



Venous Reflux Duplex Exam

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PURPOSE: To identify patterns of incompetence and which veins are involved.

-Guidance for the appropriate treatment of veins based on location, size and communication with other veins.

Keep in mind, different patterns of incompetence can have similar clinical presentations.

Patient also needs to be evaluated for the presence of previous thrombosis and deep vein incompetence

GOAL- Identify ALL incompetent primary (truncal veins GSV and SSV) and their tributaries and accessories, as well as incompetent perforators and neovascularization from previous treatment.

EQUIPMENT AND PATIENT POSITION

- ▶ 7.5 MHz – 20 MHz Linear Transducer
- ▶ Raised standing platform with safety support(bar) (ideal set up)
- ▶ Floor pad with support(such as a walker)
- ▶ Rapid release pressure cuff placed distal to the transducer will provide uniformity with distal compression, or operators hand
- ▶ Consider later appointment – better filling of veins
- ▶ Veins constrict when they are COLD- **USE WARM GEL**
- ▶ Room temperature- comfortably warm

EQUIPMENT AND PATIENT POSITION

- ▶ Preferably standing with weight on the contralateral limb, scanned limb externally rotated.
- ▶ If unable to stand, reverse Trendelenburg with knee slightly bent and externally rotated.
- ▶ If used, the cuff is placed distal to the transducer.
- ▶ If no cuff is used, manual compression is performed distal to the transducer.
- ▶ Val salva maneuver is effective only with the SFJ and CFV.



Reflux Testing Position

Ideal Testing Position



Reverse Trendelenburg



“DEAR”

- ▶ • **D**DEPTH
 - Where is fascial layer, where is the skin
- ▶ • **E**EVALUATION of SIZE
 - Measure at SFJ, mid thigh, knee, mid calf, ankle
- ▶ • **A**ANATOMICAL VARIANTS
 - Tortuosity, Double system, Accessories, Termination, Previous treatments, Segmental occlusion, Phlebosclerosis, Varix, Aneurysm)
- ▶ • **R**REFLUX

SCAN PROTOCOL

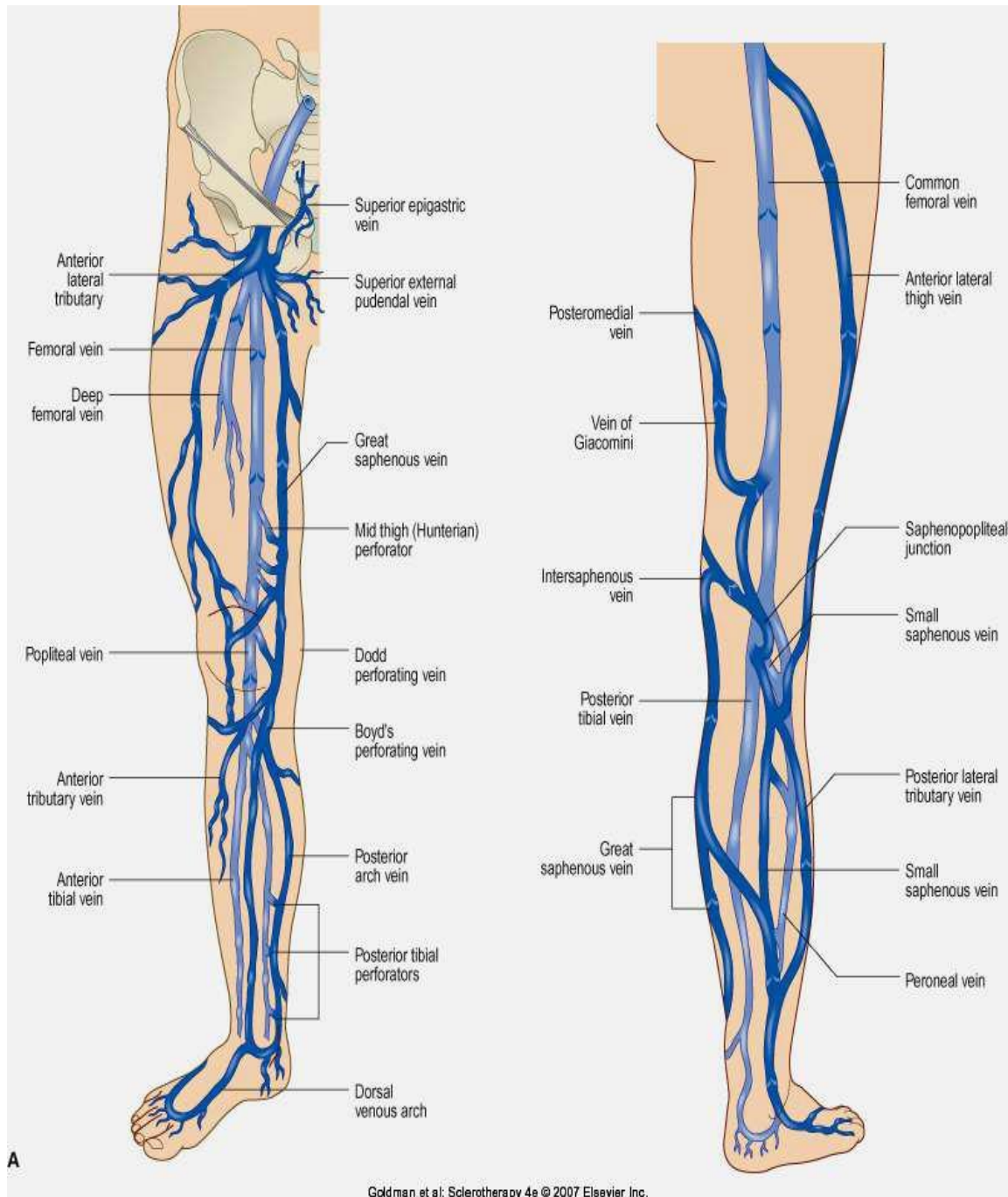
- ▶ Scan the limb, beginning in the groin at the Sapho-femoral Junction(SFJ) through the distal thigh noting overall anatomy with focus on the GSV. GSV is identified by it's location in the “Egyptian eye” or fascial envelope. Diameter of the vein and areas of reflux are identified at the SFJ. Pay special attention to the tributaries in the groin (epigastric, superficial circumflex iliac, external pudendal). Examine GSV to knee.
- ▶ Scan the anterior and posterior accessory GSV(if present), noting size and hemodynamics at SFJ, mid thigh and knee.
- ▶ Document(size, depth, reflux) of any notable varices, epifascial veins, large tributaries.
- ▶ Key is to determine origin of these refluxing segments

SCAN PROTOCOL

- ▶ Below knee, evaluate the GSV from the medial malleolus to the knee, measuring size and reflux just below knee, mid calf and ankle.
- ▶ Note large and refluxing perforators
- ▶ Remember, GSV has numerous variations and may not be present, and not all perforators will be visualized. Focus on large and obviously refluxing veins.
- ▶ Posterior leg: Find origin of Small saphenous vein(SSV), (may be above or below popliteal fossa). Note size of the sapho-popliteal junction(SPJ) and reflux if present.
- ▶ Make note of any cross over patterns between the networks of the GSV and SSV.
- ▶ Identify the thigh extension of the SSV and intersaphenous vein(if Present)

Augmentation-cuff or manual

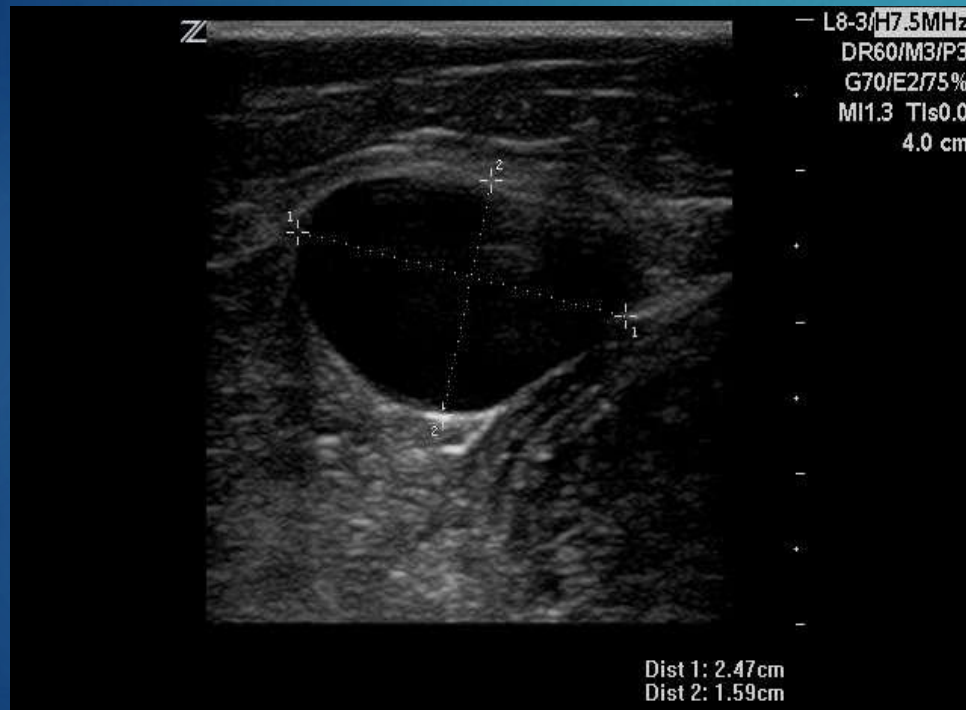
- ▶ Cuff (or hand) is placed inferior to vein segment being tested
- ▶ Cuff inflated to 100-150 mm Hg
- ▶ Cuff deflated rapidly within 0.3 sec, inducing reflux in venous segment
- ▶ May use hand compression/release
- ▶ reflux defined as ≥ 0.5 seconds.
- ▶ Valsalva maneuver may be unreliable below the SFJ if there is a competent valve
- ▶ Proximal compression most effective in reverse Trendelenburg



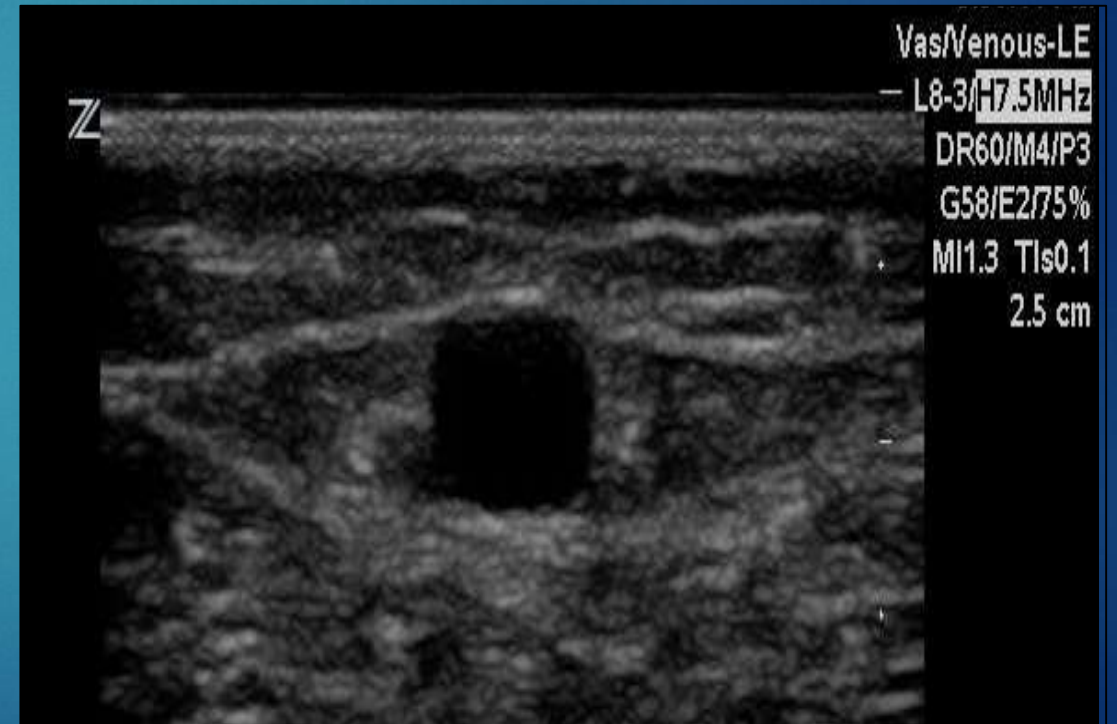
Vein Anatomy

Saphenous Vein – location and sizing

Dilated GSV

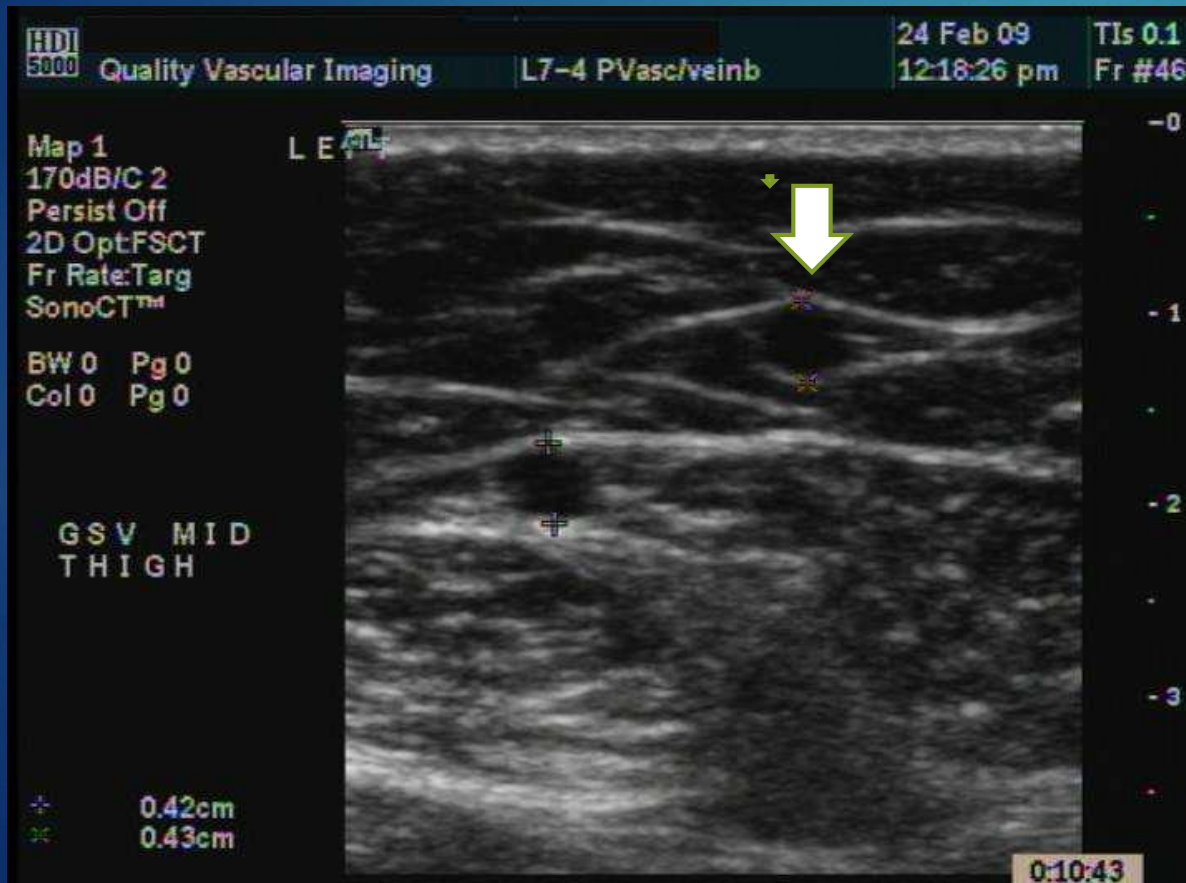


The Saphenous “eye”

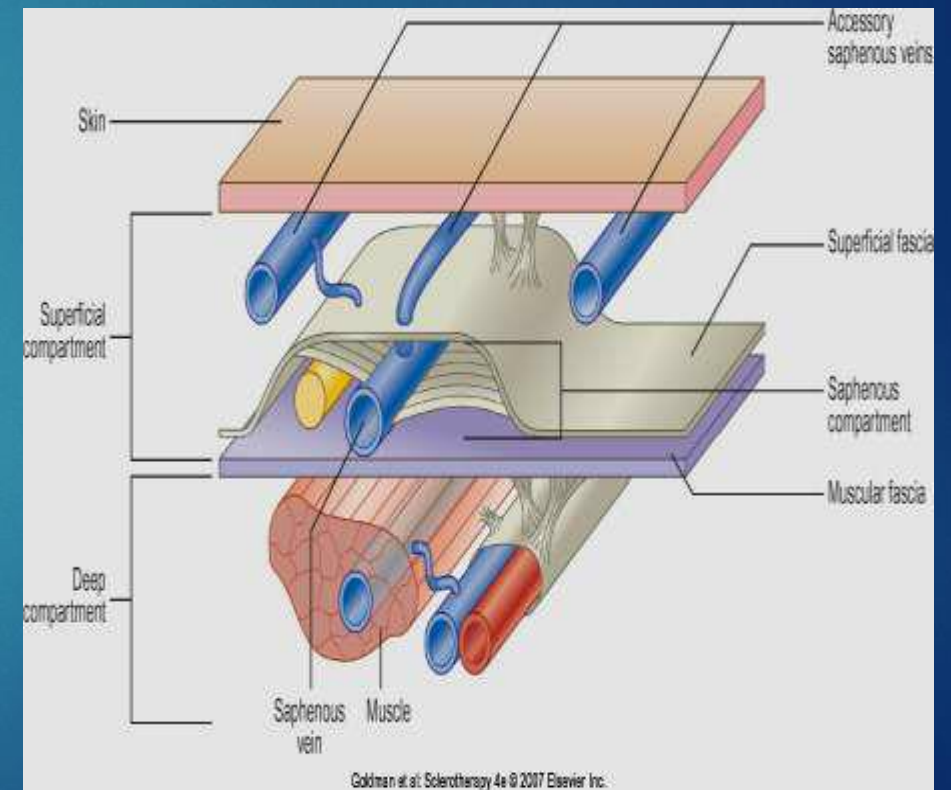


Great Saphenous vein with accessory mid thigh

► US of GSV vs. Accessory

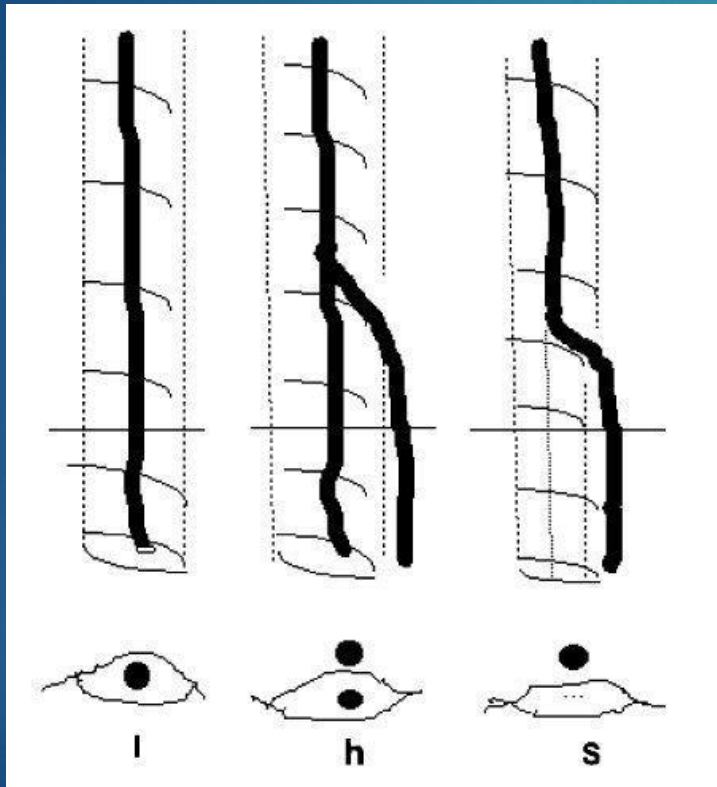


► Note location of accessory veins

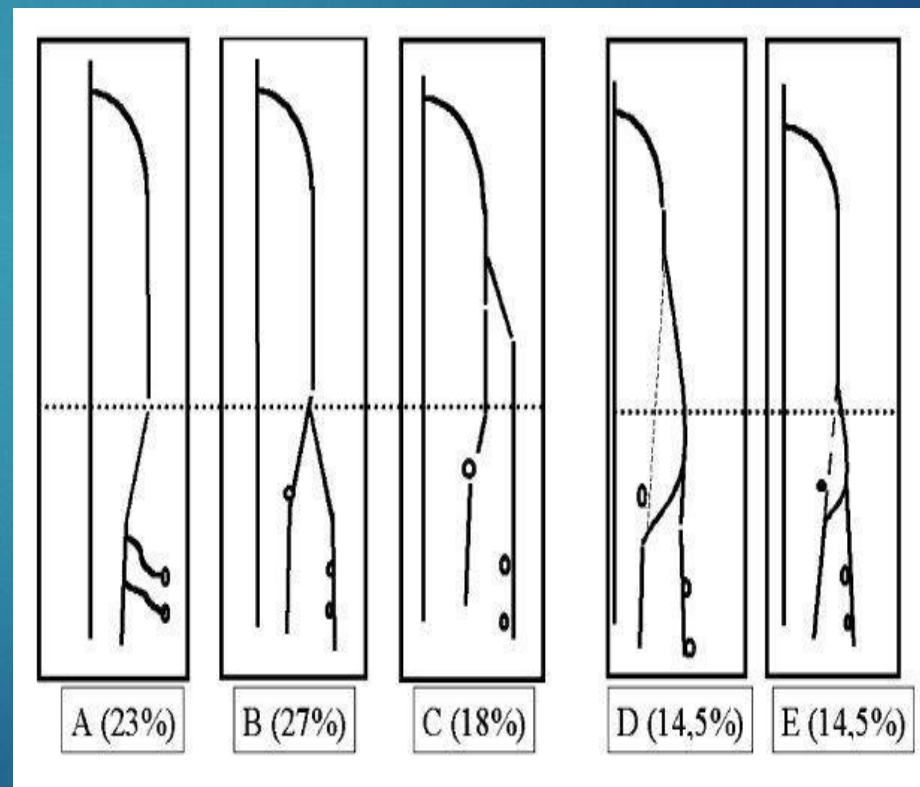


GSV identification and possible variations

Above Knee

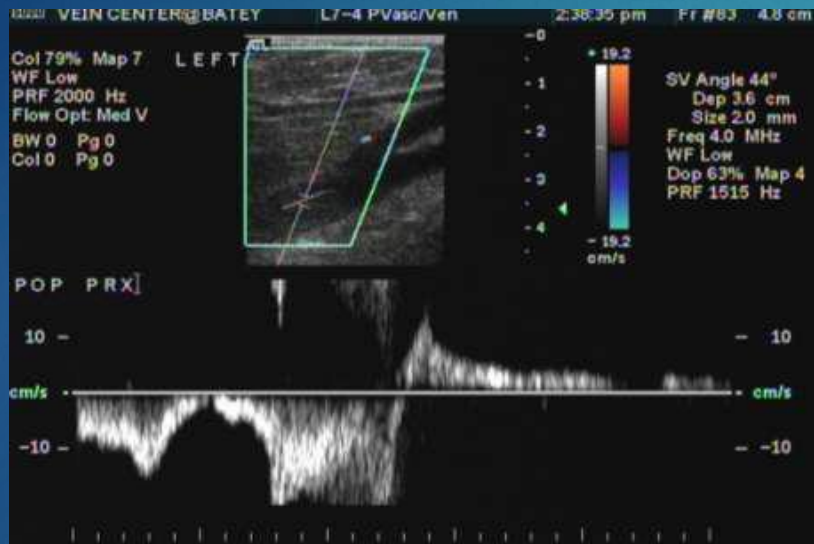


Below knee

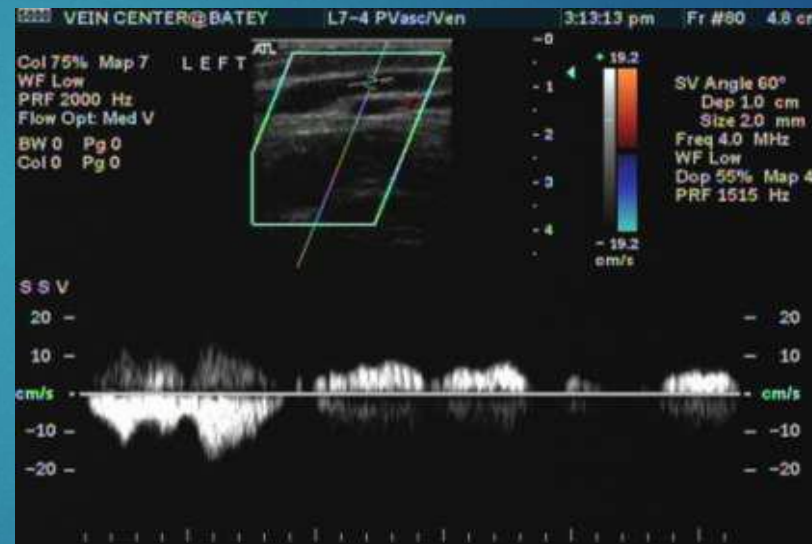


REFLUX

Deep Veins > 1.0 sec

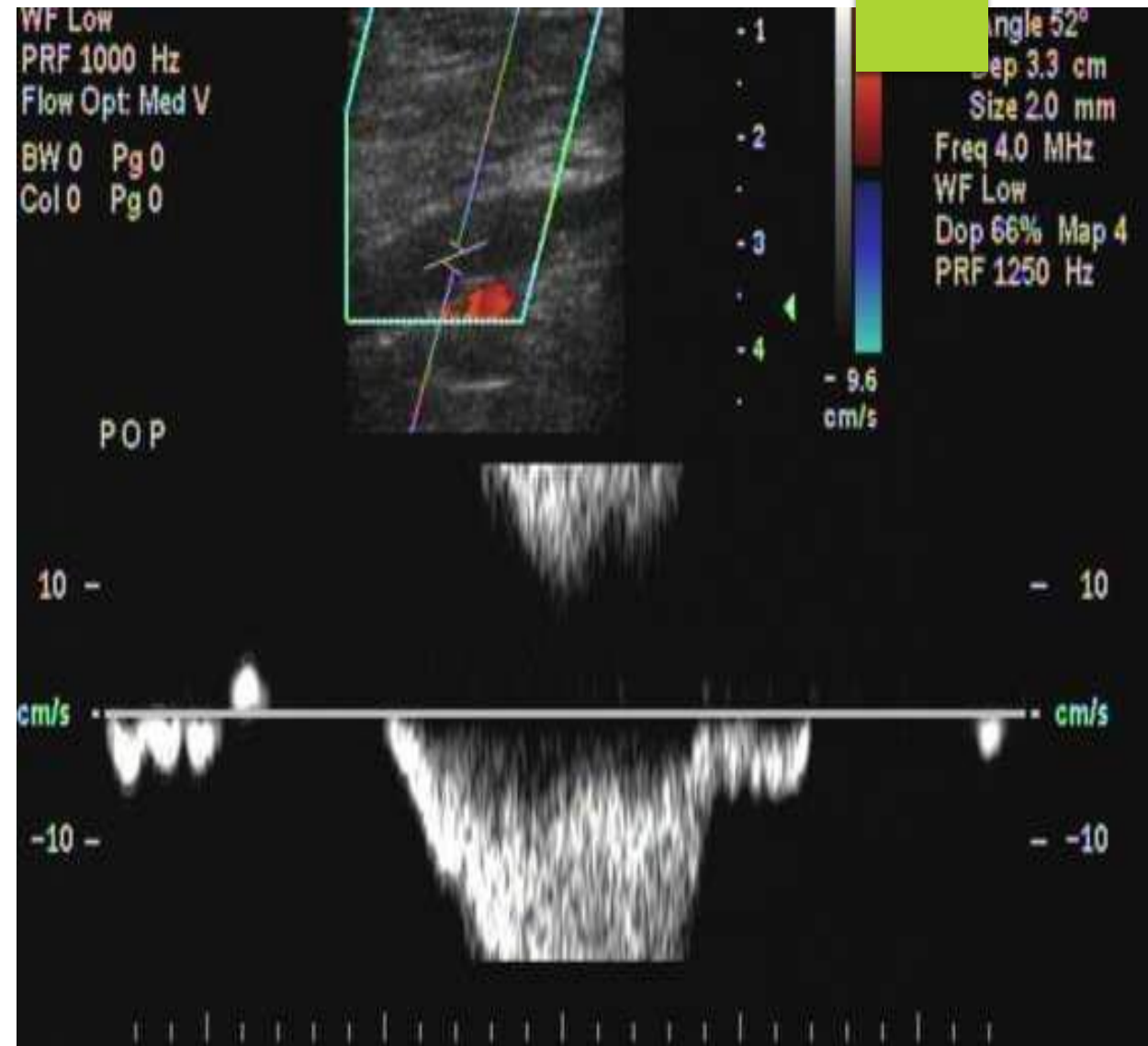


Superficial Veins > 0.5 sec



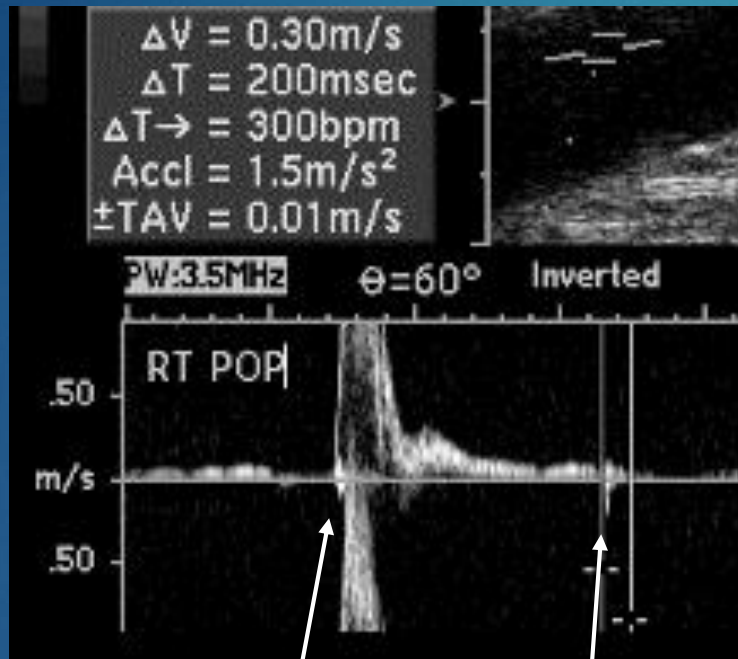
Proximal Compression

- ▶ Proximal Compression
 - ▶ • Compress manually proximal to probe
 - ▶ • Normal Response
 - ▶ – no flow with proximal compression
 - ▶ – flow with release of proximal compression



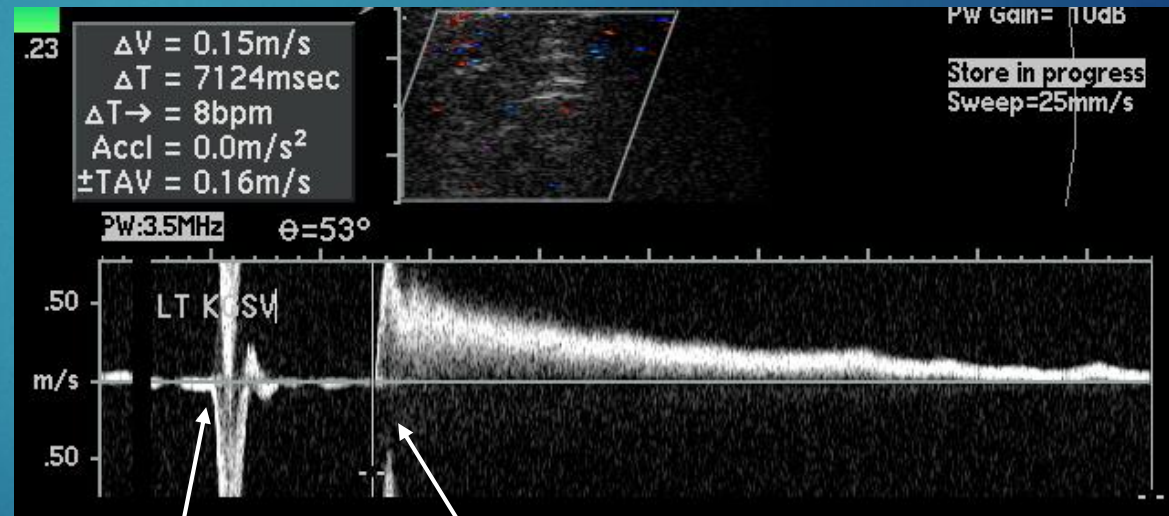
Reflux tracings

Normal



Compression Release

Abnormal

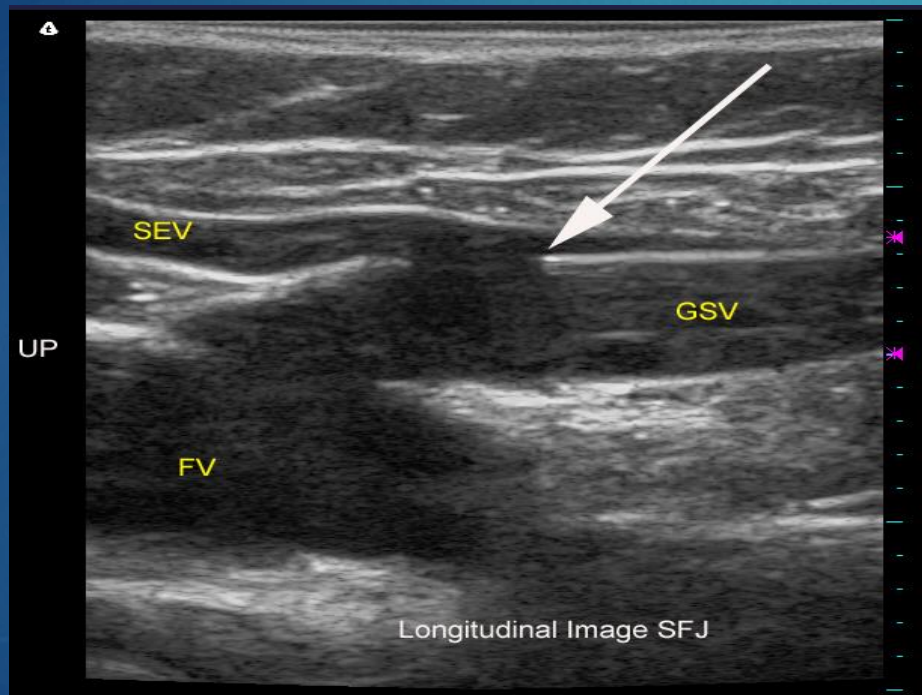


Compression Release

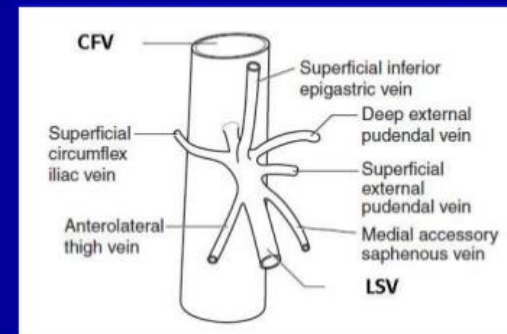
Pay special attention to branches of the Junction

GSV junction w/tributaries

Junction Anatomy



Anatomy of the saphenofemoral junction

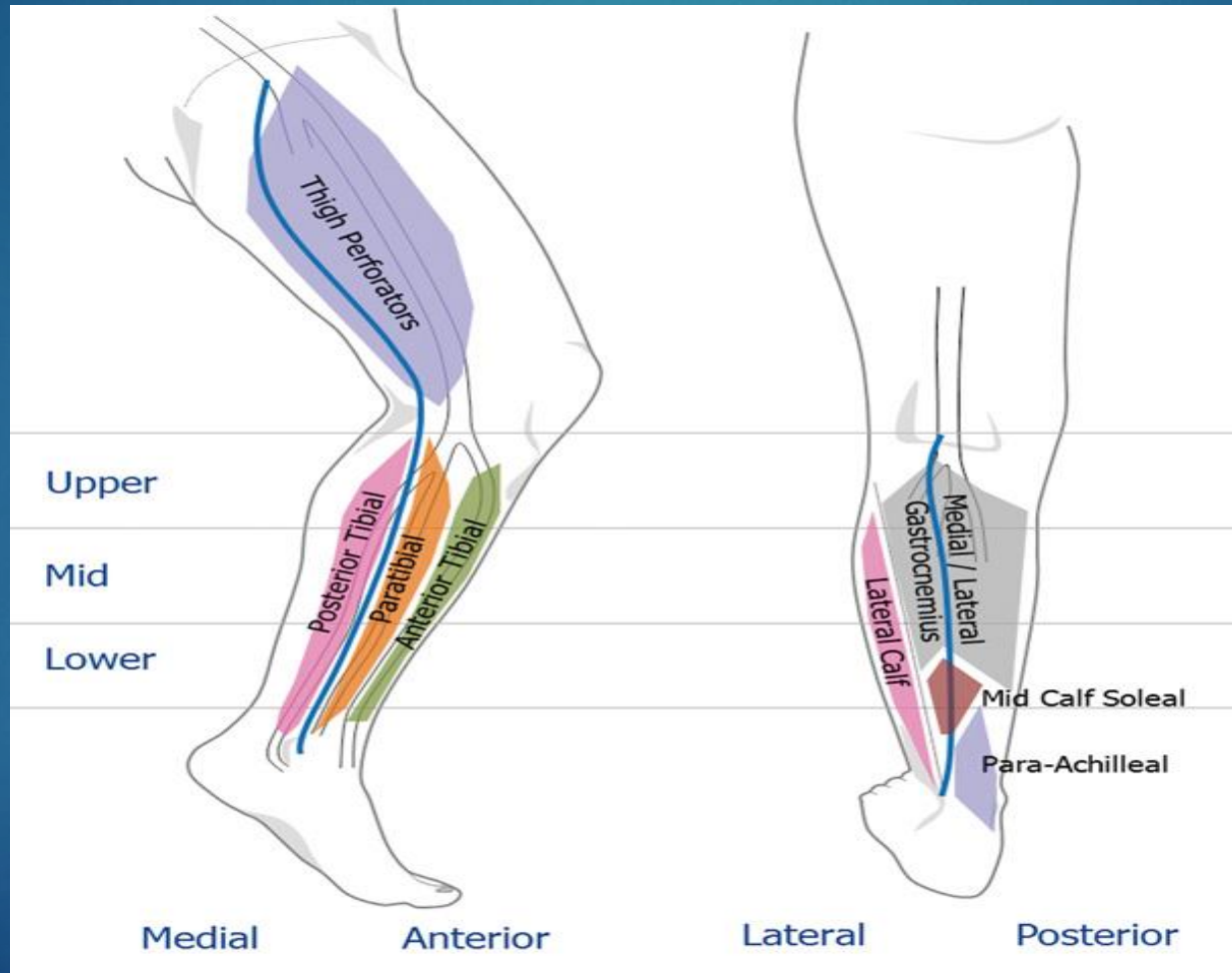


At least 6 other tributaries draining to LSV at level of SFJ

Can be source of primary or recurrent varicose veins

Thrush A, Hartshorne T. Peripheral vascular ultrasound: How, why and when. Elsevier Churchill Livingstone, London, 2nd edition, 2005.

Perforator Distribution



VEIN NOMENCLATURE

▶ Old Terminology

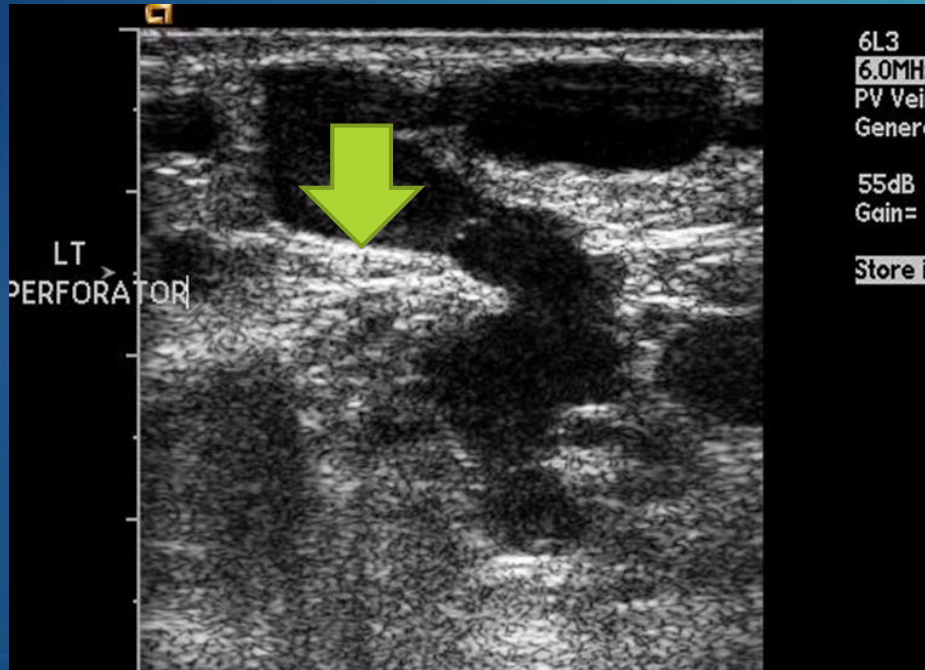
- ▶ Femoral vein
- ▶ Superficial femoral vein
- ▶ Profunda femoris vein
- ▶ Greater or long saphenous vein
- ▶ Smaller or short saphenous vein
- ▶ Sural veins
- ▶
- ▶
- ▶
- ▶ Vein of Giacomini
- ▶ Dodd's perforator
- ▶ Boyd's perforator
- ▶ Sherman's perforator (24 cm)
- ▶ Cockett's perforators

New Terminology

- Common femoral vein
- Femoral vein
- Deep Femoral
- Great saphenous vein
- Small saphenous vein
- Soleal veins
- Gastrocnemius veins
- Medial gastrocnemius vein
- Lateral gastrocnemius vein
- Intersaphenous vein
- Perforator of the femoral canal
- Para tibial perforator (upper third of the leg)
- Para tibial perforator (midthird of the leg)
- Poster tibial perforators

Perforator Evaluation-Important !

Perforator crossing fascia



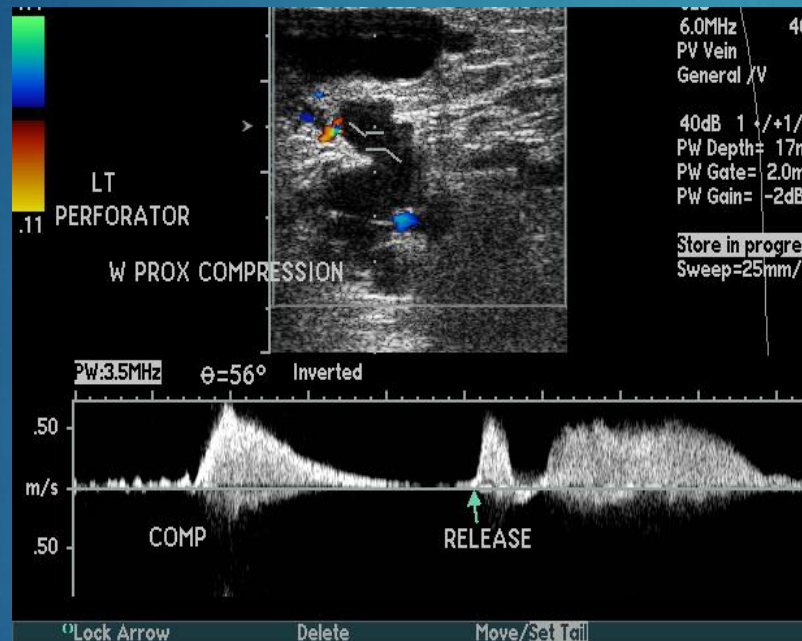
Perforating vein - > 0.35 – 0.50 seconds

- ▶ Commonly found penetrating fascia
- ▶ Evaluation for reflux using hand compression and release
- ▶ flow should be seen running inward but not outward

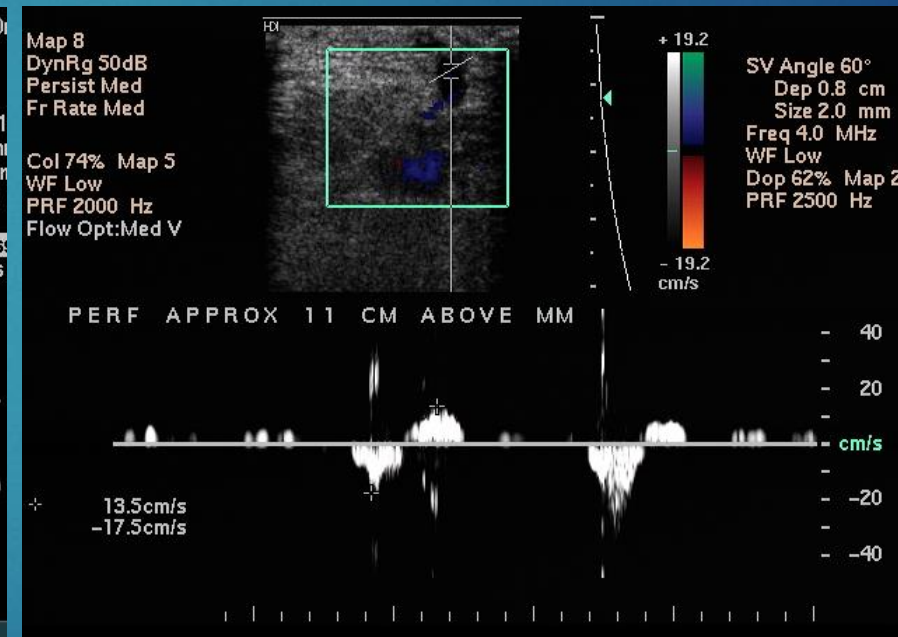
Perforator reflux:

Evaluate Doppler tracings to determine volume of reflux

A



B



Both demonstrate outward flow with compression release, but volume of flow much higher in A than in B

Reflux Worksheet Example

Name: _____
Date: _____

RIGHT

SAPHENO-FEMORAL JUNCTION — GSV

Size (mm)	Reflux (Sec)	Depth (cm)
3.0		
5.0		
3.0		
5.0		
7.0		

SAPHENO-POPITEAL JUNCTION — SSV

Size (mm)	Reflux (Sec)
c	
d	

OTHER VESSELS: _____
Reflux: _____
(Normal 0-1/2, Max 4+ Seconds)

THROMBUS VISUALIZED: I I Yn I I No
Deep Vein Obstruction I I Yn I I No
Deep Vein Insufficiency: I I Yn I I No

PHYSICIAN: _____ TECH: _____

Name: _____
Date: _____

LEFT

SAPHENO-FEMORAL JUNCTION — GSV

Size (mm)	Reflux (Sec)	Depth (cm)
3.0		
5.0		
3.0		
5.0		
7.0		

SAPHENO-POPITEAL JUNCTION — SSV

Size (mm)	Reflux (Sec)
c	
d	

OTHER VESSELS: _____
Reflux: _____
(Normal 0-1/2, Max 4+ Seconds)

THROMBUS VISUALIZED: I I Yn I I No
Deep Vein Obstruction I I Yn I I No
Deep Vein Insufficiency: I I Yn I I No

PHYSICIAN: _____ TECH: _____

FIGURE 2. Example of technical worksheet.

Some Key Points

- ▶ LE superficial vein anatomy can be extremely variable
- ▶ Time of day may affect results, reflux may be more pronounced in the afternoon
- ▶ Identification of incompetent accessory veins is crucial to effective treatment.
- ▶ Note any neovasculature and try to trace its origin in those patient's who have had previous treatment.
- ▶ Have marking pens and worksheet easily accessible during the exam.
- ▶ Make sure to document size , depth and hemodynamics in several segments of the GSV and SSV to localize treatment access points.
- ▶ Test is very operator dependent and can be time consuming, practice , practice, practice!

REFERENCES

- ▶ Carty G, Steele J, Clemens J. Standing versus supine evaluation for superficial venous reflux. *J Vasc Ultrasound*. 2013;37(3):119-124.
- ▶ Coleridge-Smith P, Labropoulos N, Partsch H, Myers K, Nicolaides A, Cavezzi A. Duplex ultrasound investigation of the veins in chronic venous disease of the lower limbs – UIP consensus document. Part I. Basic principles. *Eur J Vasc Endovasc Surg*. 2006;31(1):83-92.
- ▶ Fowler B, Zygmunt, J, Ramirez H, Kolluri R. Venous insufficiency evaluation with duplex scanning. *J Vasc Ultrasound*. 2014;38(1):1-7.
- ▶ Labropoulos N, Kokkosis A, Spentzouris G, Gasparis A, Tassiopoulos A, The distribution and significance of varicosities in the saphenous trunks. *J Vasc Surg*. 2010;51(1):96-103.