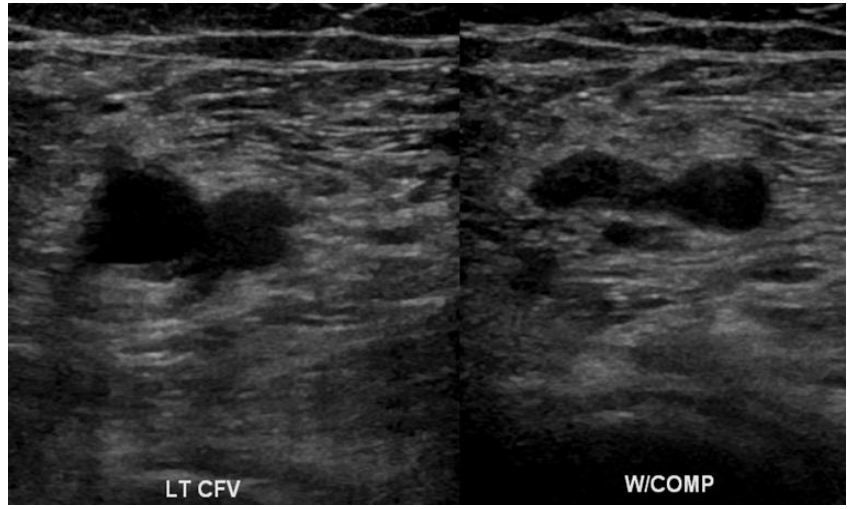
Clinical Evaluation

- Evaluate for other signs of CVD
- Rule out other causes of ulcers
- Document size of ulcer
- Arterial evaluation including ABI
- Venous duplex ultrasound

Duplex Ultrasound

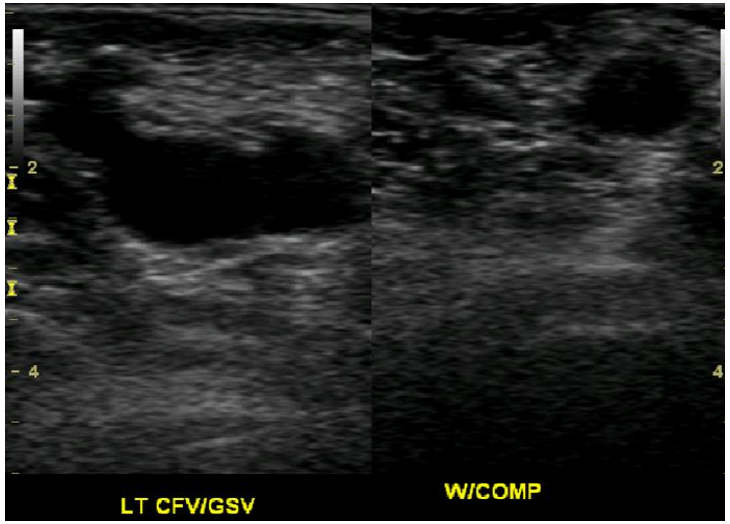
- Supine
  - Direct visualization
  - Compressibility
  - Phasicitiy

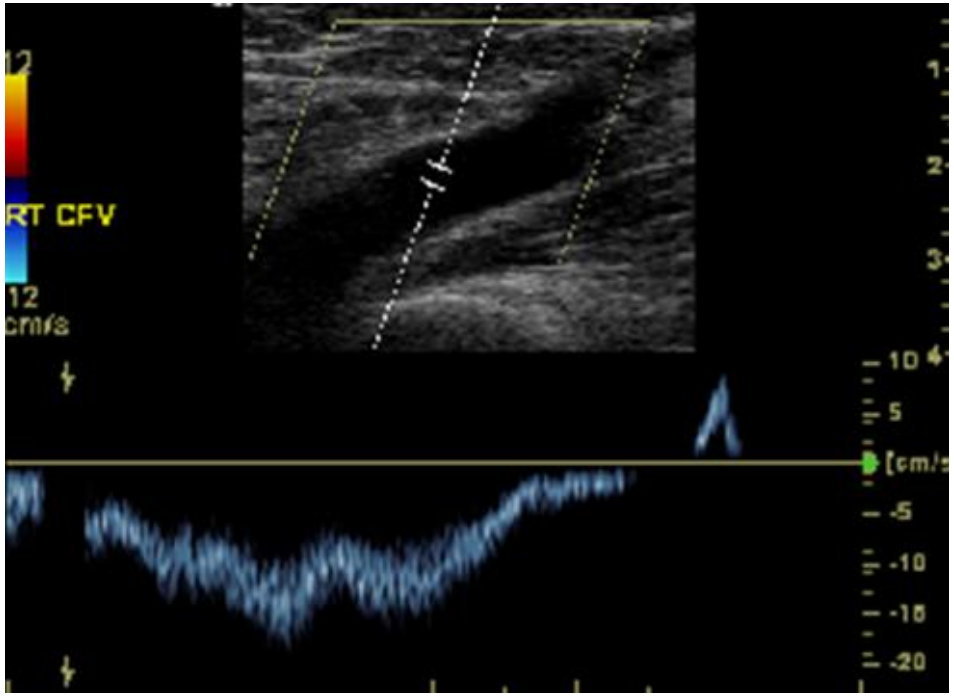


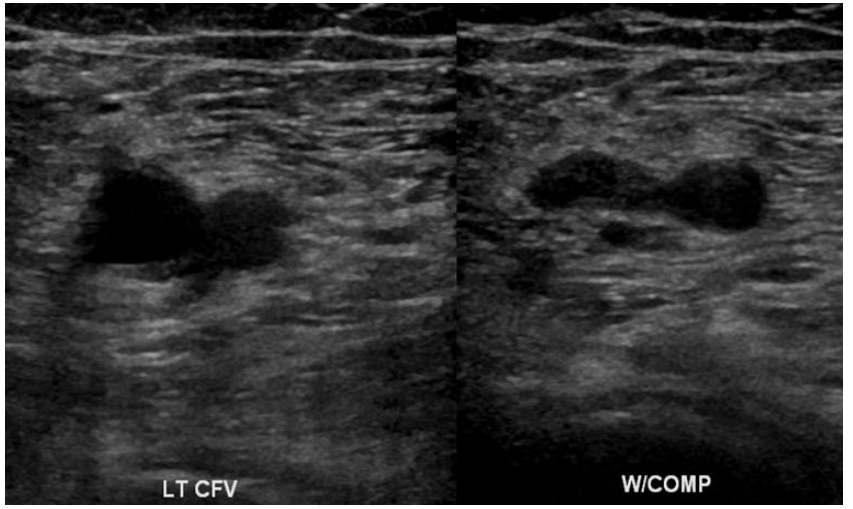


Duplex Ultrasound

- Supine
  - Direct visualization
  - Compressibility
  - Phasicitiy

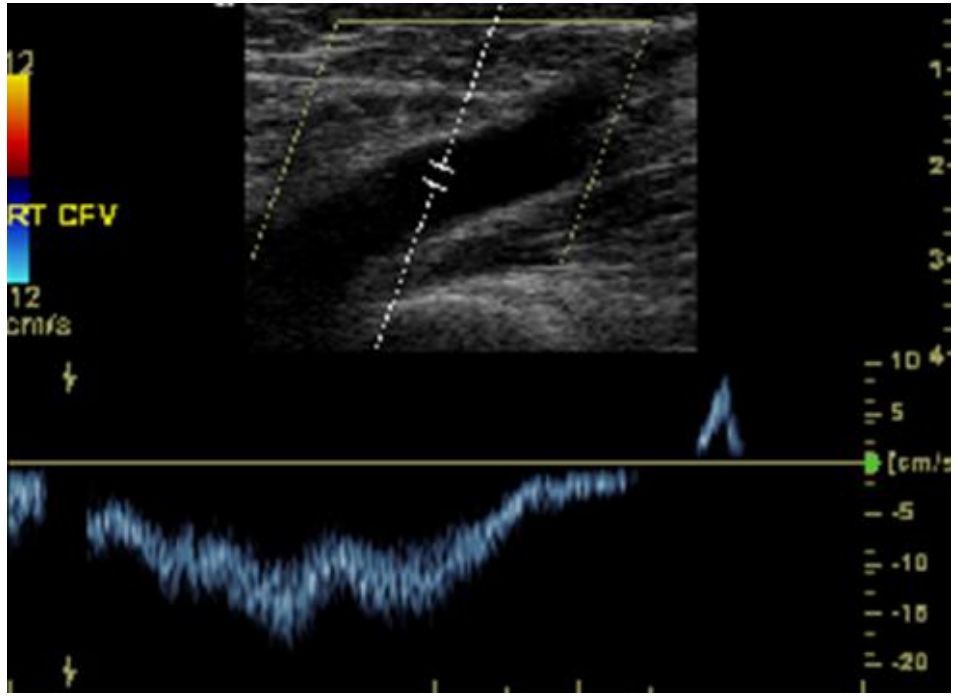


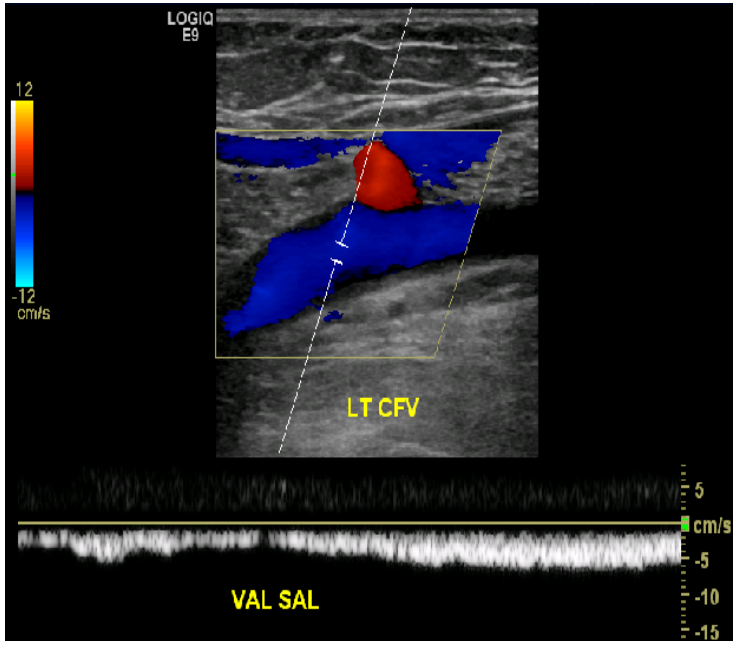




Duplex Ultrasound

- Supine
  - Direct visualization
  - Compressibility
  - Phasicitiy

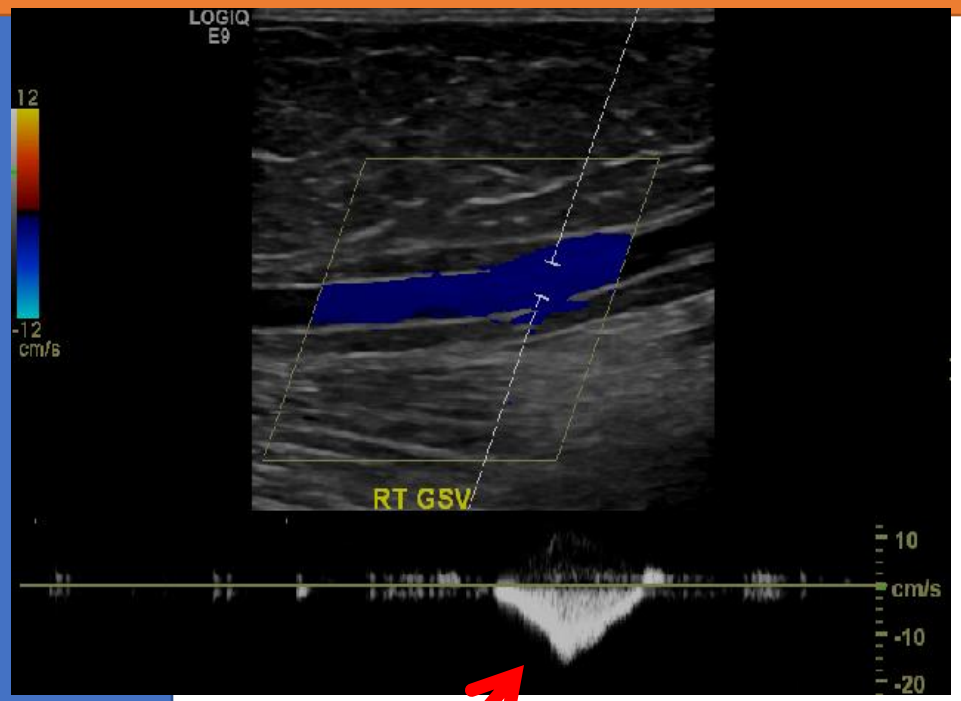


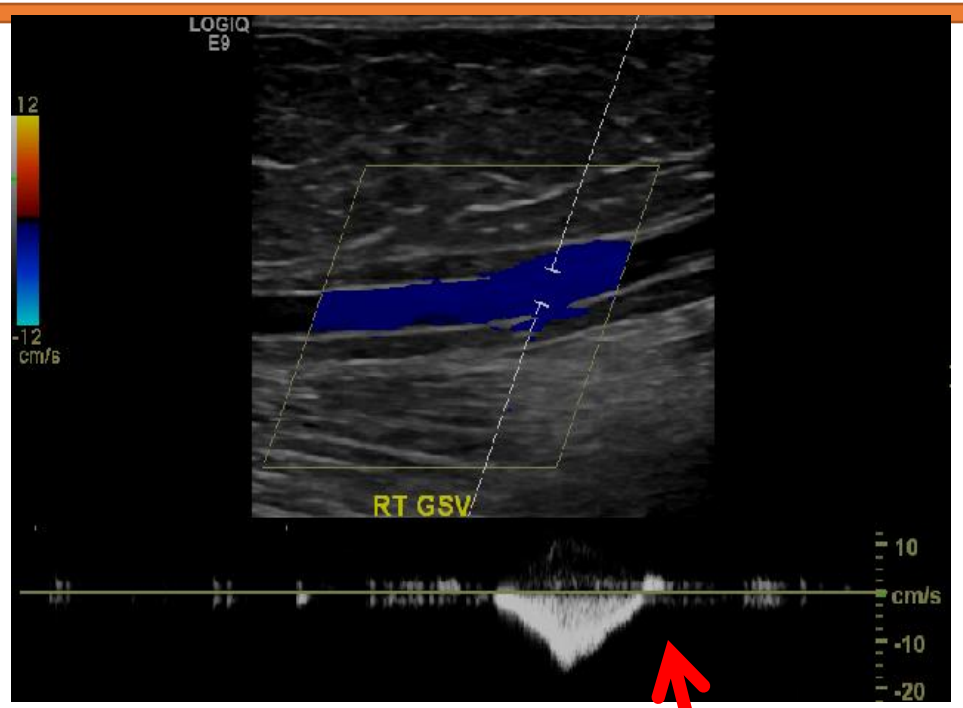


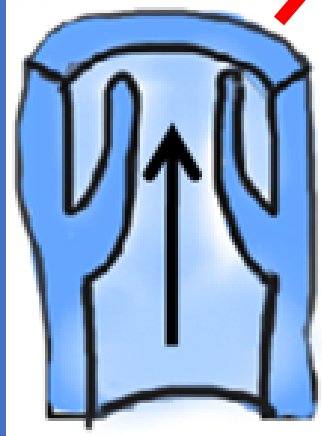
Venous Duplex – Reflux Testing

- Reflux studies while patient standing with distal augmentation (manual squeeze or blood pressure cuff)
- Evaluate superficial, perforating, and deep systems
- DEEP REFLUX: >1 sec reflux
- SUPERFICIAL: >5mm diameter, >500msec reflux
- Pathologic PERFORATOR: refluxing, valve closure >500msec, >3.5mm diameter, near ulcer

Normal Valve Function





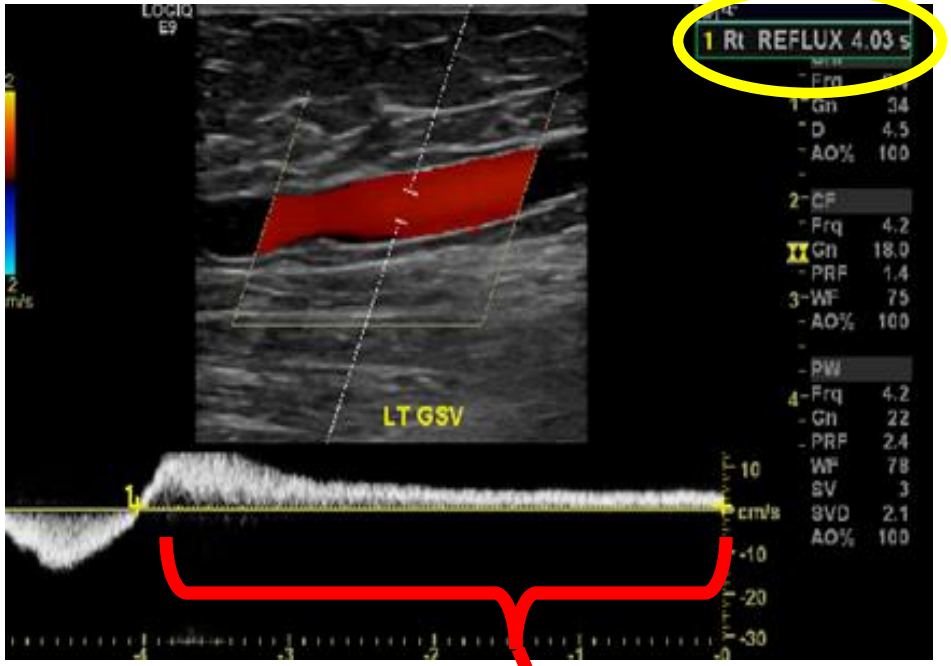


Augmentation of calf: valves open, blood returns to heart

Valves close, Blood flow in the vein temporarily stops

Abnormal Valve Function

Augmentation of calf



Failure of valves to close causes venous reflux

Treatment Algorithm

- Compression for everyone
- Debridement of wound bed
- Address refluxing veins
- Rule out proximal stenosis

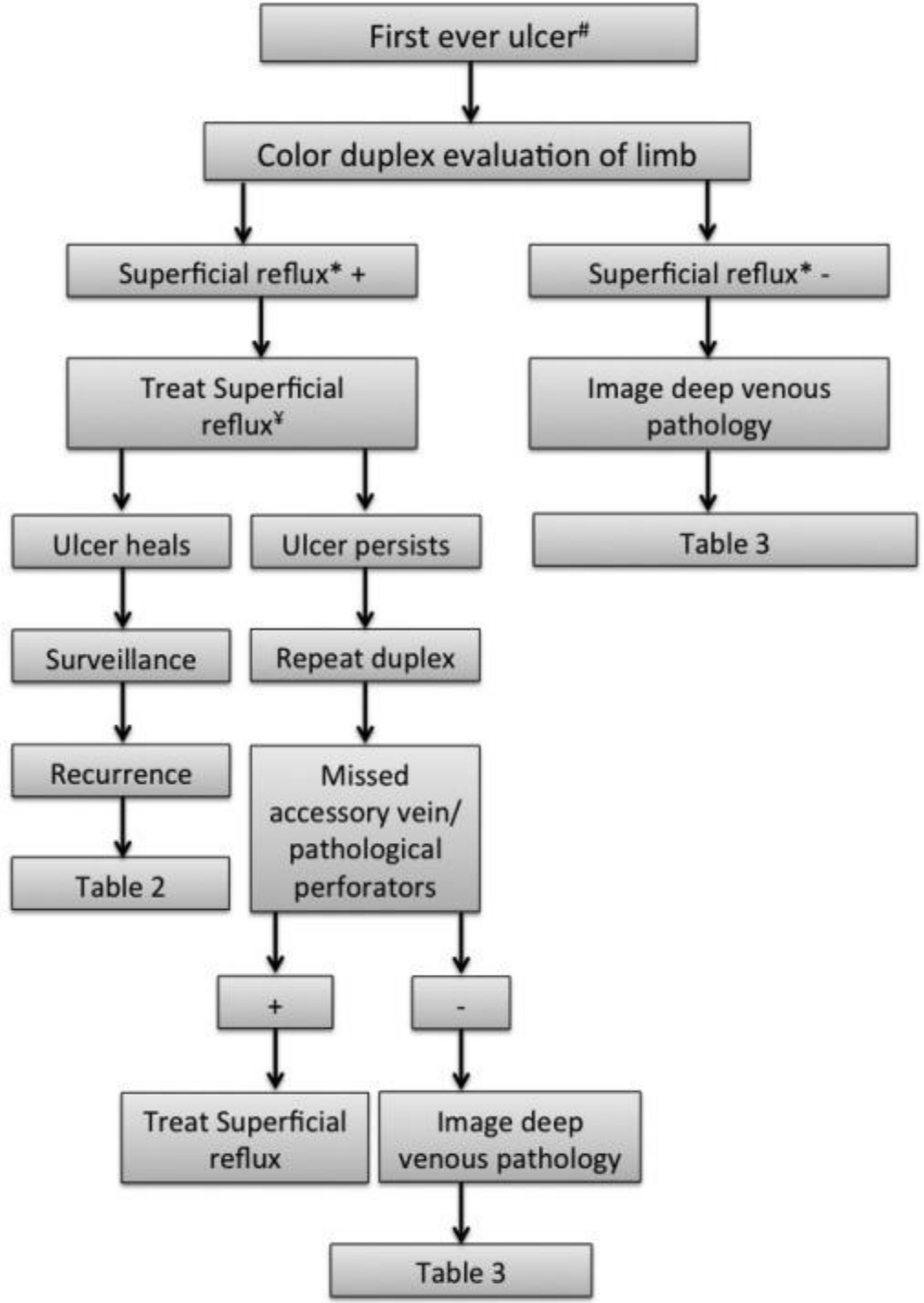
Treatment Algorithm

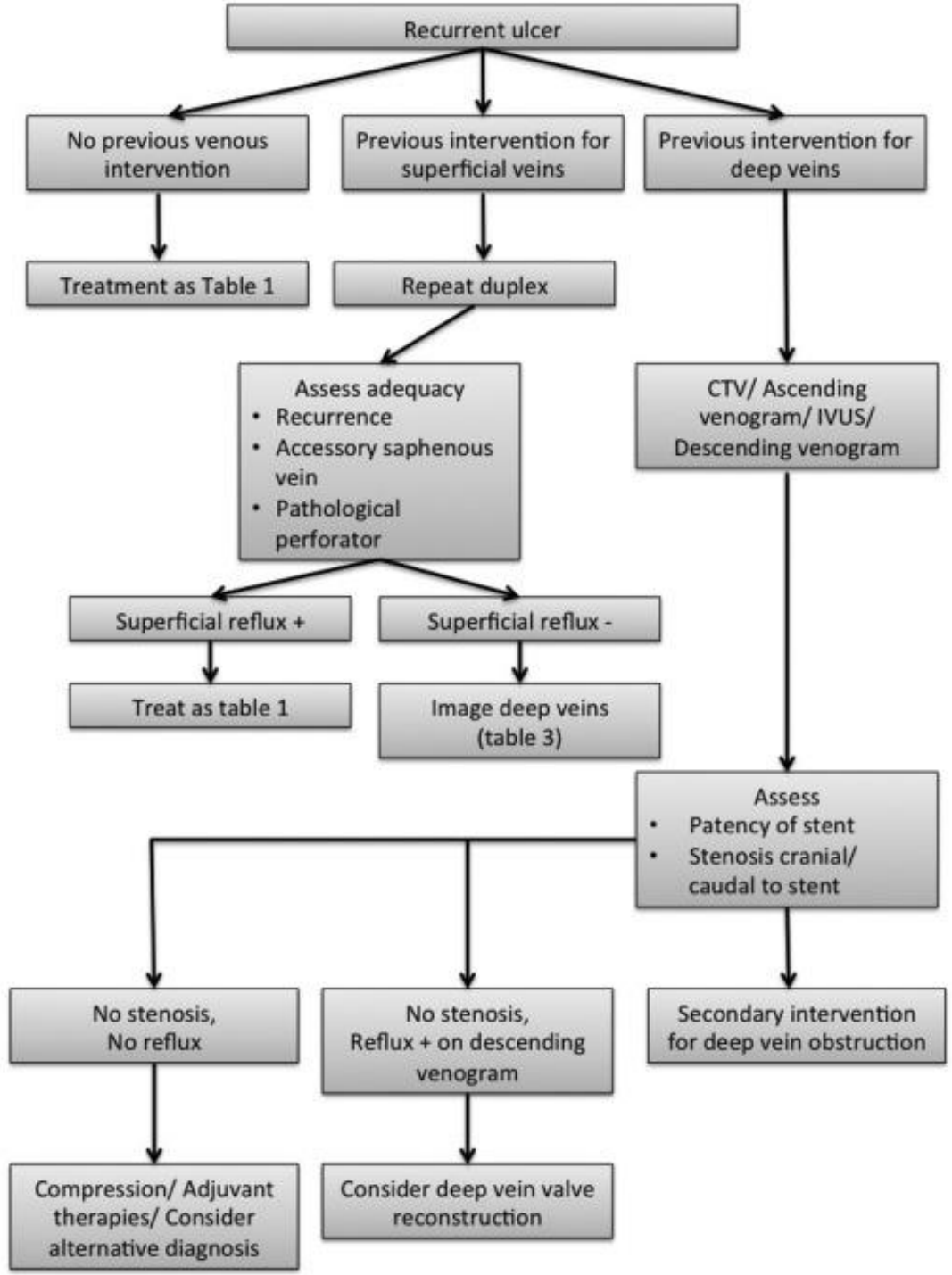
- Graded compression stockings reduce edema, augment venous return
  - 10-15 mm Hg – Good for elderly patients
  - 20-30 mm Hg – young patients with edema/pain symptoms
  - 30-40 mm Hg – Patients with ulceration/healed ulcers

Dolibog P, et al. A Randomized, Controlled Clinical Pilot Study Comparing Three Types of Compression Therapy to Treat Venous Leg Ulcers in Patients with Superficial and/or Segmental Deep Venous Reflux. Ostomy Wound Manage. 2013 Aug; 59(8): 22-30

Treatment

- Mainstay of treatment is COMPRESSION
  - Multiple RCTs showing compression therapy leads to faster healing rate when compared to standard wound care
- **Inelastic** compression do not give way with expanding muscle are more effective in venous pumping function
  - Unna boot
- **Elastic** bandages are effective for edema but less effective in improving venous pumping, but provide compression at rest
  - ACE, stockings, multi-layer bandages (e.g. ProFore)


First ever ulcer#
Color duplex evaluation of limb
Superficial reflux* +
Superficial reflux* -
Treat Superficial reflux¥
Image deep venous pathology
Ulcer heals
Ulcer persists
Table 3
Surveillance
Repeat duplex
Recurrence
Missed accessory vein/ pathological perforators
Table 2
+
-
Treat Superficial reflux
Image deep venous pathology
Table 3


Recurrent ulcer
No previous venous intervention
Previous intervention for superficial veins
Previous intervention for deep veins
Treatment as Table 1
Repeat duplex
Assess adequacy
• Recurrence
• Accessory saphenous vein
• Pathological perforator
CTV/ Ascending venogram/ IVUS/ Descending venogram
Superficial reflux +
Superficial reflux -
Treat as table 1
Image deep veins (table 3)
Assess
• Patency of stent
• Stenosis cranial/ caudal to stent
No stenosis, No reflux
No stenosis, Reflux + on descending venogram
Secondary intervention for deep vein obstruction
Compression/ Adjuvant therapies/ Consider alternative diagnosis
Consider deep vein valve reconstruction

Unna's Boot

- 18-24 mmHg compression
- Contains zinc oxide, gum acacia, glycerol, castor oil, H2O
- Changed every 3-7 days
- 2005 RCT comparing Unna vs four-layer bandage showed faster healing with inelastic compression

Layer One Padding Bandage:
Spiral technique wraps from the base of the toes to just below the knee

Layer Two Crepe Bandage:
Figure 8 technique stretches the bandage 50% as well as wraps the overlap of 50% up the leg

Layer Three Compression Bandage:
Figure 8 technique provides bandage stretch of 50% as well as an upward overlap of 50%

Layer Four Cohesive Bandage:
Spiral technique stretches to 50% while overlapping - heel should be covered by all four layers

Recurrence

- Potential for recurrence is high – up to 67% in some studies
- High pressure (34-46mmHg) compression associated with significantly less recurrence at 6 months
- Poor compliance with compression has been associated with 100% recurrence
- Two studies compared moderate- to high-grade compression
  - No difference in ulcer recurrence
  - Significantly less compliance in high-grade compression

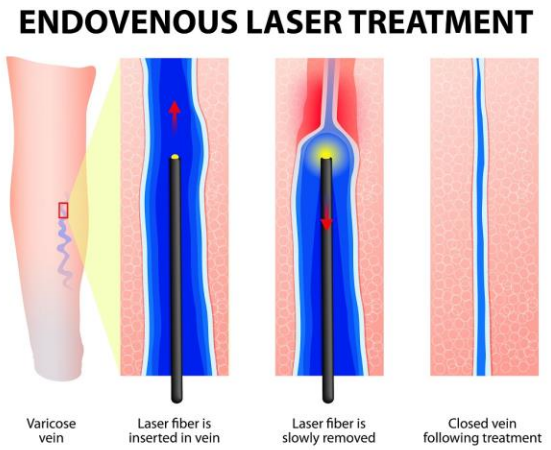
Surgical Options

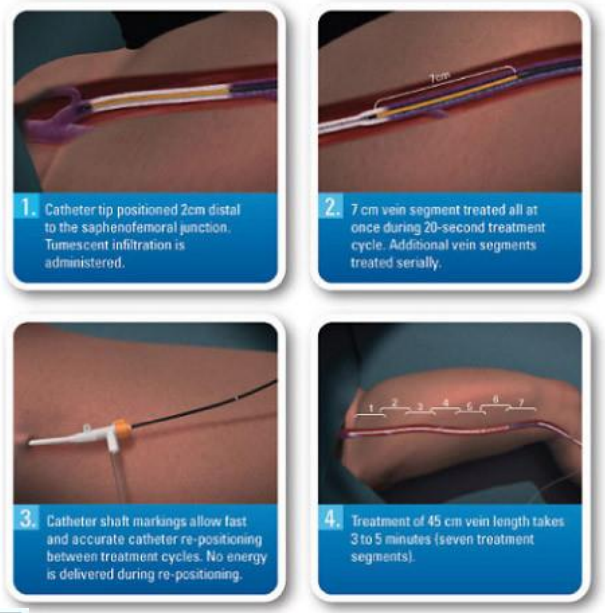
- ESCHAR study: compression alone vs compression + surgery
  - SFJ disconnection, stripping, stab phlebectomy
- RCT of 500 patients with CEAP 5 of 6 disease
- No difference in healing rates (89% vs 93%, P=0.73)
- 4 years: less recurrence with surgery (56% vs 31%, P=.01)
- Greater proportion of ulcer free time (78% vs 71%, P=.007)

Barwell, et al. Lancet June 2004

Endovenous Treatment

- Thermal
  - Laser
  - Radio-frequency ablation
- Non-thermal
  - Foam sclerotherapy
  - Veanseal (glue)
  - Mechanochemical Ablation (MOCA)





Semin Vasc Surg. 2015 Mar;28(1):54-60.

Endovenous Thermal Ablation

- 2017 retrospective review of CEAP 5-6 patients treated with EVTA (146 GSV, 20 SSV, 7 both)
- Concomitant phlebectomy in 59 limbs

Time	Healed		Time	Recurrence
3 months	57%		1 year	9%
6 months	74%		2 years	20%
12 months	78%		3 years	29%

- More recurrence with deep venous insufficiency and in those without concurrent phlebectomy

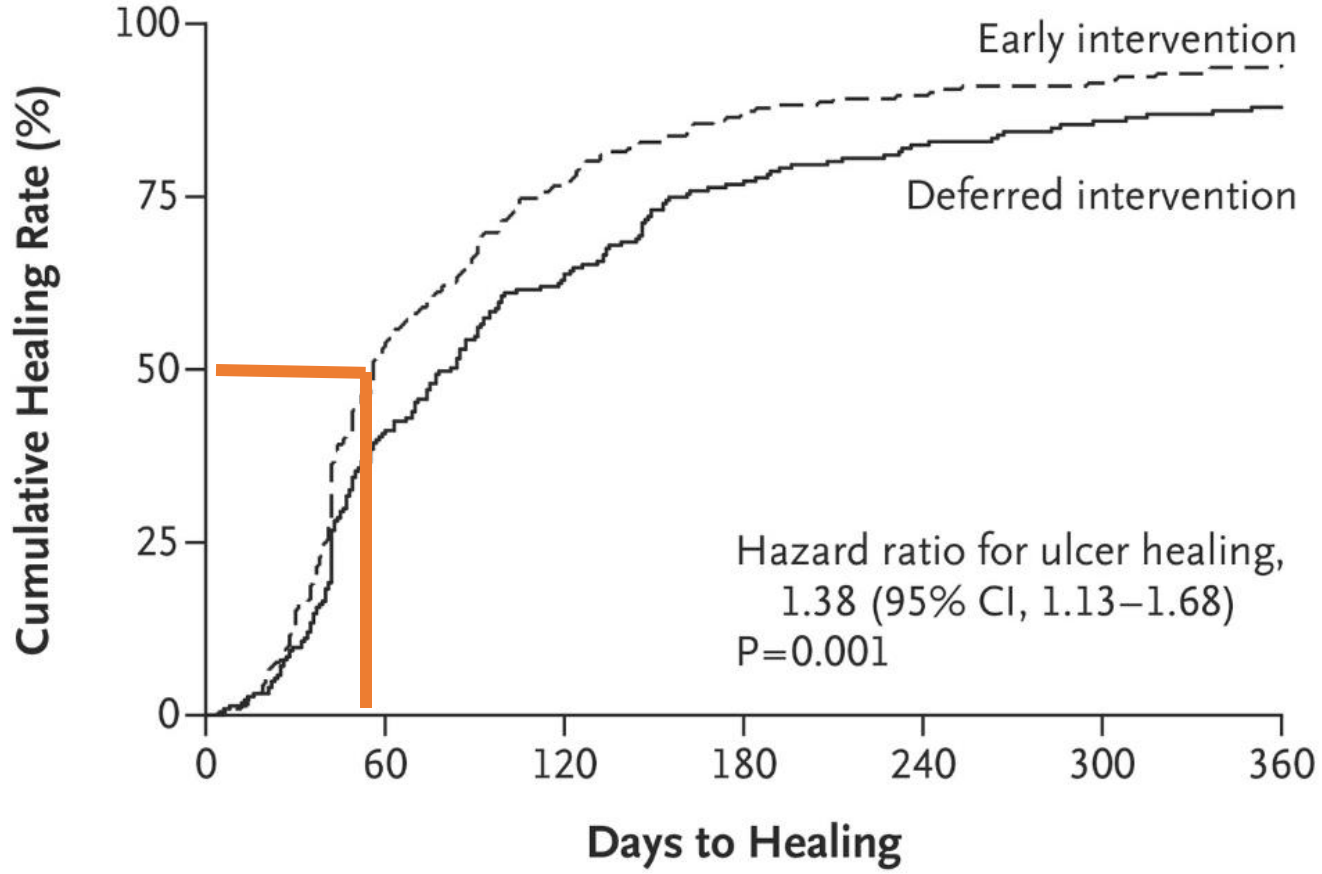
J Vasc Surg Venous Lymphat Disord. 2017 Jul;5(4):525-532

Early Venous Reflux Ablation (EVRA)

- NEJM 2018: 450 patients in 20 UK centers with CEAP 6 randomized to compression + EVA within 2 weeks of randomization or compression + delayed EVA (after healing)
  - Laser, RFA, foam, nonthermal, nontumescent all included
- Primary Outcome: time to heal from date of randomization
- Secondary: 6 month healing, recurrence, 1-yr ulcer-free time

N Engl J Med. 2018 May 31;378(22):2105-2114

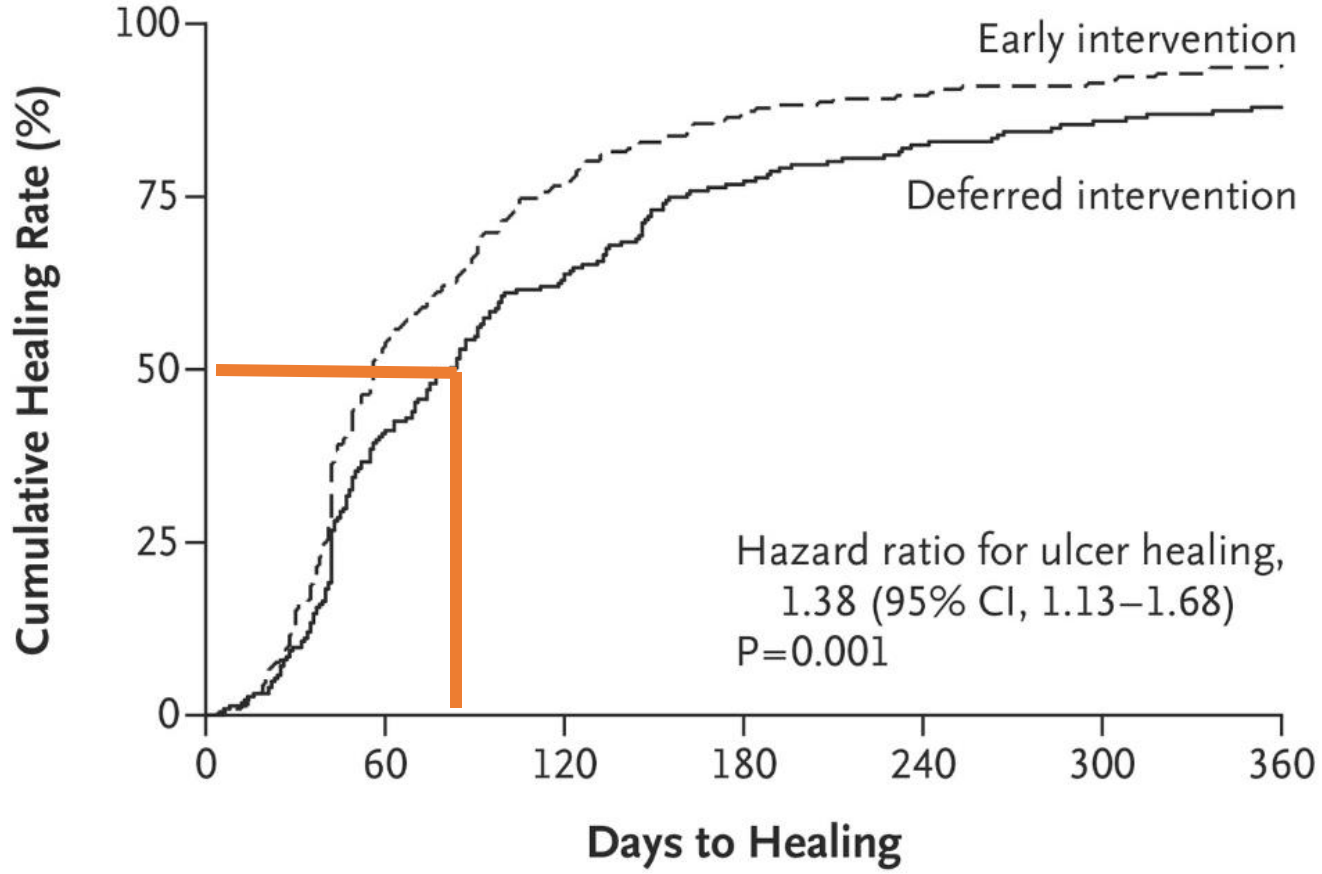
EVRA continued



No. at Risk

Early intervention	223	104	51	29	23	19	14
Deferred intervention	225	131	81	50	36	28	23

EVRA continued



No. at Risk

Early intervention	223	104	51	29	23	19	14
Deferred intervention	225	131	81	50	36	28	23

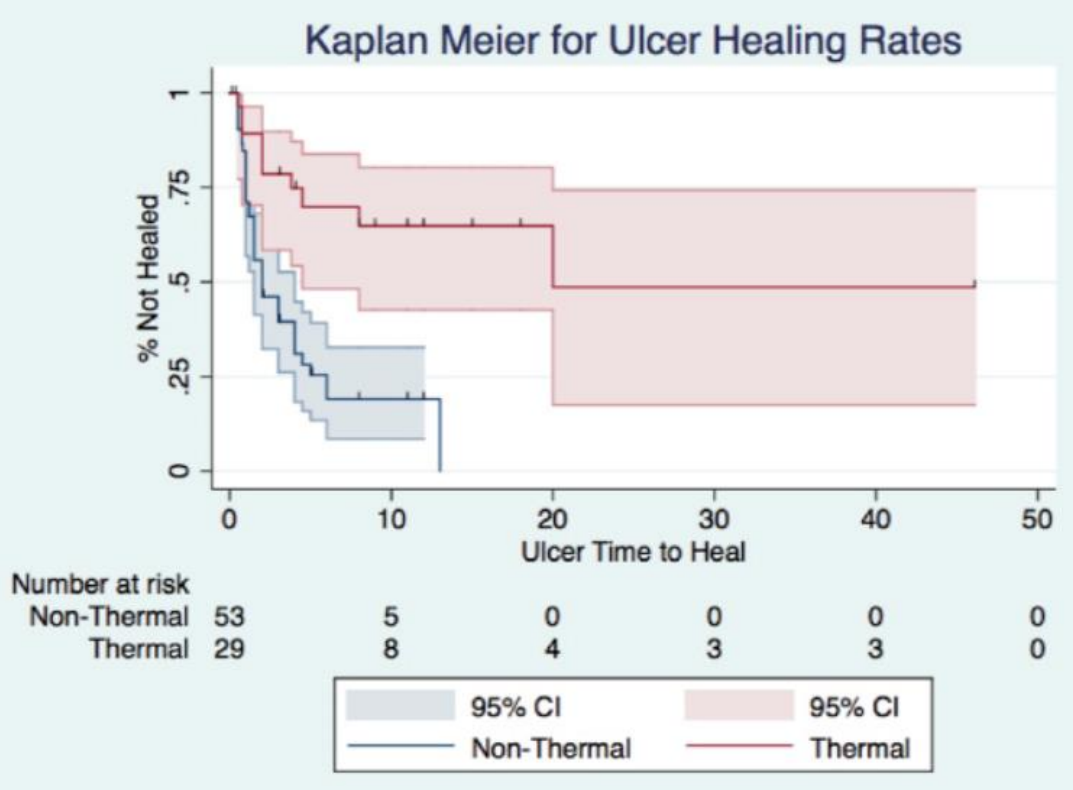
EVRA Secondary Outcomes

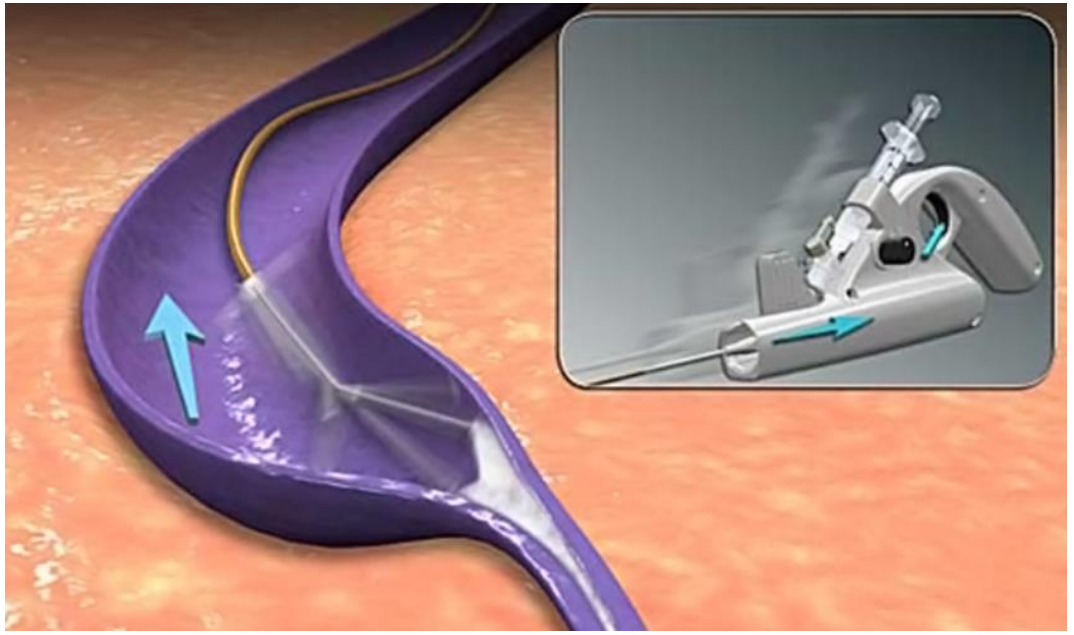
- Early intervention associated with
  - Better 12-wk, 24-wk, and 1-yr healing rates (94% vs 86%)
  - Less recurrence in 1 year (11% vs 17%)
  - Ulcer-free time (306 days vs 278 days)
  - Lower venous clinical severity score (VCSS, 10.5 vs 12.6)

- Improvement in quality of life in early treatment

Mechanochemical Ablation

- Non-thermal, non-tumescent
- Retrospective studies have shown improved healing when compared to thermal techniques

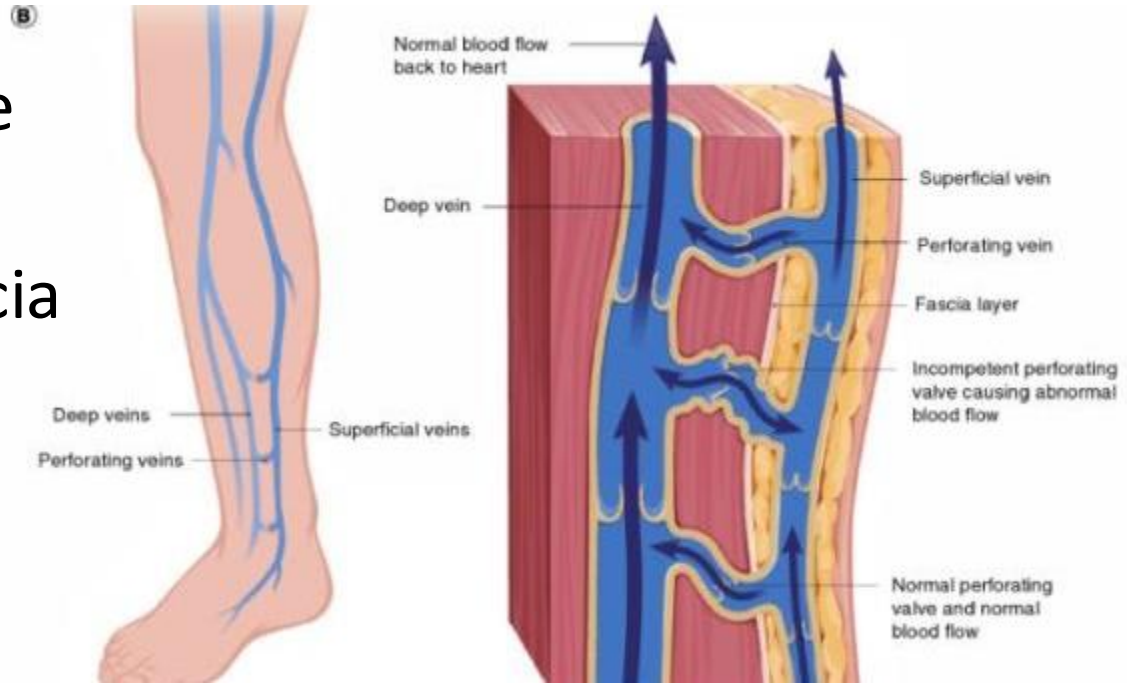




J Vasc Surg Venous Lymphat Disord. 2019 Sep;7(5):699-705

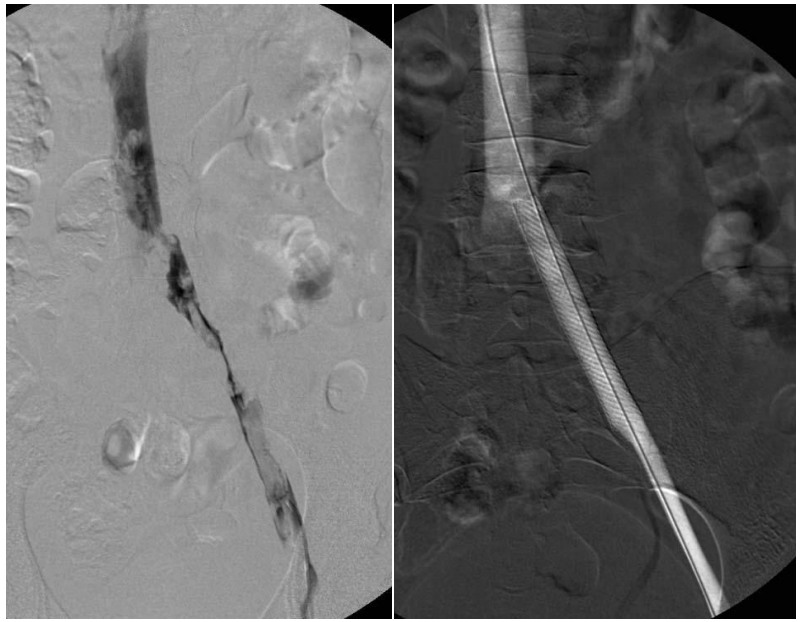
Perforating Veins

- Common to have refluxing (pathologic) perforators nearby
- Use ultrasound to guide the needle into the perforator
- Treat at the level of the fascia
  - Below fascia – DVT or nerve injury
  - Too superficial – inadequate treatment



Proximal Occlusions

- Ulcers with absent or adequately treated superficial reflux may be a clue to proximal stenosis
  - Consider CT venogram, MRV, venogram, IVUS
- >50% of ulcers associated with 50% iliac stenosis
- 528 limbs with C3-C6 treated with iliac vein stent
- Drastic improvement of symptoms
- Low rates of ulcer recurrence



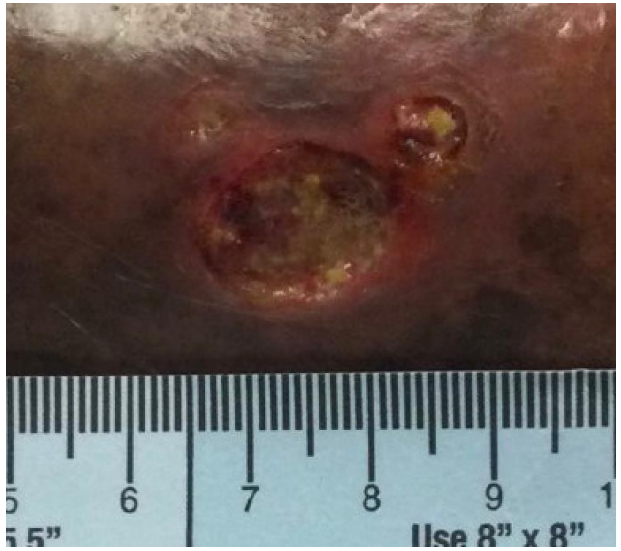
Semin Vasc Surg. 2015 Mar;28(1):54-60.
J Vasc Surg. 2010 Feb;51(2):401-8

Stubborn Ulcers

- Wound biopsy if no change/improvement in 4-6 weeks

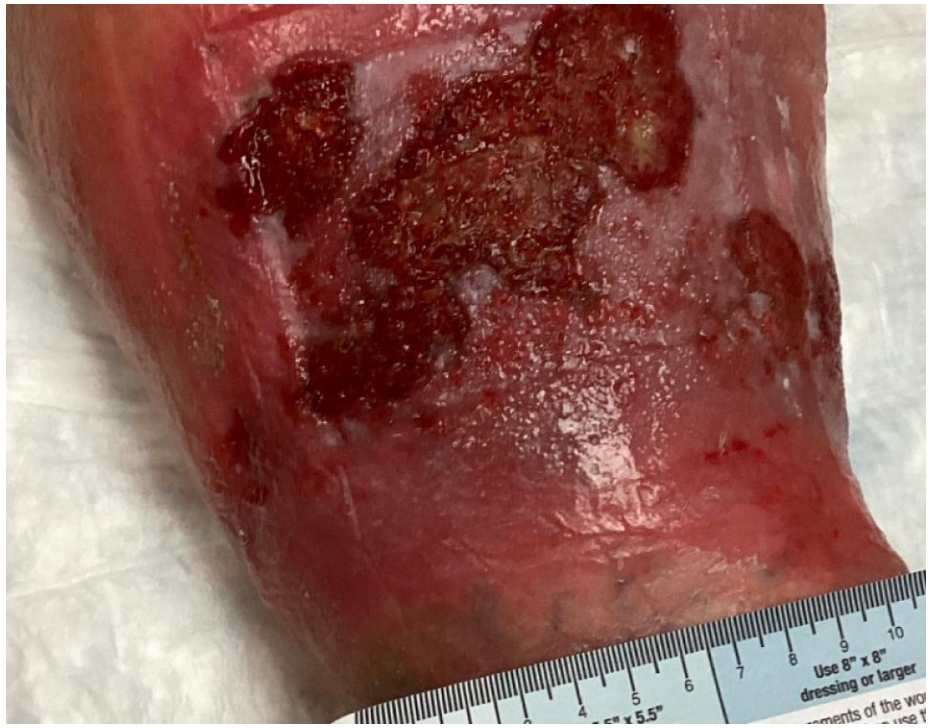
Patient Encounters - Corine

- 86F with peripheral arterial disease with lateral ankle wound
- ABI 0.59 with Left GSV reflux ablated Nov 2021
- Aug 6, 2021 Dec 27, 2021 Aug 26, 2022



Patient Encounter - Ken

- 45M with lymphedema and wounds after dogs jumped on him and scratched his legs
- R GSV ablation + ongoing sclerotherapy injections since Feb

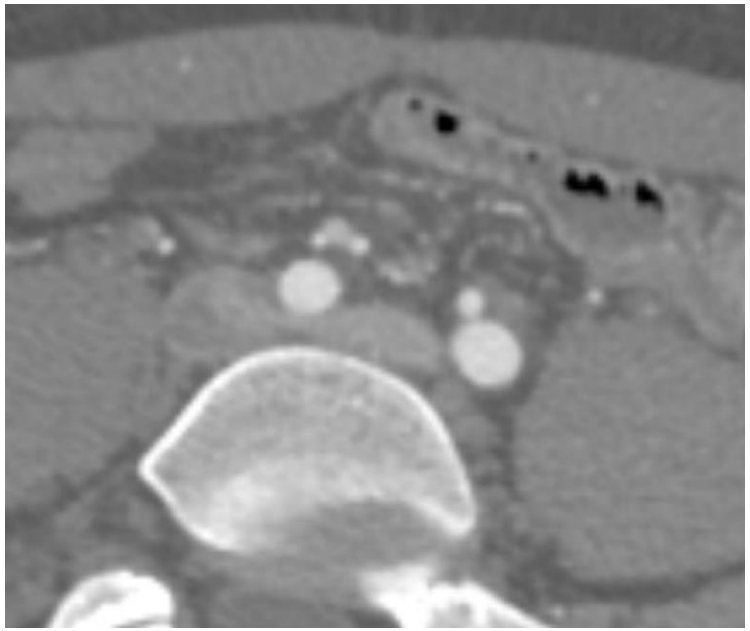


Patient Encounter - Katelin

- 19F with Ehlers-Danlos with multiple knee dislocations who presents with massive left leg swelling, blisters, and seeping from shin wounds

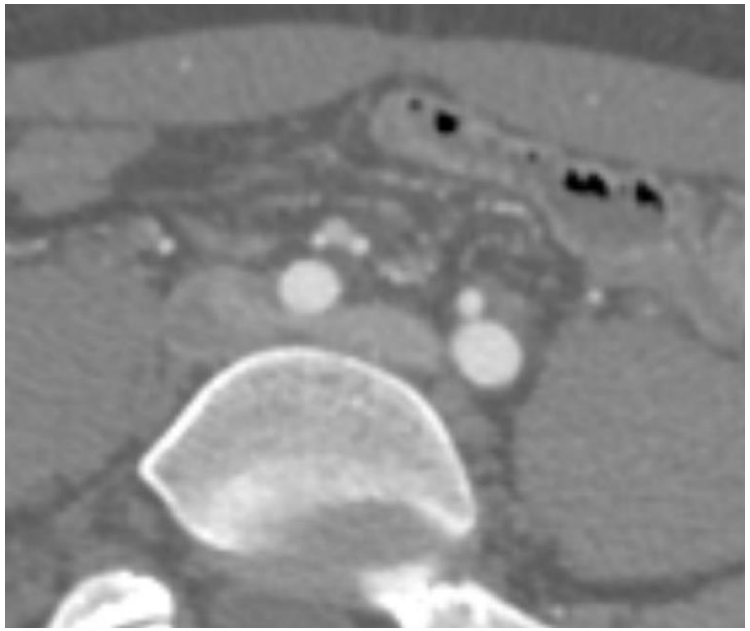
Patient Encounter - Katelin

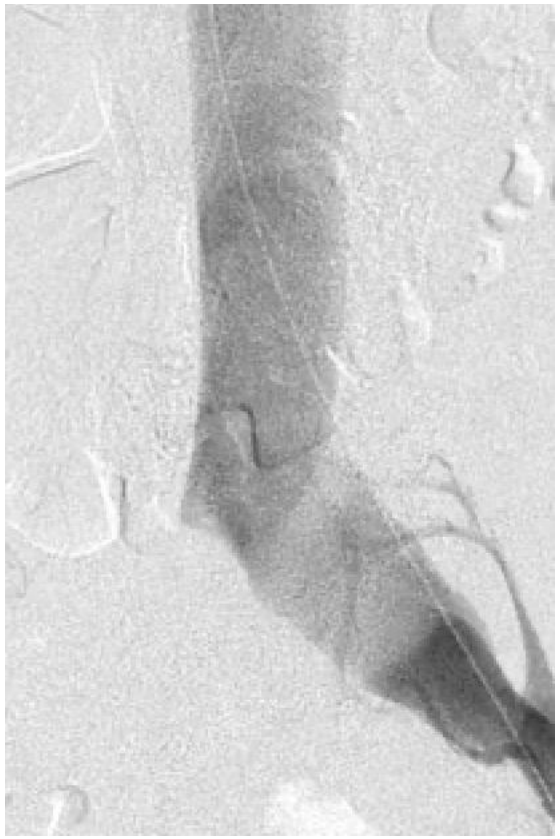
- 19F with Ehlers-Danlos with multiple knee dislocations who presents with massive left leg swelling, blisters, and seeping from shin wounds



Patient Encounter - Katelin

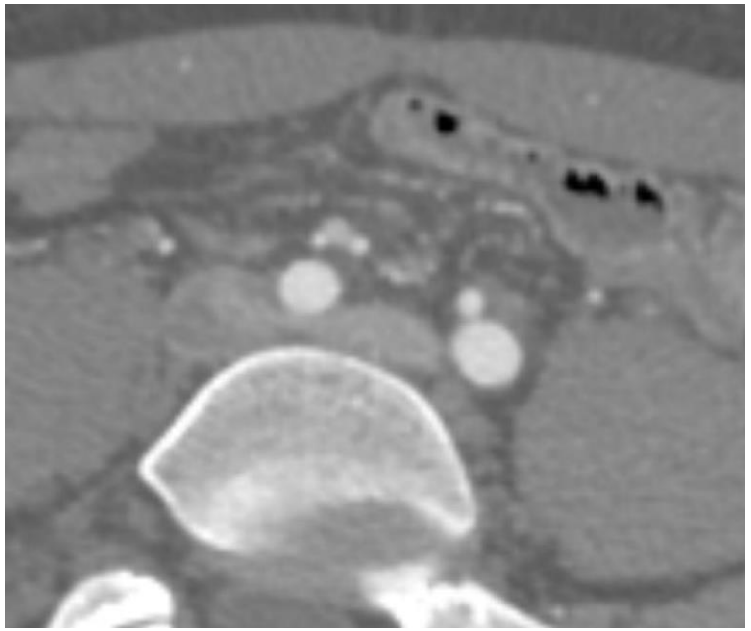
- 19F with Ehlers-Danlos with multiple knee dislocations who presents with massive left leg swelling, blisters, and seeping from shin wounds

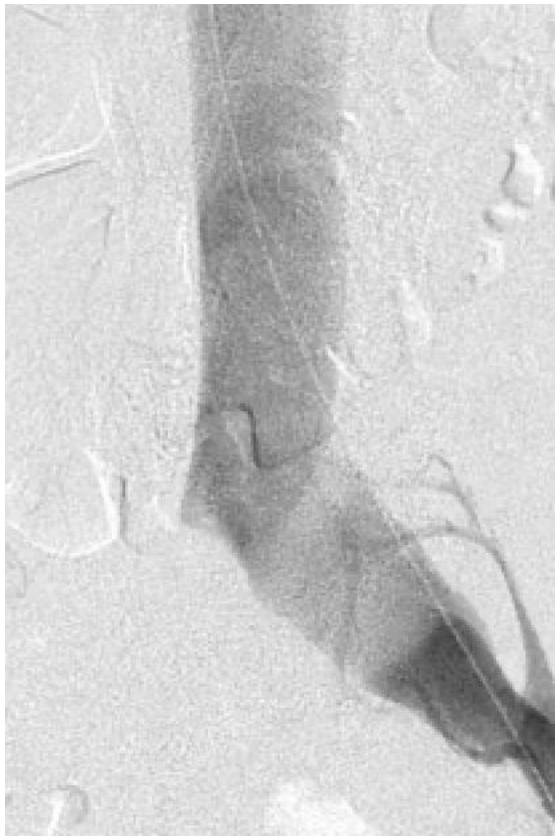


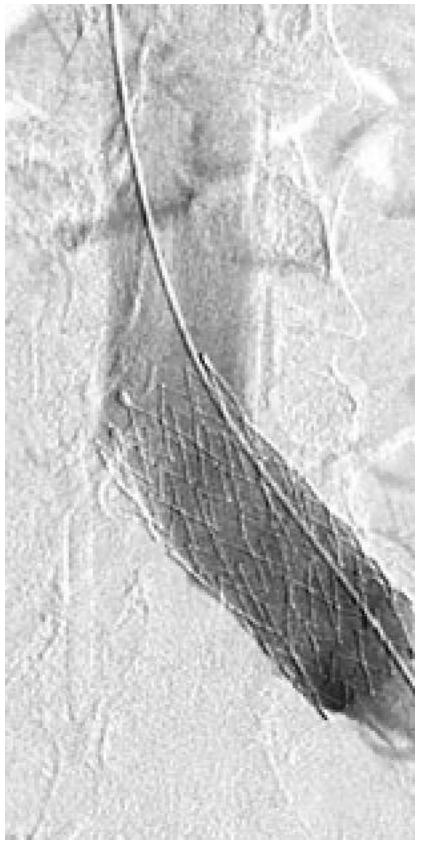


Patient Encounter - Katelin

- 19F with Ehlers-Danlos with multiple knee dislocations who presents with massive left leg swelling, blisters, and seeping from shin wounds







Patient Encounter - Katelin

- 19F with Ehlers-Danlos with multiple knee dislocations who presents with massive left leg swelling, blisters, and seeping from shin wounds

UPMC McKeesport Vein and Wound Center

- Vascular Surgery
- Podiatry
- Plastics Surgery
- General Surgery
- Infectious Disease

Contact Us

To schedule an appointment, call **412-664-2400** or email korpj@upmc.edu.

UPMC Wound Healing Services at UPMC McKeesport
500 Hospital Way
Painter Building, Suite 111
McKeesport, PA 15132

Other References

- https://www.sciencedirect.com/science/article/pii/S0895796715000459?via%3Dihub

- Cochrane Database Syst Rev. 2012 Nov 14;11:CD000265. doi: 10.1002/14651858.CD000265.pub3