

Venous Disease:

Aching legs, ugly veins, wounds and more

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Albuquerque Vein
& LASER INSTITUTE

IMPORTANCE OF VENOUS DISEASE

- Up to 25% of American women and 15% of American men suffer from venous disease
- Highly symptomatic
- Discomfort and wounds affect quality of life
- 1-2% prevalence of leg ulceration (open or healed)

THE SPECTRUM OF VENOUS DISEASE

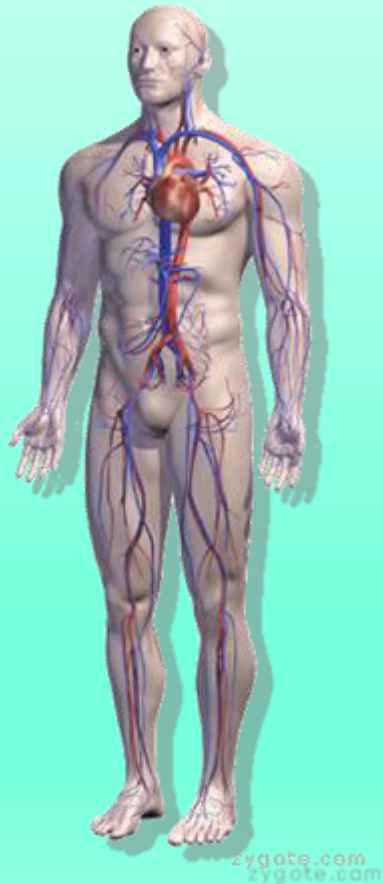


and more....



Anatomy & Physiology

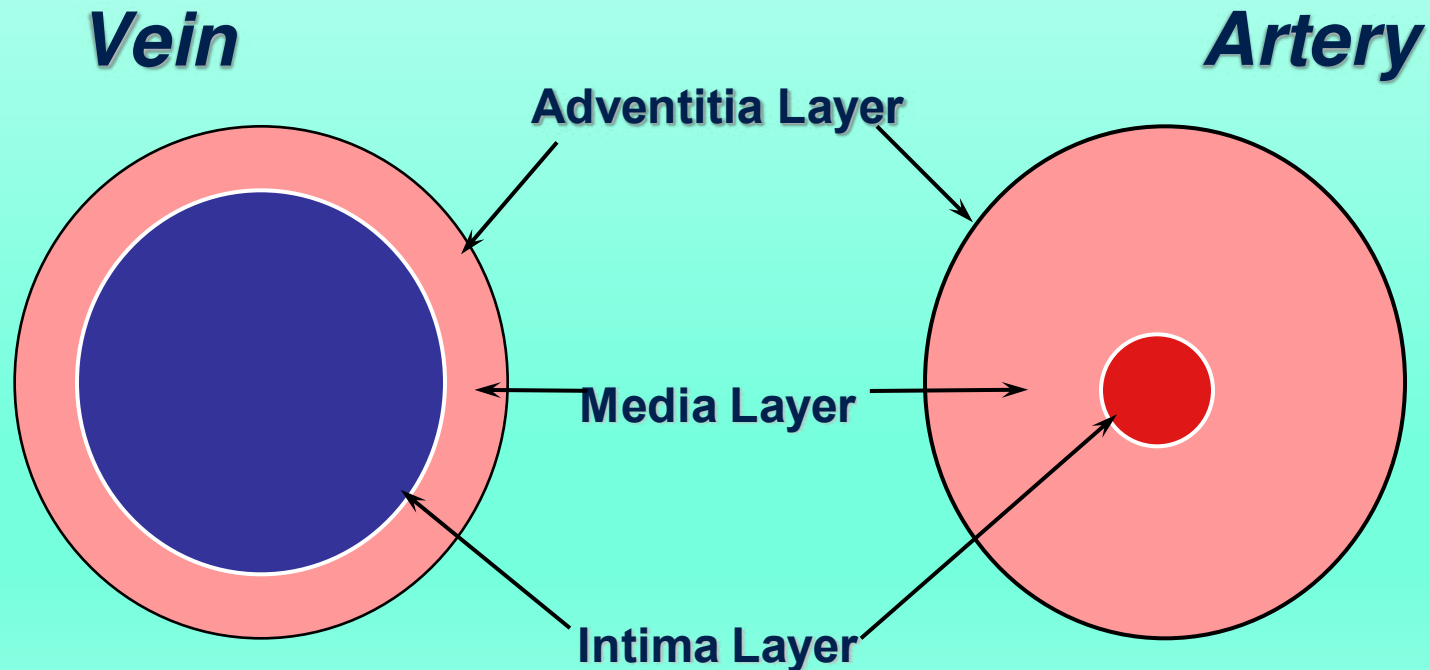
The Circulatory System



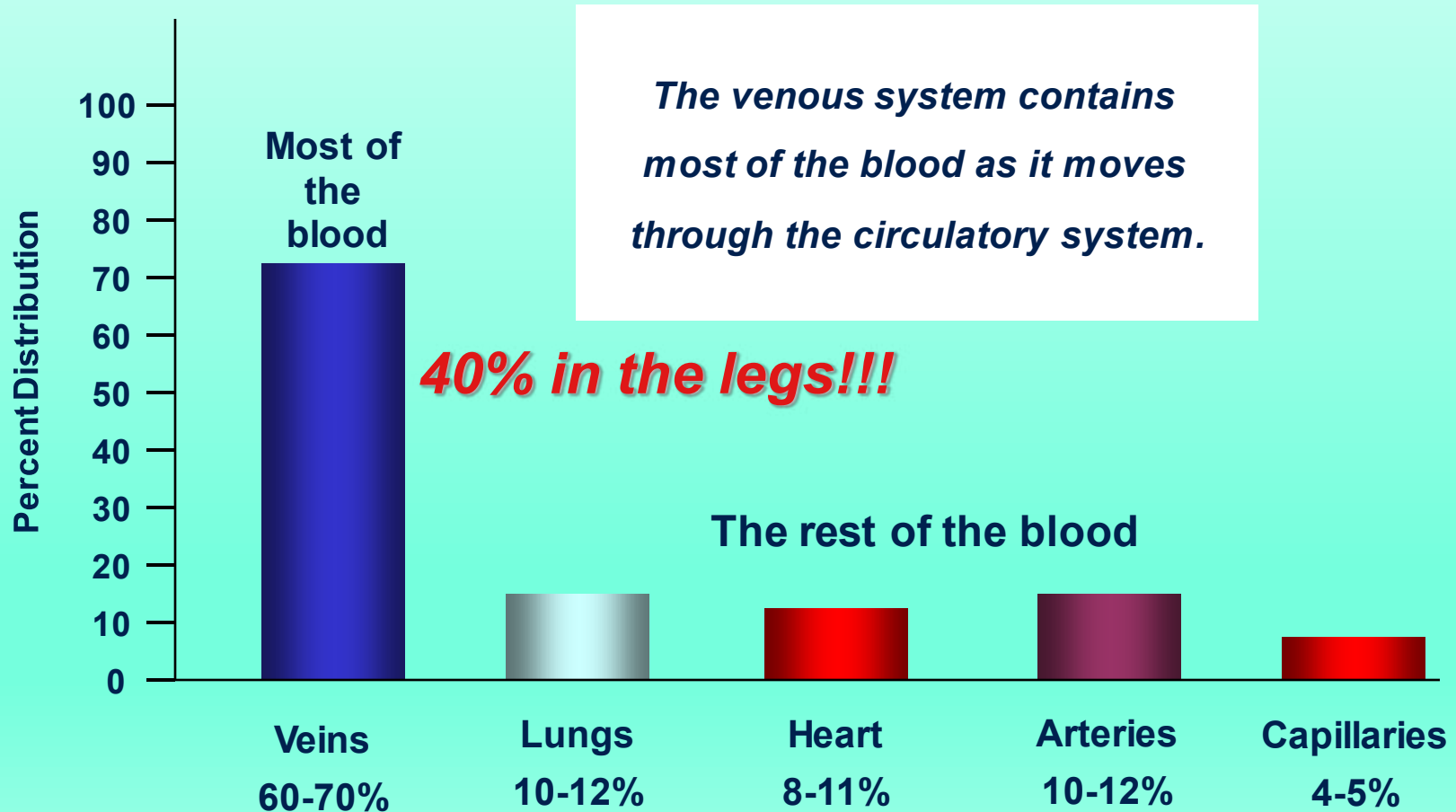
- The Heart is the main pump to get oxygenated blood to tissues via the **arteries**
- The Calf muscle is the main pump to get **venous** blood back to the heart from the legs

Venous vs. Arterial

INTERNAL STRUCTURE



The Significance of Veins

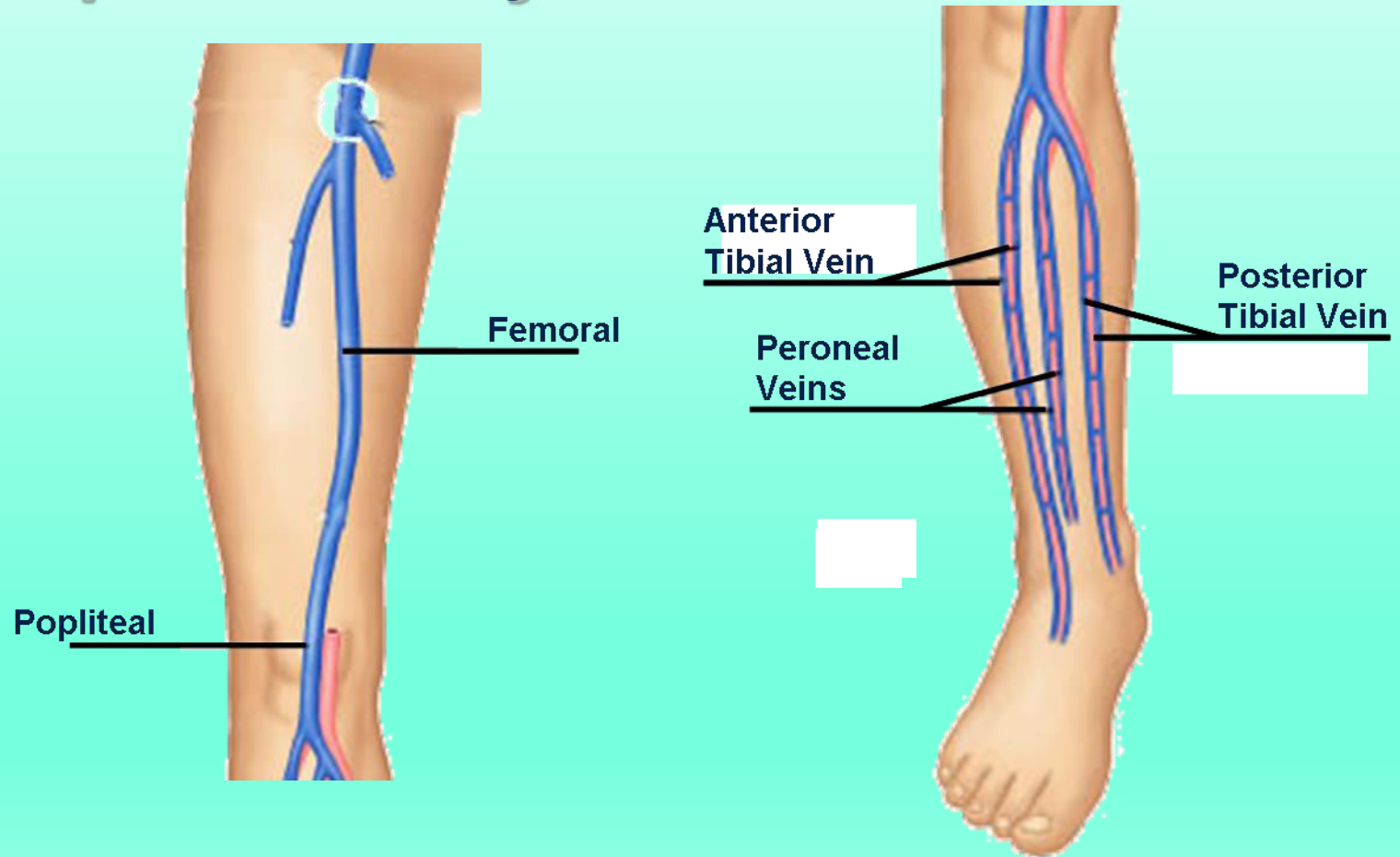


Three Systems of Veins

- Deep
- Superficial
- Perforator/communicating

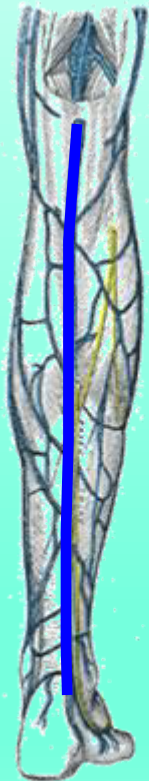


Deep Venous System



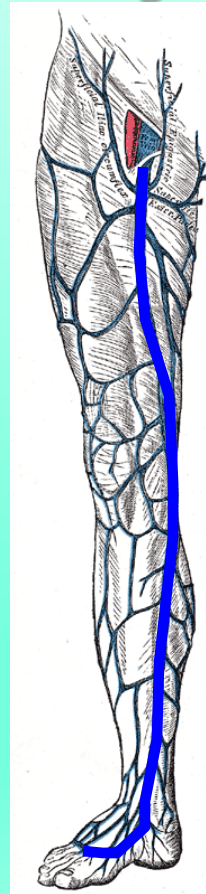
Deep system handles up to 90% of the venous blood volume.

Veins of the Superficial System – 10%



The Superficial Venous System-
Small Saphenous Vein

Henry Gray (1825-1861).
Anatomy of the Human Body.
1918.

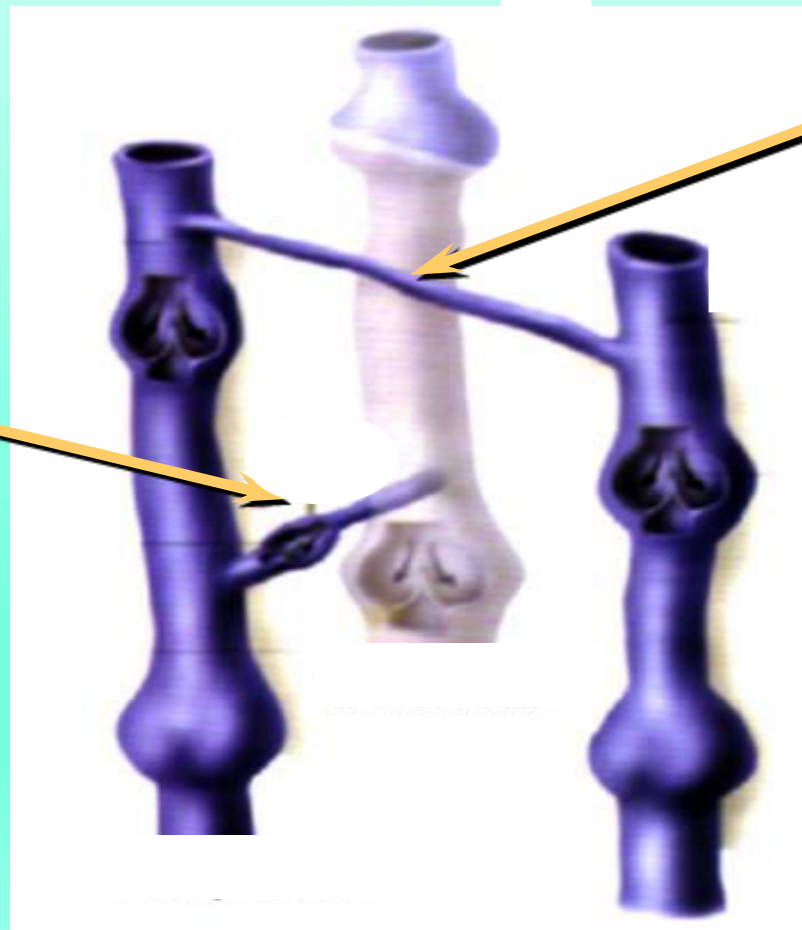


The Superficial Venous System-
Great Saphenous
Vein & Tributaries

Communicating / Perforator Veins

Perforator

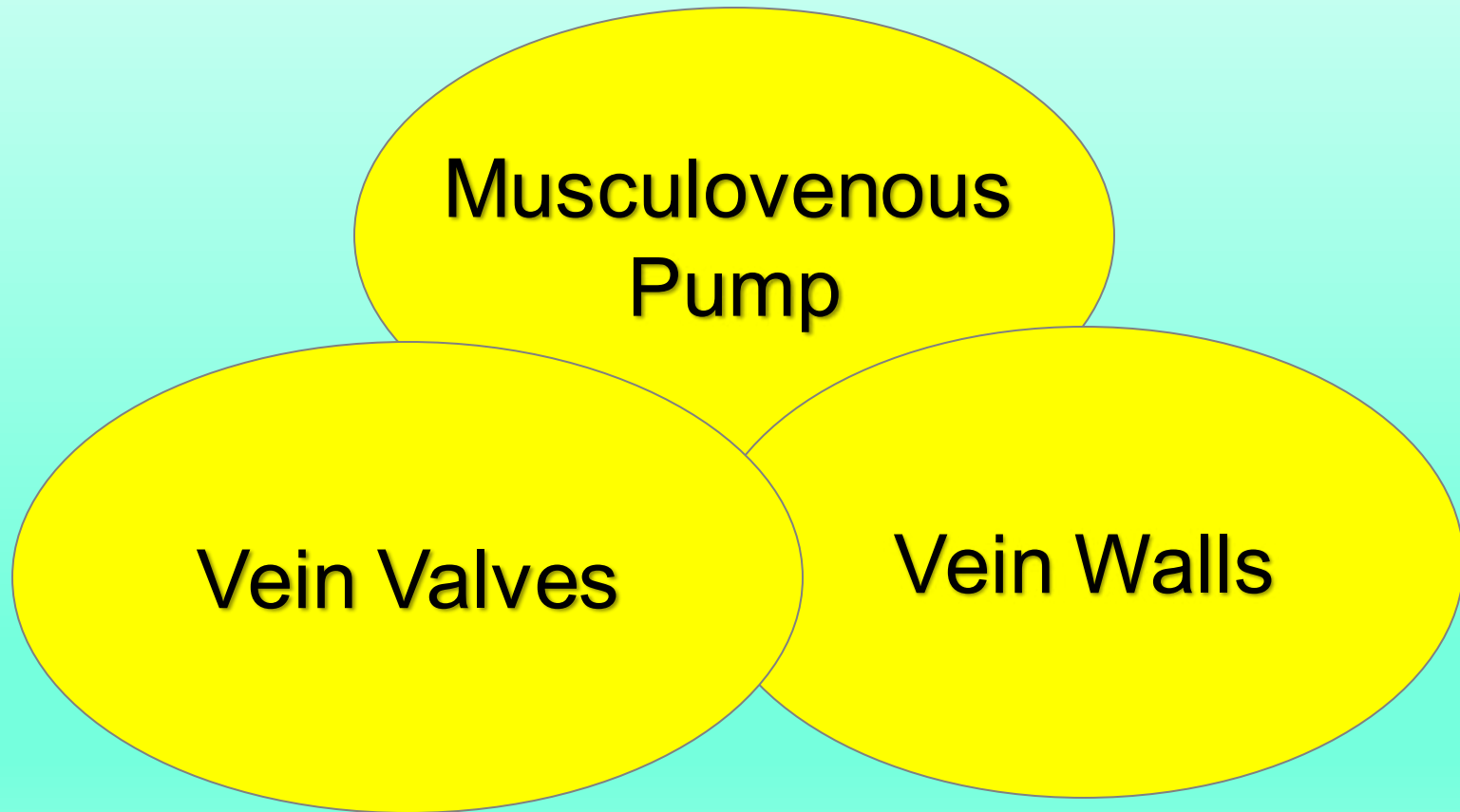
Connecting Deep to Superficial



Communicating

*Connecting “like” veins
Deep to deep
or
Superficial to Superficial*

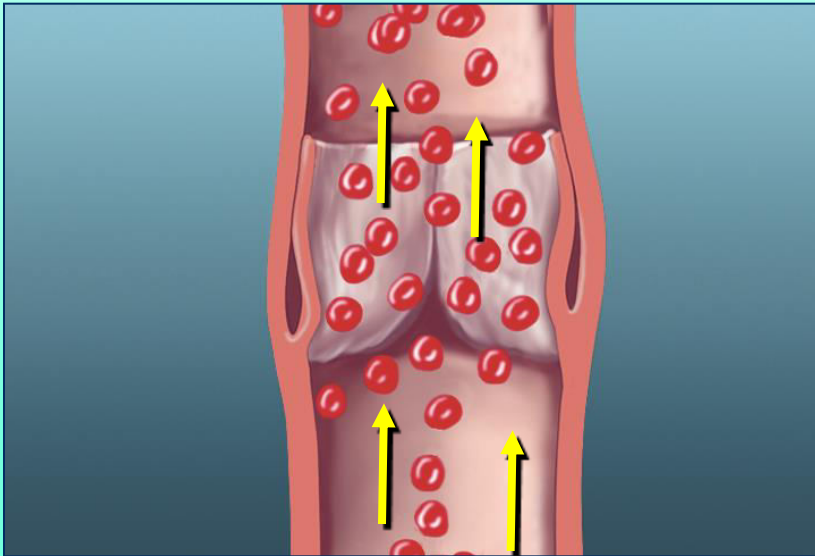
Components of Normal Venous Hemodynamics



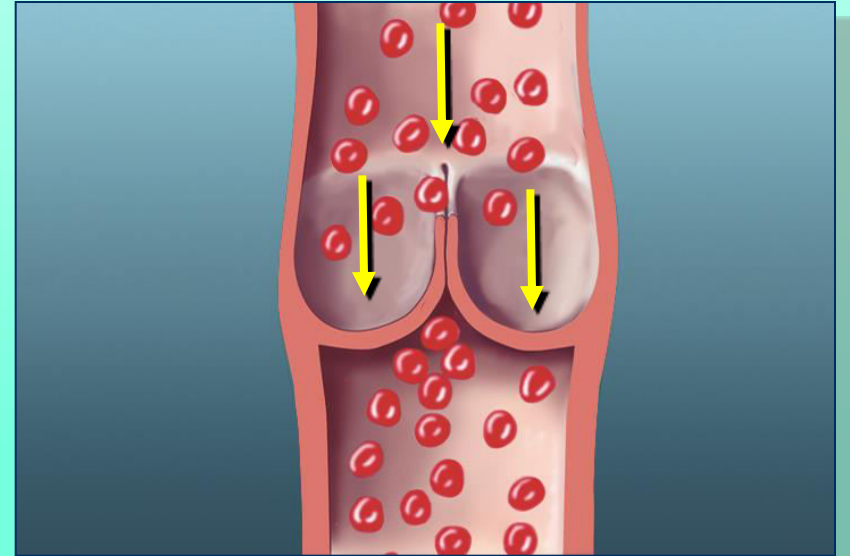
Dysfunction of any component may lead to abnormal flow

Normal Valve Function

VEIN ANATOMY



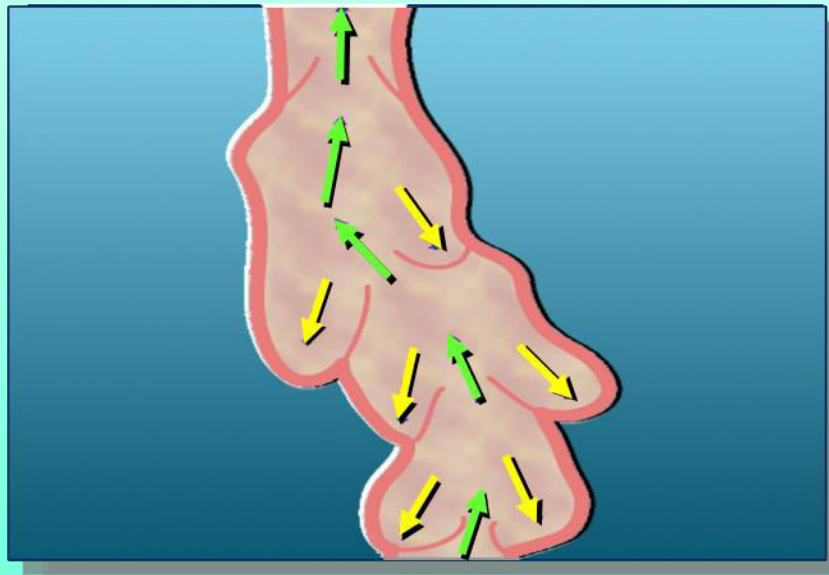
Valve Open
Blood flows toward heart



Valve Closed
Prevents blood from reverse flow

Abnormal Valve Function → Venous Dilation

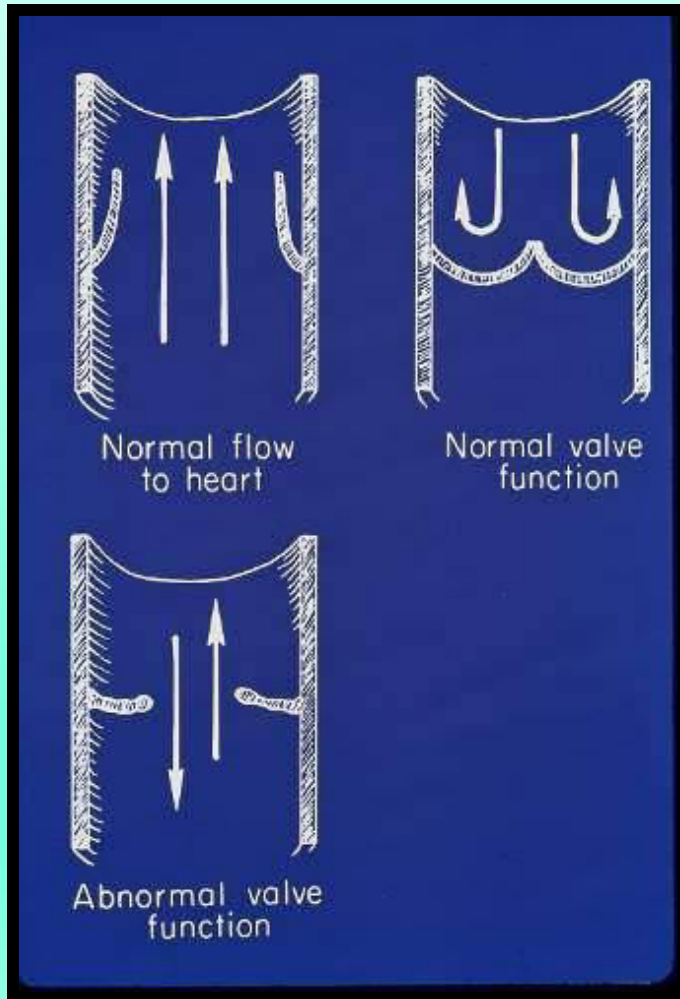
When valves don't close....



They are **INCOMPETENT....**

*and reverse blood flow causes back pressure, “pooling”
and weakening of the vein wall.*

Valve Dysfunction vs. Wall Dilation



- Valves can fail leading to increasing distal pressure (descending pattern)
- Walls can dilate leading to valve failure (ascending pattern)

Musculovenous Pump



Foot veins are emptied by weight bearing.

Musculovenous Pump -- Foot

- Foot veins are emptied by weight bearing, not by muscular contraction
- Weight bearing on a paralyzed limb results in a strong Doppler signal in the femoral vein
- Prolonged non-weight bearing deprives the venous system of this component.

Musculovenous Pump -- Thigh



- Makes up only 15% of volume ejected with each muscular contraction

Musculovenous Pump -- Calf

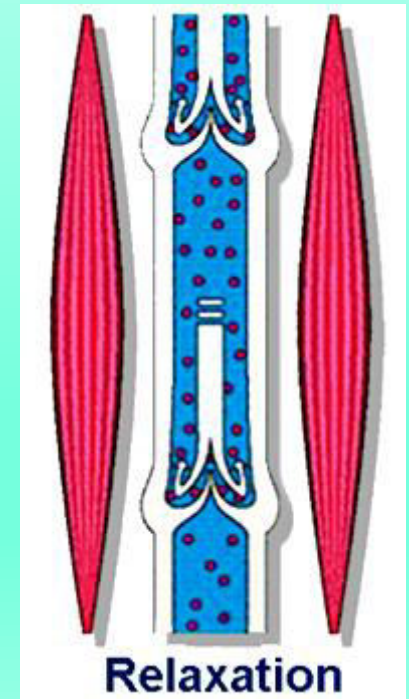
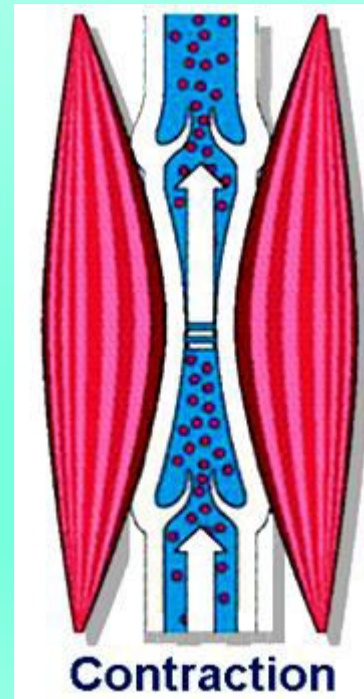
- The true workhorse of venous return – 60% ejected with each contraction.

- **Contraction**

- Pressure on vein forces valves open, antegrade flow

- **Relaxation**

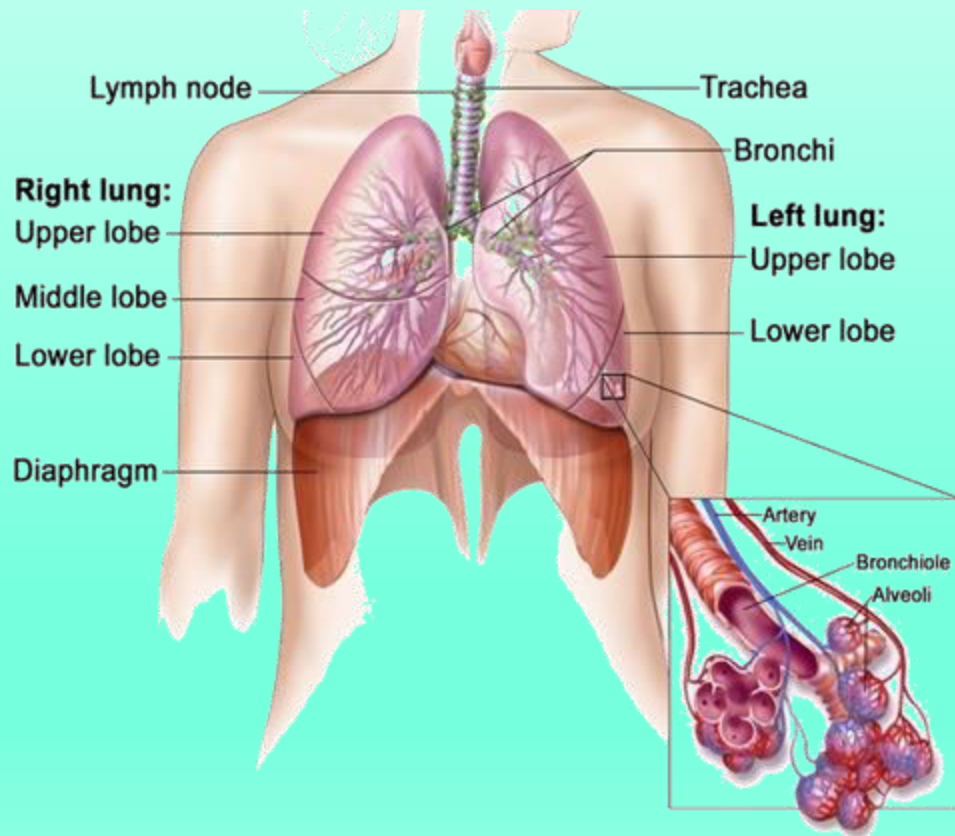
- Pressure subsides, gravity pulls, valves close



Gait Disorders → **Calf Muscle Pump** **Dysfunction** → **Swelling**

- Limping
- Walker (Balance)
- Obesity
- Injury/Weakness (Stroke)

Other Sources of Venous Return



- Arterial Pressure (venous inflow)
- Abdominal/ Intrathoracic Pressure (breathing)

Venous Pressure at the Ankle *in Normal Legs*

Recumbent → 10 mmHg

Standing → 90 mmHg

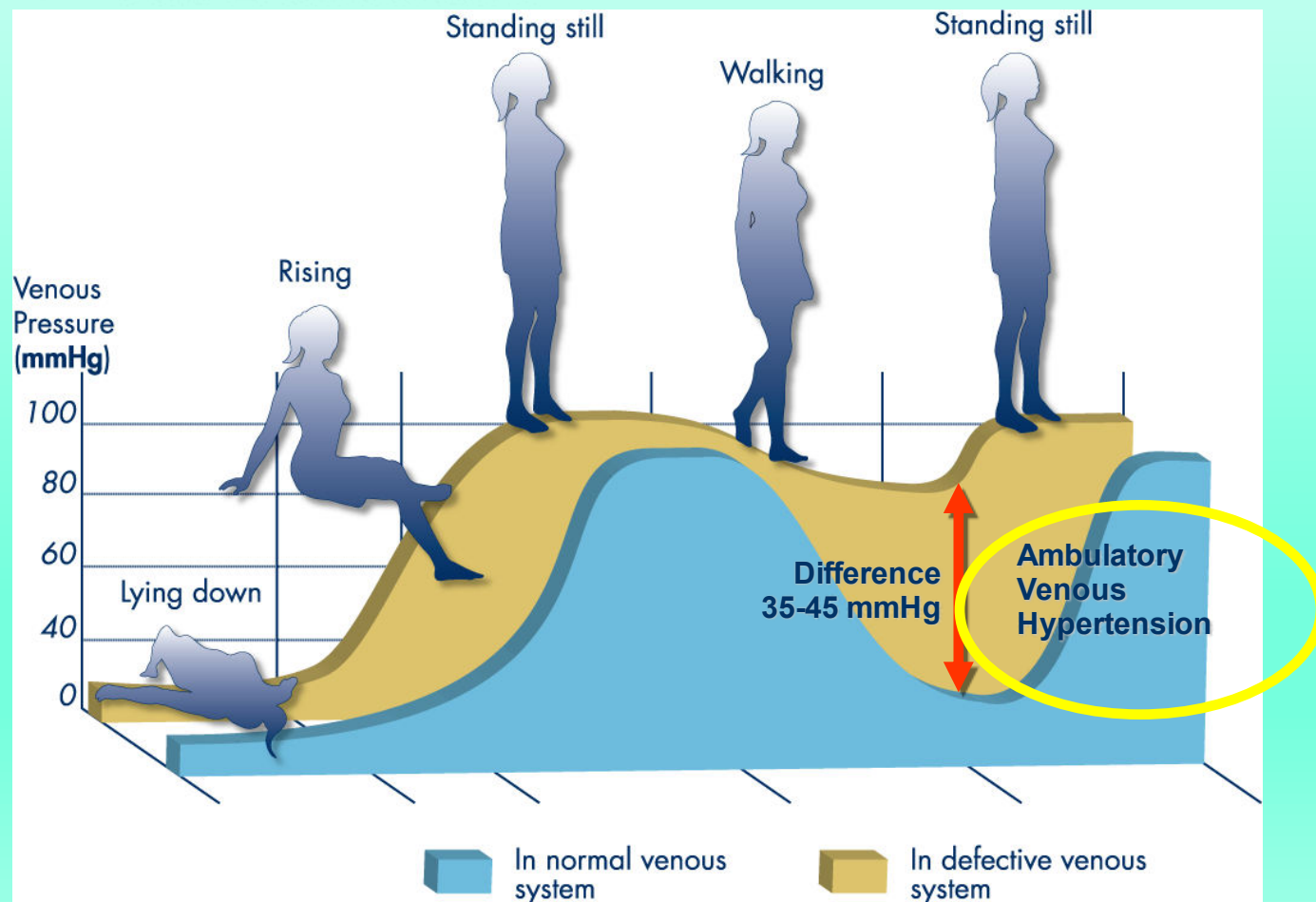
Walking → 25-35 mmHg

The effect of the calf and ankle pumps takes place after

only 7 steps!

Venous Pressure at the Ankle

Normal vs. Defective



Venous Reflux

- Vein wall dilation and valve failure lead to reflux
- Gravity is tough to beat
- BLOOD FLOWS THE WRONG WAY
- Chronic venous hypertension results

Venous Obstruction

- Results from DVT, intrinsic compression (May-Thurner Syndrome), extrinsic compression (obesity)
- Valves damaged by thrombus as a result
- Chronic venous hypertension and reflux often result

So, lower extremity venous return is adversely affected by:

- Reflux (=incompetence, =insufficiency)
- Obstruction (clots, compression, obesity)
- Musculovenous pump inefficiency

Epidemiology: Who develops venous disease?

Venous Disease is a Hereditary Disorder

134 families were examined:

The risk of developing varicose veins was:

89% if both parents had varicose veins

47% if one parent had varicose veins

20% if neither parent had varicose veins

Heredity in Chronic Venous Insufficiency

- Increased collagen found in varicose veins
- Decreased elastin, hexosamine
- Greater intersegmental variation in water and hexosamine content
- Penetration of gene, gene(s) involved and method of transmission still unclear

Inactivity aggravates venous disease

- 2854 patients with varicose veins, working in a factory
- **64.5% had jobs standing in one place**
- 29.2% had jobs requiring prolonged periods of sitting
- 6.3% had jobs allowing frequent walking during their shift

Varicose Veins are more common in women than men



Each pregnancy worsens the condition

- 405 women with varicose veins
- 13% had one pregnancy
- 30% had two pregnancies
- 57% had three pregnancies

Venous Disorders

- Venous Insufficiency
- Venous Obstruction
- Venous Malformation

Venous Insufficiency (Venous Reflux)

- Venous flow toward feet instead of toward heart
- Implies broken venous valves
- Can occur in the superficial and deep system
- Creates venous hypertension
- Causes symptoms of heaviness, aching, tiredness, burning, throbbing, itching, swelling, skin damage
- Pooling can cause increased risk for SVT

Superficial vs Deep Venous Insufficiency

- Superficial = varicose veins. Genetics, pregnancy, job, age, injury contribute
 - Can be treated by eliminating abnormal veins
- Deep: often associated with prior DVT and damaged venous valves
 - No great solutions other than compression

Chronic Venous Insufficiency (CVI)

- Describes severity, not duration of symptoms
- Denotes damage to skin
- Progresses, if not treated



Venous Obstruction

- Thrombosis
 - Superficial or Deep
- Compression
 - Non-thrombotic iliac vein lesion (May-Thurner Syndrome)
 - RCIA compresses LCIV
- Post-thrombotic obstruction (scarring)
- Biggest symptoms: pain and swelling. Chronic issues lead to skin changes.

Venous Thromboembolism

■ Superficial

- Low risk of embolization
- Higher risk for extension of thrombus
- Common in large bulging varicose veins (pooling)
- Treatments include:
 - Anticoagulation (depending on thrombus burden)
 - Compression (once initial inflammatory response decreases)
 - Heat
 - Daily ambulation

Venous Thromboembolism

■ Deep

- Higher risk for embolization than with superficial
- Thrombus extension can have more significant consequences
- Incomplete resolution of thrombus can lead to chronic leg pain and swelling
- Post-thrombotic syndrome (damage to venous valves with resultant deep vein reflux) may occur in as many as 40% of cases
- Treatments include:
 - Anticoagulation
 - Compression (once initial inflammatory response decreases)
 - Daily ambulation
 - Thrombophilia testing should NOT be routine

How do we visually classify venous disease?

■ CEAP Classification

- Clinical Signs (C1-C6)
- Etiology (Primary, Secondary, Congenital)
- Anatomy (Superficial, Deep, Perforating Veins)
- Pathophysiology (Reflux, Obstruction, Both)

CEAP Classifications

Clinical Signs



C₁ - telangiectasias or reticular veins

C₂ - varicose veins

C₃ - edema & corona

C₄ - lipodermatosclerosis and eczema

C₅ - ulcer scar

C₆ - active ulcer

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

C-1 Spider Veins



Telangiectasias and Reticular Veins

C-2 Varicosities



C-3 Edema or Corona Phlebectatica



Corona Phlebectatica

C-4 Skin Changes



Dermatitis, Cellulitis



Hyperpigmentation
Atrophie Blanche

C-5 Healed Ulcer



C-6 Active Venous Stasis Ulcer



Cosmetic or Medical?

- Spider veins are always considered cosmetic, even if they cause discomfort
- Varicose veins that cause symptoms are a MEDICAL problem. Their treatment is almost without exception **covered by insurance**, including Medicare, although insurance companies often make things difficult.
 - 6-12 weeks of compression stocking use (some)
 - BMI requirements (<35)
 - Some veins may be excluded

Evaluation of the Patient With Venous Disease

History

- History of problem: onset, exacerbating/alleviating factors, pregnancies, prior DVT, immobilization, job
- Associated symptoms and relationship to standing, menses, exercise and compression
- Current medications
- Family history
- Previous treatment and result
- Goals of patient
- Night-time symptoms are typically NOT venous

Physical Examination

- Examine patient in the standing position, from the groin to the ankle
- Inspect and palpate for varicose and telangiectatic veins
- Examine the skin for color/texture changes indicative of chronic venous insufficiency
- Inspect the abdomen for enlarged superficial veins if ilio-femoral thrombosis is suspected

Duplex Ultrasound

- Gold standard for the initial evaluation of venous disease
- MUST be performed in the standing position when evaluating for reflux.
- Surprisingly, the average vascular tech is NOT adequately trained in how to do this, even with years of experience.

Venous Mapping

- Provides for accurate treatment planning
- Allows for follow-up

Albuquerque Vein & LASER INSTITUTE

ROBERT CUTCHEN, MD, RVS, RVT, RPVI | Diplomate, American Board of Venous and Lymphatic Medicine

LEFT Lower Extremity Venous Duplex Examination

Patient name: [REDACTED] DOB: 11/18/4 Date: 11/16/19

Tech: ☒ Robert Cutchen, MD, RVS, RVT, RPVI

Indications: ☒ Leg pain ☒ Leg swelling ☐ Previous DVT ☐ Previous PE
☐ Trauma ☐ Tachycardia ☐ Venous ulcer ☐ Other _____

PT: _____
 DP: _____
 Edema: _____

Incompetence is defined as reflux >1.0 sec in the deep veins and >0.5sec in the superficial veins

Vessel	Diam. (mm)	Reflux (s)	Vessel	Diam. (mm)	Reflux (s)
GSV	<u>6.2</u>	<u>2.4</u>	SSV	<u>3.4</u>	<u>⊖</u>
MT GSV	<u>5.6</u>	<u>2.2</u>	Distal SSV	<u>3.1</u>	<u> </u>
Knee GSV	<u>5.1</u>	<u>2.2</u>	CFV	<u>15.6</u>	<u> </u>
Calf GSV	<u>3.6</u>	<u>1</u>	FV	<u>12.4</u>	<u> </u>
AASV	<u>3.0</u>	<u>⊖</u>	Pop	<u>11.1</u>	<u> </u>

Thrombus ☐ Yes ☒ No

Reviewed by: [Signature] Robert Cutchen, MD, RVS, RVT, RPVI

ALBUQUERQUE'S COMPREHENSIVE VEIN CARE SOLUTIONS

TEL: 505-848-VEIN (8346) FAX: 505-848-8345 WEB: www.albuquerquevein.com

5110 Masthead St. NE Suite C
 Albuquerque, NM 87109

Varicose Veins

- Varicose veins = venous insufficiency = venous reflux
- Risk factors include genetics, females, pregnancy, jobs with prolonged standing, age, trauma
- Great saphenous vein and its branches are most commonly affected.
- Should be treated if symptomatic or if skin damage is occurring.

Varicose Veins

- Typical symptoms are **aching, heaviness, burning, throbbing, tiredness, itching, and swelling** are worse with prolonged standing or sitting, heat, high progesterone states such as pregnancy/pre-menses
- Symptoms are improved with leg elevation, graduated compression (if tolerated), and often with walking

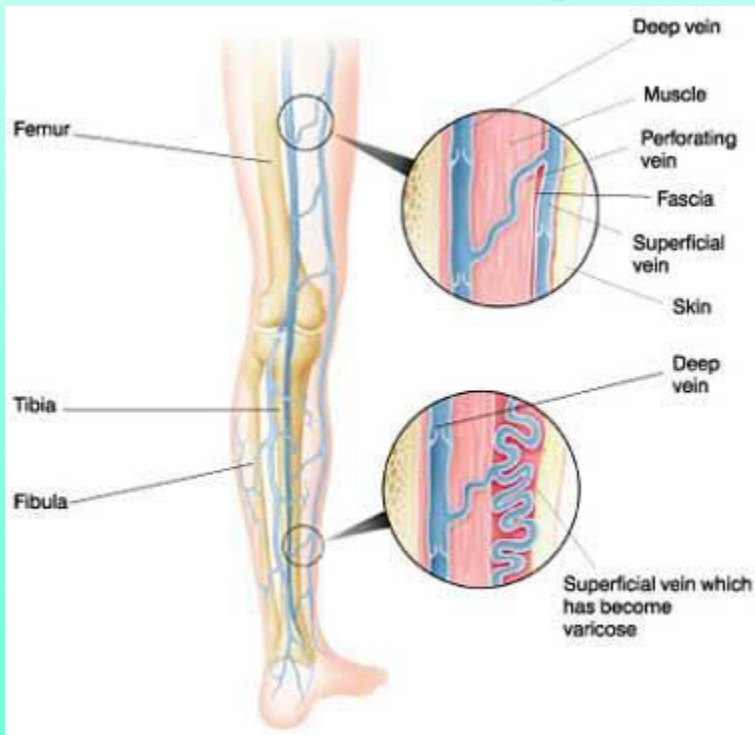
Prevalence of Varicose Veins

- Varicose veins are one of the most common chronic condition in North America
- 40 million Americans have varicose veins¹
 - 15% men; 25% women
- 4.6 million workdays are missed in the U.S. due to Chronic Venous Insufficiency

¹Society for Vascular Surgery

²Ballard and Bergen: Chronic Venous Insufficiency – Diagnosis and Treatment

Secondary Varicose Veins



DEEP VEINS OCCLUDED BY THROMBI



DESTRUCTION OF VENOUS VALVE



BLOOD POOLING IN DEEP VEINS



HIGH PRESSURE IN DEEP SYSTEM



***PRESSURE TRANSMITTED TO SUPERFICIAL SYSTEM
THROUGH PERFORATORS***



VARICOSE DILATION OF SUPERFICIAL VEINS

Procedures for Varicose Veins

- No more vein stripping!
- Endovenous Thermal Ablation
 - Great Saphenous
 - Small Saphenous
 - Ant. Access. Great Saph.
 - Perforators
- Mechanicochemical Ablation
- Ambulatory phlebectomy
- Endovenous Chemical Ablation



Before

After

Endovenous Thermal Ablation



- Outpatient procedure
- Local tumescent anesthesia
- Continuous pullback
- Closure of >93% GSV at 2 yrs
- Immediate return to activity
- Compression stockings for 1-3 weeks

Photo courtesy of Diomed, Inc.

Endovenous Thermal Ablation

- Fiber, positioning, tumescent anesthetic, laser pullback
- All done under ultrasound guidance

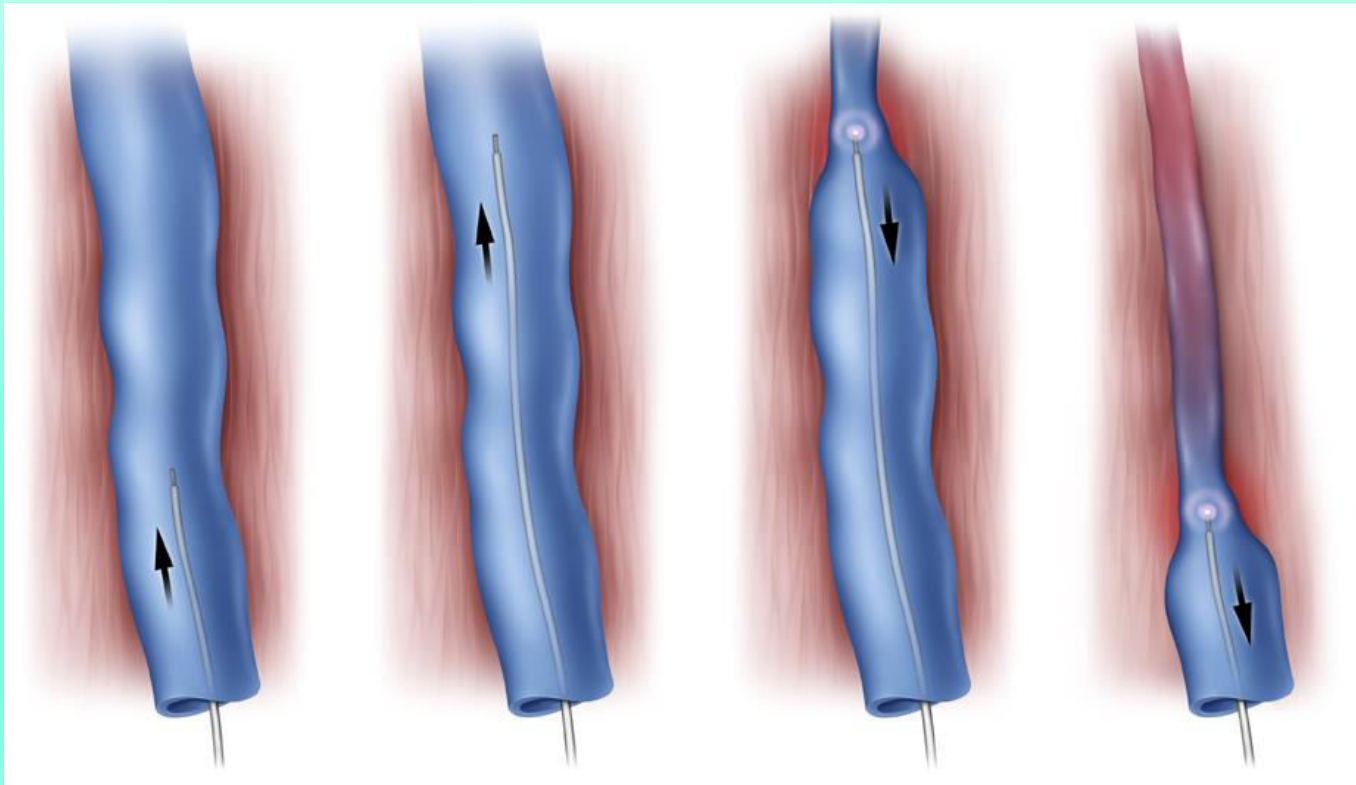
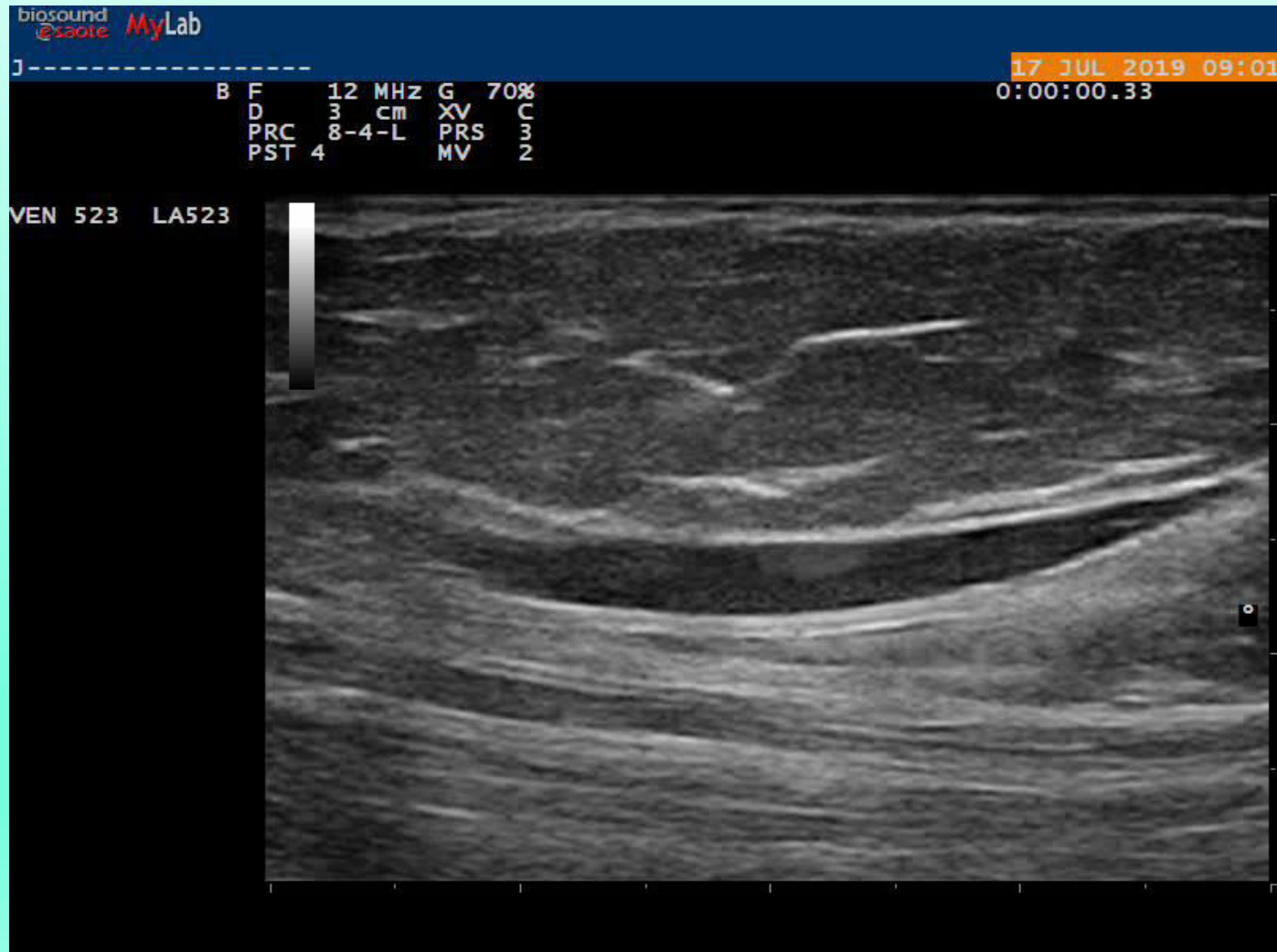
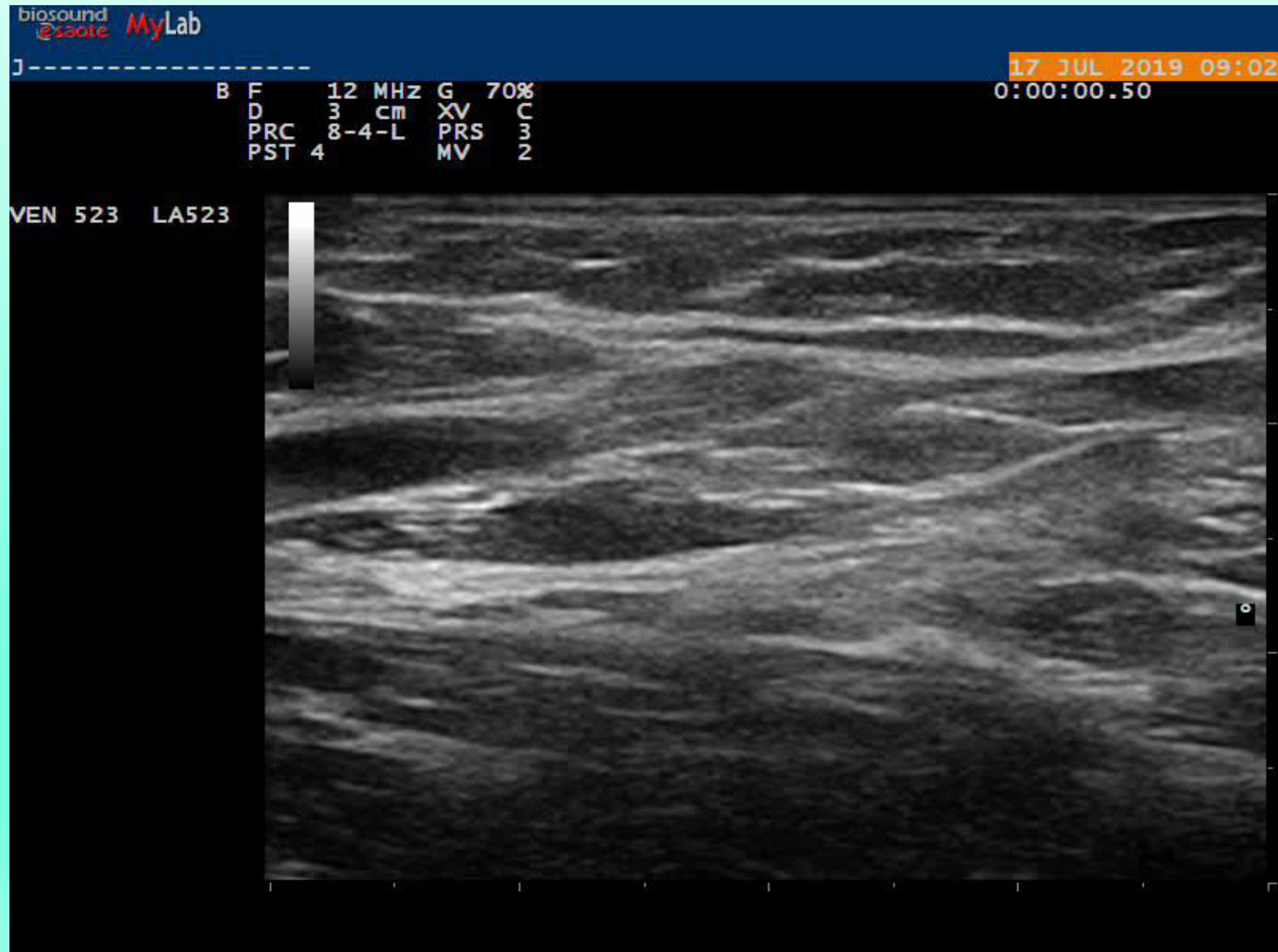


Photo courtesy of Diomed, Inc.

Endovenous thermal ablation - access



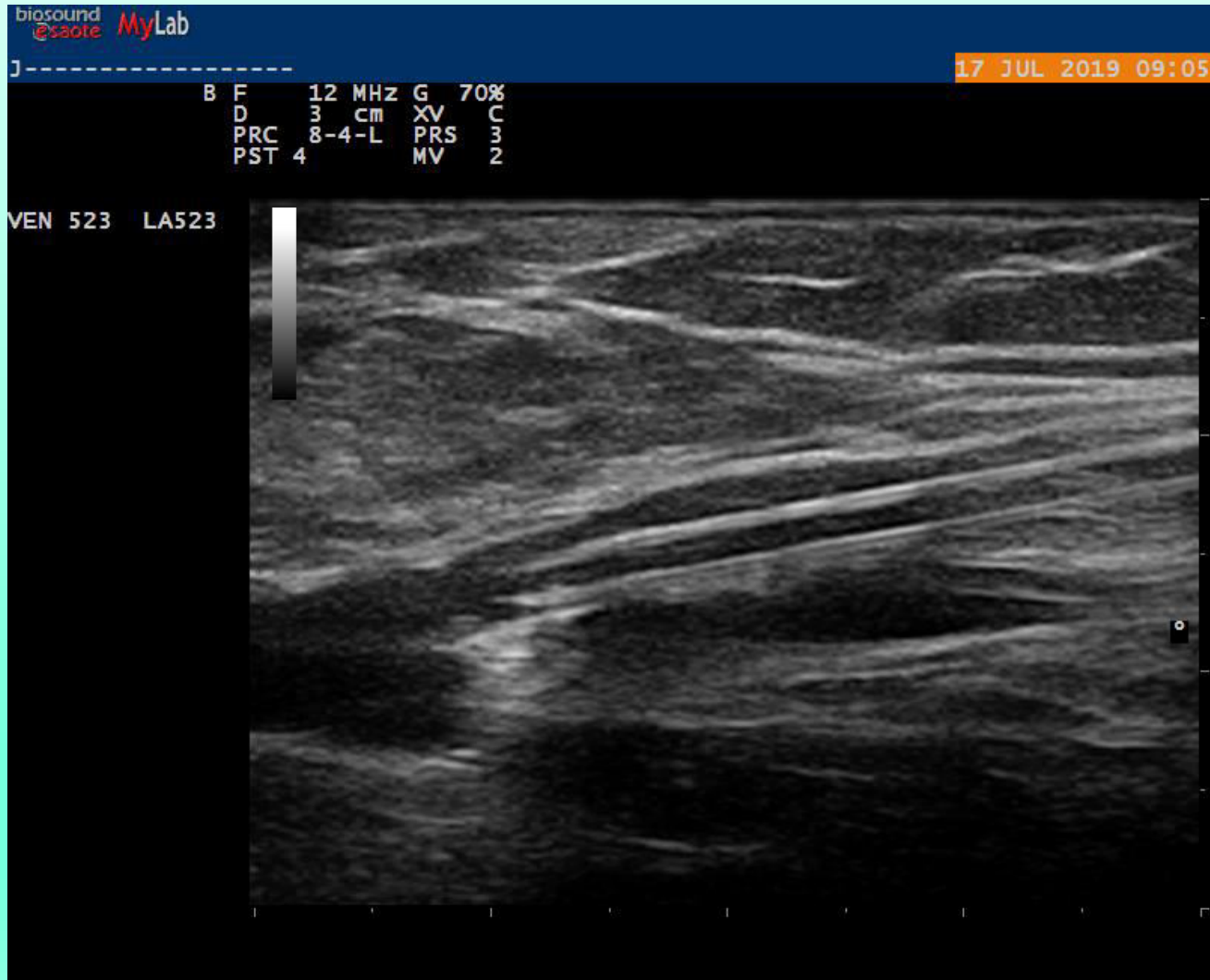
Endovenous thermal ablation - access



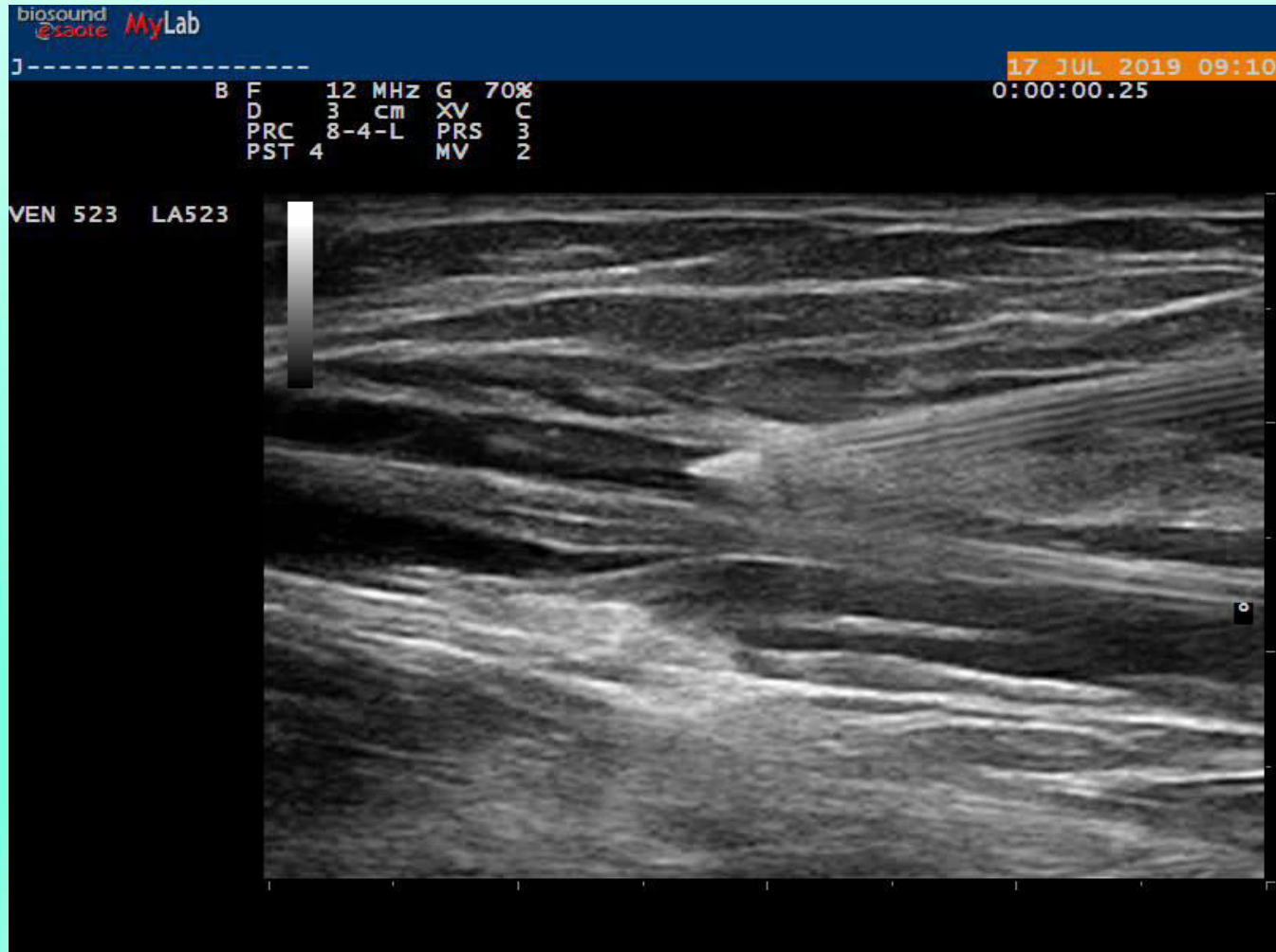
Endovenous thermal ablation - sheath



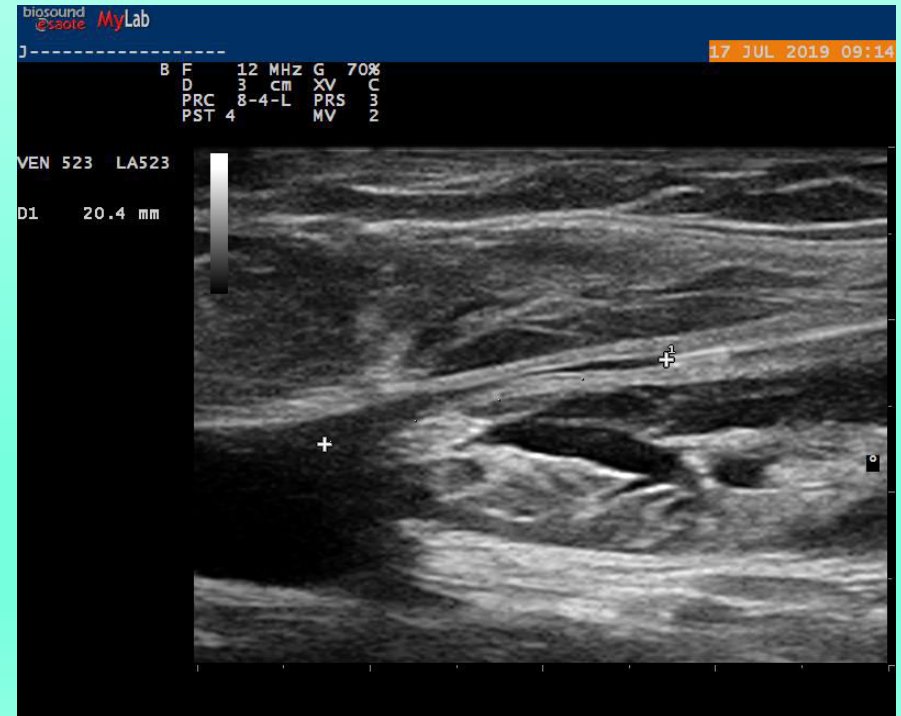
Endovenous thermal ablation - sheath



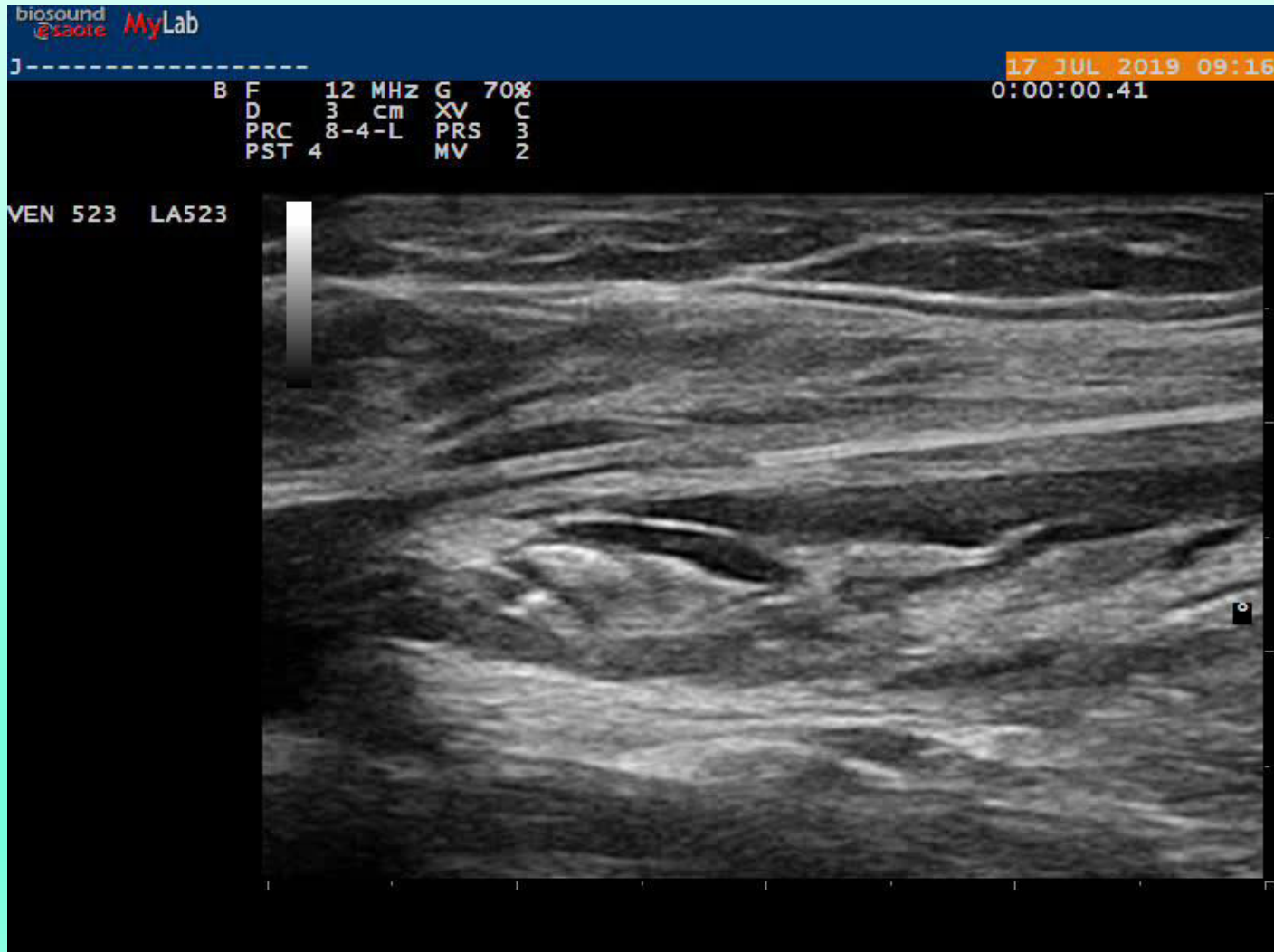
Endovenous thermal ablation – tumescence anesthesia



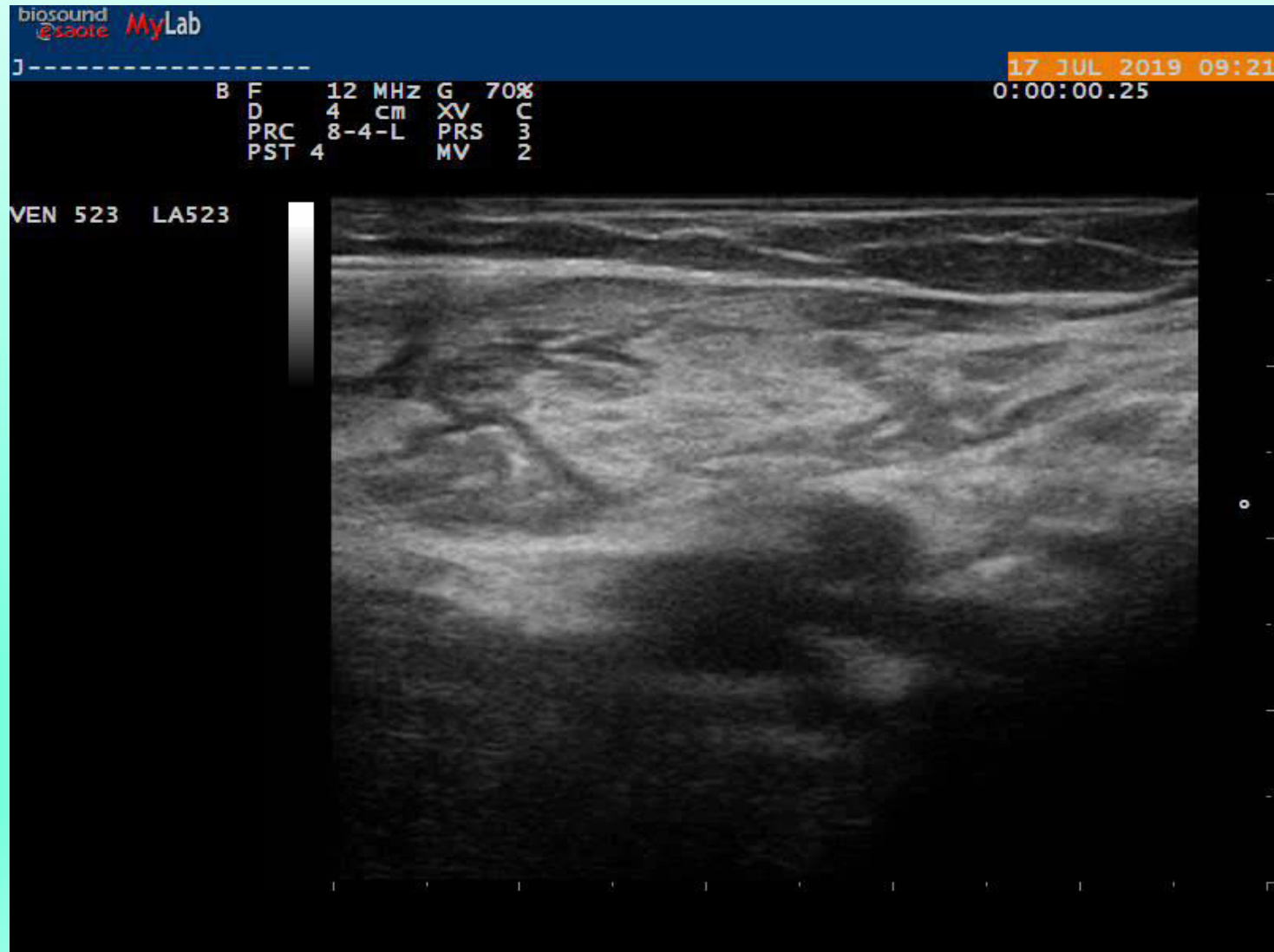
Endovenous thermal ablation - fiber



Endovenous thermal ablation - firing



Endovenous thermal ablation - deep



Mechanicochemical ablation “Clarivein”

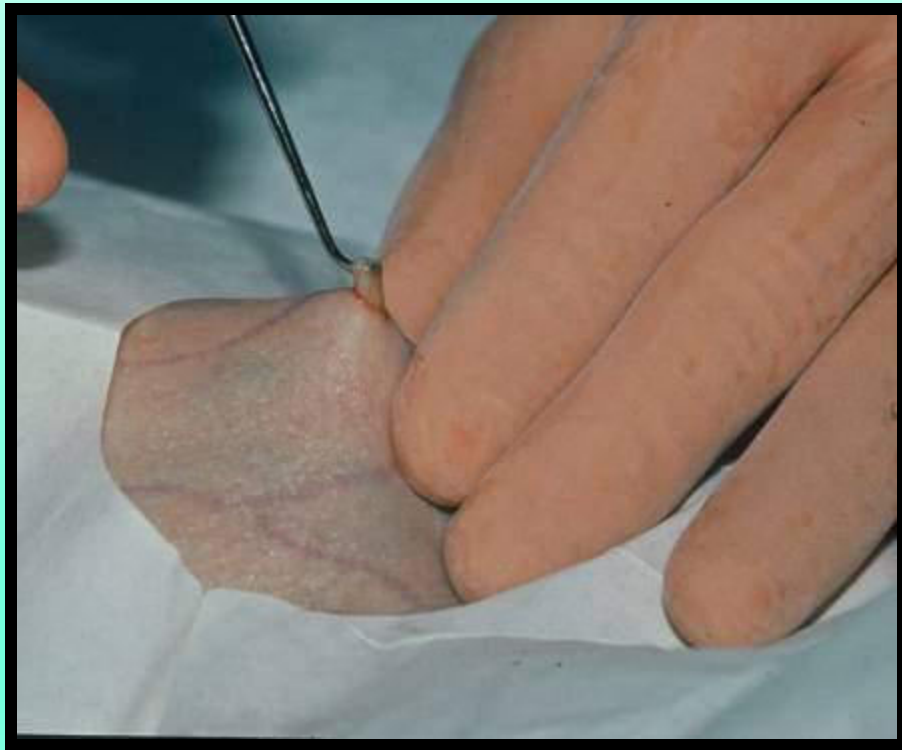
Spinning wire plus injection of liquid sclerosant



Mechanicochemical ablation “Clarivein”



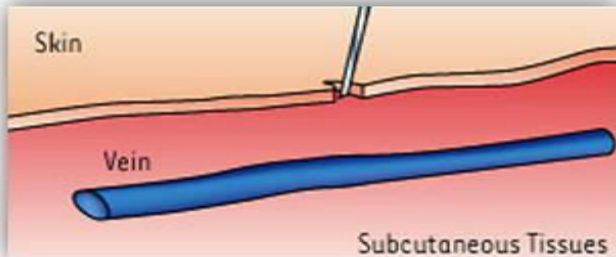
Ambulatory Phlebectomy (Microphlebectomy)



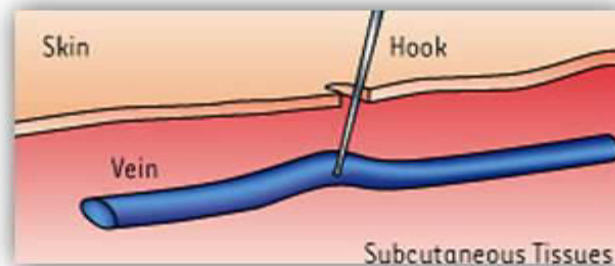
- Removal of bulging veins
- Local tumescent anesthetic
- Micro incisions (2-3mm)
- Especially useful for tributaries of GSV, SSV

Photo courtesy of Mitchel P. Goldman, MD

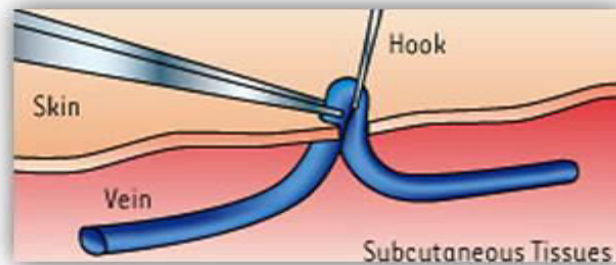
Ambulatory phlebectomy



1. 2-3mm incision is made

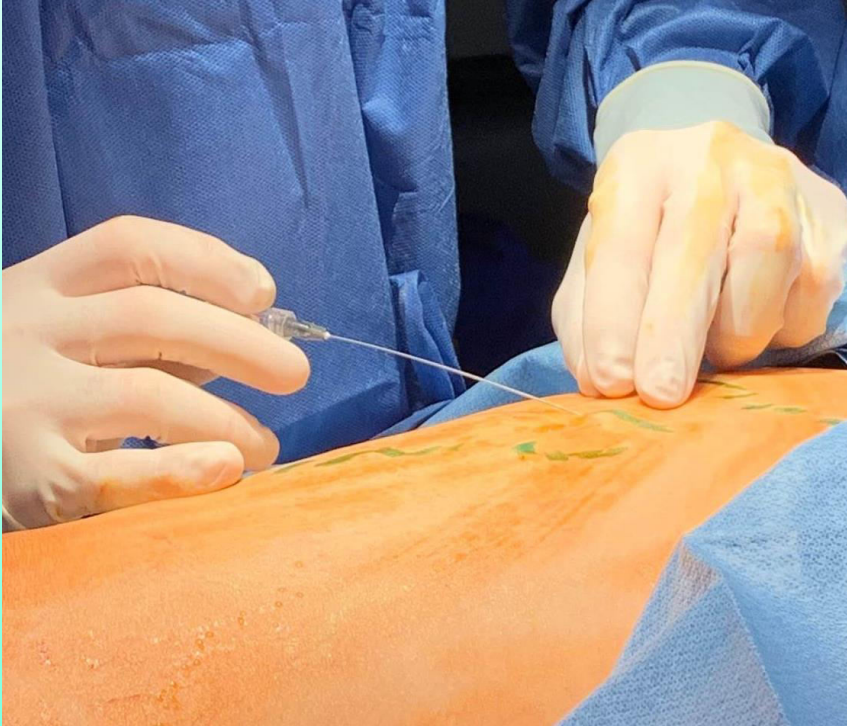


2. Vein is hooked

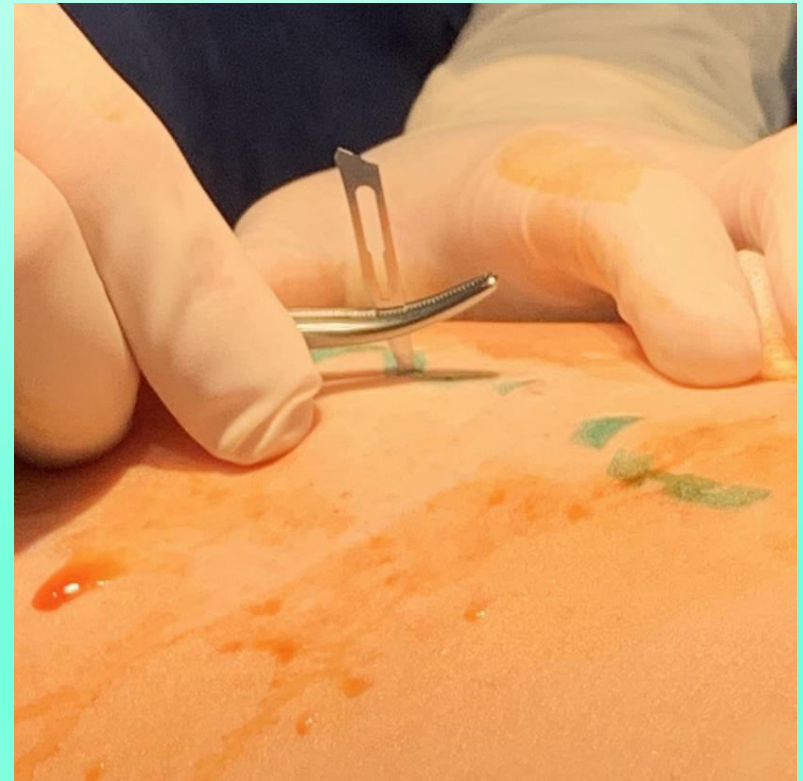


3. Section of vein is pulled through with hemostat

Ambulatory Phlebectomy



Tumescent anesthesia, 0.1% buffered lidocaine with epinephrine



11 blade, 2-3mm incision

Ambulatory Phlebectomy



Treatment Results



Before

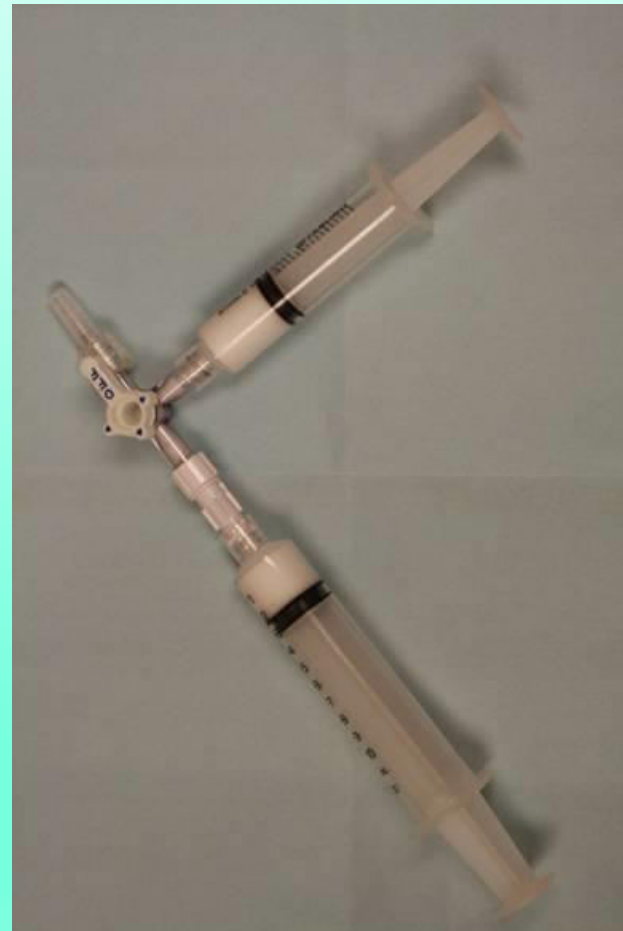


After

Endovenous Chemical Ablation

- aka Ultrasound-guided Foam Sclerotherapy
- Ultrasound-guided injections of a foamed sclerosant to close large varicose veins (2-7mm) not visible to the eye.
- Sclerosant damages the endothelium and causes the vein to close and be reabsorbed over months
- Should be followed up with compression
- No incision, minimal pain, no recovery time
- Medical procedure

Physician compounded foam



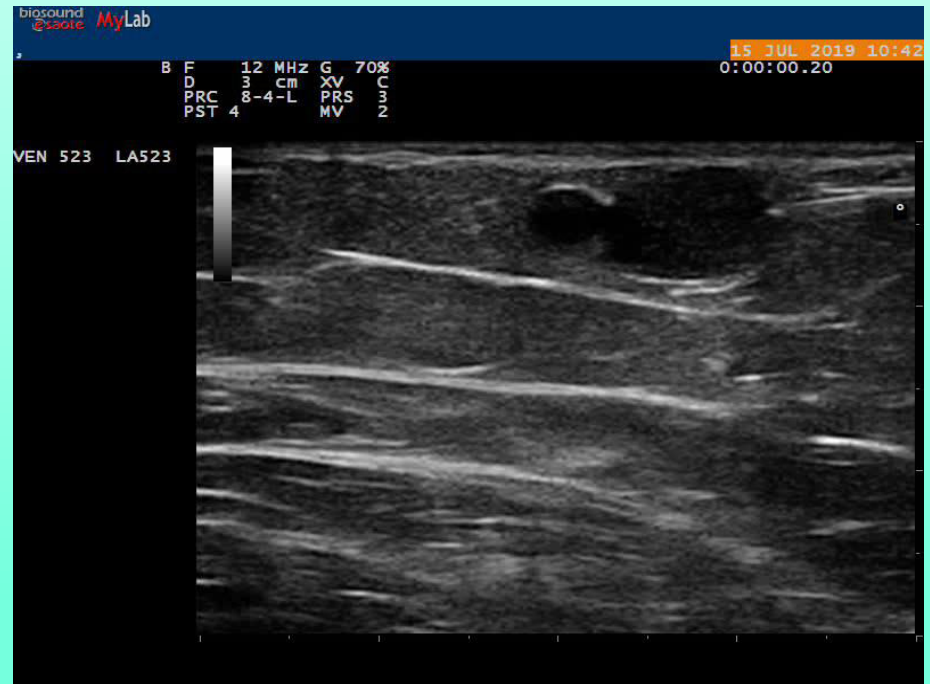
Considered an “off-label” use of an FDA approved sclerosant

Varithena microfoam



- FDA Approved
- \$\$\$\$\$
- Have to be quick as the foam breaks down somewhat rapidly
- Very nice venospasm

Endovenous Chemical Ablation



Sclerotherapy

- Cosmetic procedure
- Use a liquid sclerosant instead of foam
- No more hypertonic saline
- Veins slowly fade away. Will likely require multiple treatments.
- Not like on Dr. Oz!

Sclerotherapy Results ~ Spider Veins



Before



After

Compression and Vein Treatments

- Compression stockings should be used after any vein treatment
- 30-40mmHg is best, 20-30mmHg can be used if hand strength/arthritis is an issue.
- 2 weeks after cosmetic procedures, 3 weeks after medical procedures
- Some insurance requires a trial of compression before approving vein treatment --- hoop jumping

Compression as conservative therapy

- Some patients are not candidates for treatment
 - Age, mobility
- 15-20mmHg knee highs: great for everyday wear and control of mild swelling
- Try compression over diuretics

Venous Leg Ulcers



Venous Leg Ulcers

- Over 2.5 million people have venous leg ulcers in US and it is rising
- Recurrence rate of venous ulcers approaches 70%²
- Estimated per-episode cost of care can exceed \$40,000¹
- Estimated 2 million workdays per calendar year are lost due to chronic venous ulcers¹

¹Rudolph DM, et al. *J Wound Ostomy Continence Nurs* 1998; 25: 248-55

High Physical & Financial Costs

- Lack of recognition/treatment of early symptoms and skin changes
- Poor coordination of care
 - Multidisciplinary team approach
 - Primary care physician
 - Phlebologist/Vascular surgeon
 - Wound care/Compression
 - Bedside caregivers
 - Case manager

Management of Venous Leg Ulcers

- Address them EARLY, don't wait.
- Compression (and lots of it)
- Moisture control (problematic with wound care frequency)
- Eliminate underlying venous disease

EVRA Trial (Early Venous Reflux Ablation)

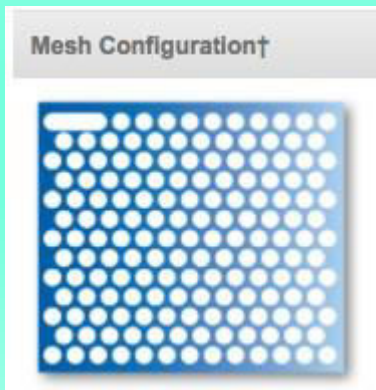
- Sought to compare compression alone with compression plus ablation of venous reflux
- 20 centers in the UK
- Median healing time in compression group: 82 days
- Median healing time in compression/treatment group: 56 days
- Time to recurrence favored treatment group
- Improved QOL scores in treatment group
- N Engl J Med 2018; 378:2105-2114

Wound Care

- Wound care plays an important role (mostly from compression)
- No significant evidence for use of any particular topical product
- Infrequent wound care (weekly) often leaves wounds macerated and delays healing (in my personal experience)
- Wound care clinics are limited by available appointments in many cases
- Avoid culturing an open wound bed which will be colonized without question

Grafting / Skin substitutes

- Should only be performed after eliminating venous reflux
- Can speed healing if used along with good wound care and compression
- EpiFix
 - A bioactive tissue matrix allograft composed of dehydrated human amnion/chorion membrane (dHACM) that preserves and contains multiple extracellular matrix proteins, growth factors, cytokines, and other specialty proteins.



Compression – the key to success

- The problem is venous hypertension
- It takes a big squeeze, 30-50mmHg
- Elastic compression vs Inelastic compression
- Wound patients need lifelong compression in some form

Elastic Compression

- Compression stockings (\$100)
- High resting working pressure
- Low active working pressure
- Very tight ones are often fairly uncomfortable
- Not the best option for venous ulcers
- Don't use ACE bandages
- No TED hose (TEDs are for beds, \$5)



Inelastic compression

- Best for healing wounds
- Velcro compression garments (CircAid)
- Short stretch bandaging (Comprilan)
- Multilayer wraps
- Unna Boot
- Low resting working pressure
- High active working pressure
- Giraffe skin is inelastic (250mmHg at ankle)



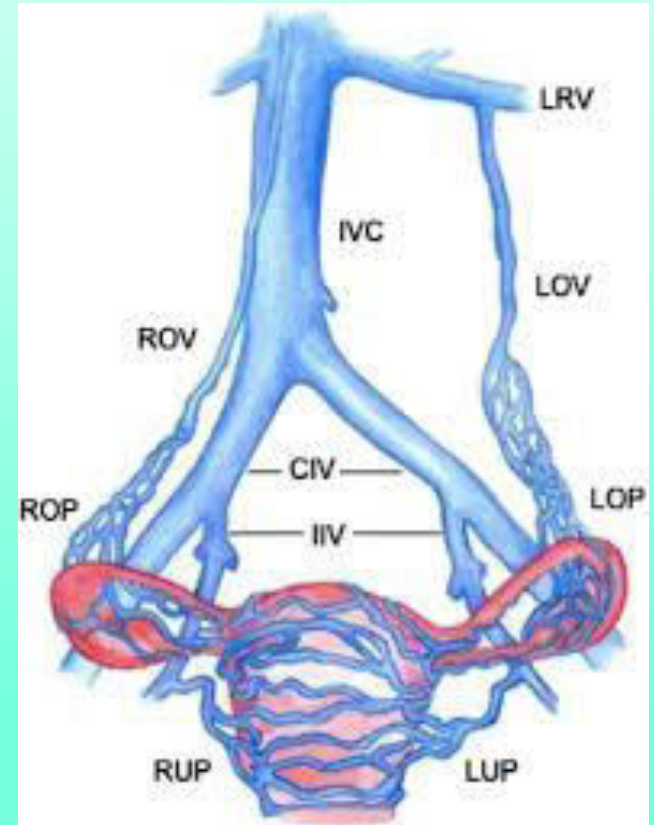
Pelvic Venous Disease

■ Reflux

- Gonadal vein, internal iliac vein
- Includes vulvar varicose veins
- Pelvic escape veins

■ Obstructive

- Non-thrombotic iliac vein lesions
- Post-thrombotic iliac vein lesions



Pelvic Venous Reflux

- Reflux in the ovarian vein or internal iliac vein most common source (L>R)
- Can cause visible vulvar veins that may course into the leg (pelvic escape veins)
- Increased risk in multiparous women
- Worse symptoms around menses

Clinical Presentation

- Symptoms can be non-specific
 - Generalized lethargy
 - Abdominal/pelvic tenderness
 - Pelvic heaviness and deep ache
 - Varicose veins, vulvar varices, hemorrhoids
 - Dysmenorrhea
 - Urinary frequency or rectal pain/pressure
 - Back pain
 - Depression

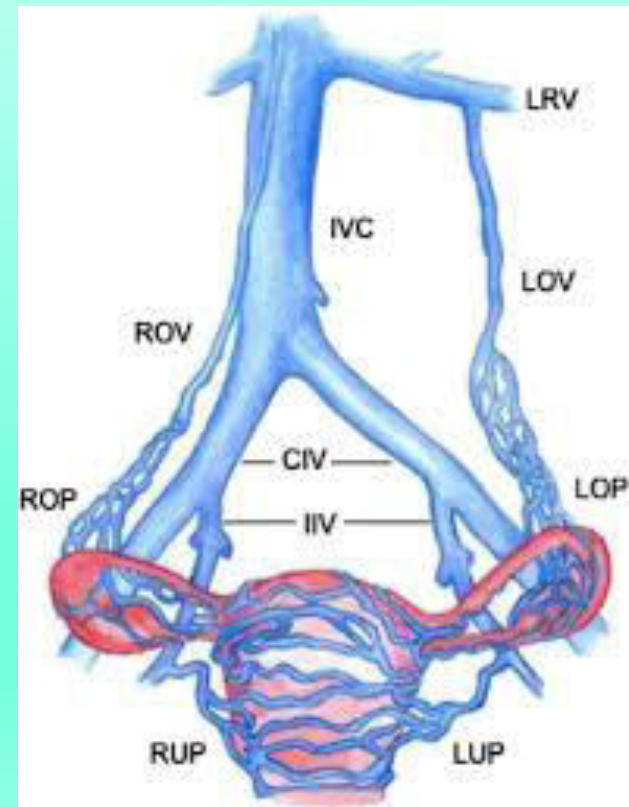
Pathophysiology – Gonadal reflux

■ Compensated

- Pelvic escape → pelvic varices
- Perineal, saphenous, vulvar varices

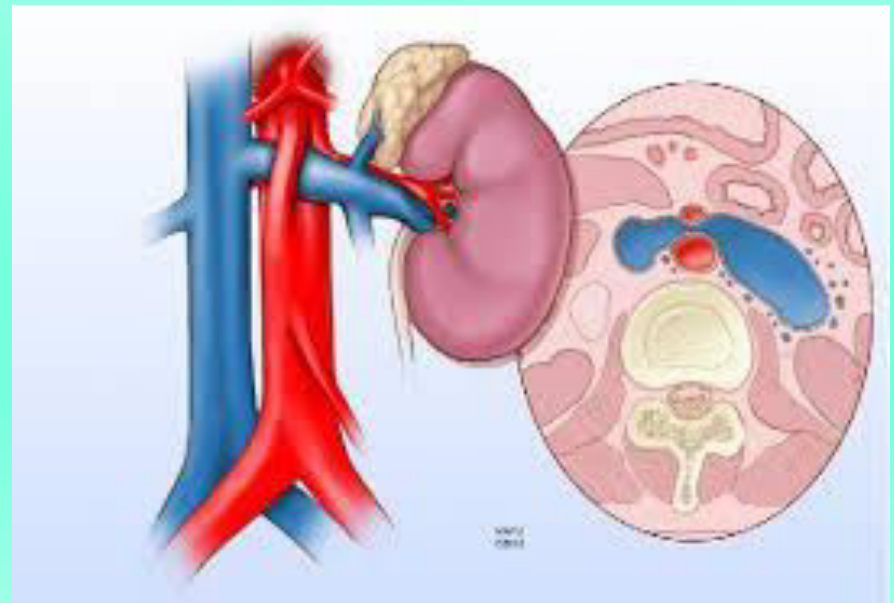
■ Uncompensated

- Pelvic pain



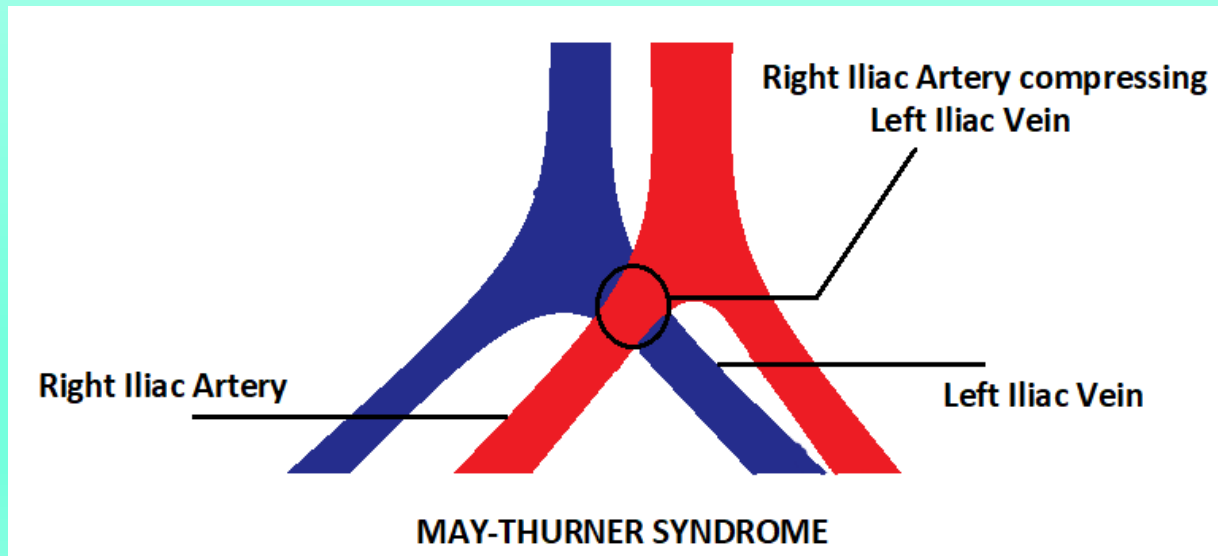
Pathophysiology – LRV obstruction

- LRV crushed by SMA
- Compensated
 - Left gonadal reflux → pelvic pain
- Uncompensated
 - Left kidney pressurized, flank pain, hematuria



Non-thrombotic iliac vein lesions

- May-Thurner syndrome
- Pain and swelling often much worse on one side
- Typically presents with iliofemoral DVT



Post-thrombotic iliac vein lesion

- Complication of iliofemoral DVT
- Incomplete clot resolution leads to scarring and diminished venous outflow
- May see “crossover” veins going across pubic symphysis

Pelvic Venous Reflux – Imaging

- Contrast venogram is best
 - Provides physiologic information
- CT Venography or MR Venography is often required before contrast venography
- In thin patients and with good technical skill, ovarian veins can be seen on ultrasound



Pelvic Venous Reflux - Treatments

- Treatments
 - Coil embolization
 - Foam sclerotherapy
- Vulvar varicosities can be treated with foam sclerotherapy
- Post-pregnancy: the only time VV may improve



Iliac vein lesion workup and treatment

- CT Venography, MR Venography often are first step
- Intravascular Ultrasound (IVUS) is BEST
- Treat with angioplasty and stenting IF patient is having significant symptoms, wounds, skin changes, chronic severe swelling, DVT



DVT -- A serious problem

- Every year in the USA:
 - As many as 900,000 people affected by DVT/PE
 - As many as 60,000 – 100,000 deaths (compared to 41,000 from breast cancer)
- A leading cause of maternal death in developed countries

Risk Factors for DVT

- Prolonged bed rest
- Prolong sitting or being in a cramped position
- Surgery or major injury (especially orthopedic)
- Age over 40
- Smoking
- Excessive weight (BMI>30)
- Hypercoagulable genetic condition
- High estrogen states
- Dehydration
- Cancer, cardiopulmonary disease, IBD

DVT Treatments

■ Anticoagulation

- LMWH – Enoxaparin, Dalteparin, Fondaparinux
- Warfarin (must start with LMWH)
- DOACs – Rivaroxaban, Apixaban (not in morbidly obese)

■ Thrombolysis (Iliofemoral DVT)

■ Regular Ambulation

- Walk, walk, walk

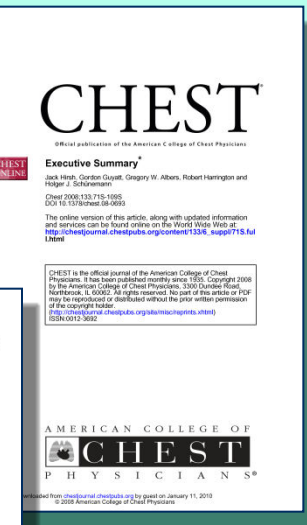
■ Compression Stockings

- 30-40 mmHg
- Reduces pain and swelling
- Encourages physiological thrombolysis
- Prevents Post Thrombotic Syndrome (PTS)

■ Prevent Recurrence!

Post Thrombotic Syndrome (PTS)

- Long-term complication of DVT
- Approximately 40% of DVT patients will develop PTS within 1-2 years¹
- ACCP Guidelines direct 30-40 mmHg for a minimum of 2 years, post DVT²
- Compression stockings reduce the risk of DVT or complications by 50%¹



¹ Brandjes DP, et. al. *Lancet* 1997
² 2008 ACCP Guidelines



Questions?