VENOUS INSUFFICIENCY TESTING

An overview of anatomy, nomenclature, current trends and pitfalls in venous insufficiency testing.

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CONFLICTS OF INTEREST

• None
• Open for opportunities!

PREVALENCE AND ETIOLOGY OF VENOUS INSUFFICIENCY

Venous reflux disease is 2x more prevalent than coronary heart disease (CHD) and 5x more prevalent than peripheral arterial disease (PAD)!

VENOUS ANATOMY

Anatomy of the venous system is the basis of clinical phlebology. Correct identification of the venous anatomy is essential to the modern diagnosis and treatment of venous disease.

NOMENCLATURE

1995 – John J. Bergen publishes paper showing that there was confusion in the treatment of superficial femoral vein thrombus due to the nomenclature.

2001-2002 – International Interdisciplinary Consensus Statement on Venous Anatomical Terminology was published.

Further modified in 2005.


SIGNIFICANT CHANGES

• Superficial Femoral Vein – Femoral Vein *
• Long Saphenous or Greater Saphenous Vein – Great Saphenous Vein
• Short or Lesser Saphenous Vein – Small Saphenous Vein
• Naming of additional veins including accessory saphenous veins.

*Artery is still called Superficial Femoral Artery
TYPES OF VEINS

Three Types of Veins
• Deep Veins (intramuscular) often paired with an artery.
• Superficial Veins
• Perforators

DEEP VEINS

• Iliac Veins
• Common Femoral Vein
• Profunda Femoris Vein or Deep Femoris Vein
• Femoral Vein
• Popliteal (AK, Fossa, BK)
• Gastrocnemius Veins
• Posterior Tibial Veins
• Peroneal Vein
• Soleal Veins
• Anterior Tibial Veins (not routinely imaged)

SUPERFICIAL SYSTEM

Great Saphenous and Small Saphenous Veins – The saphenous compartment contains the saphenous veins arteries and nerves. The saphenous compartment is bounded superficially by the saphenous membrane and deeply by the muscular fascia – Creates Saphenous Eye

SAPHENOUS COMPARTMENT (EYE)

GREAT SAPHENOUS VEIN

SUPERFICIAL SYSTEM CONTINUED

• Great Saphenous Vein (A)
• Anterior Accessory Saphenous Vein (dotted line)
SUPERFICIAL SYSTEM

• Great Saphenous Vein (B)
• Posterior Accessory Saphenous Vein (dotted line)

SUPERFICIAL SYSTEM CONTINUED

• Extension of the Small Saphenous Vein (C)
• IGV – Inferior Gluteal Vein (<1%)
• CV – Circumflex Vein
• ScP – Sciatic Perforator
• IV – Intersaphenous Vein
• Vein of Giacomini – No connection to popliteal and stays superficial and connects into the GSV or SFJ. (not pictured)

SUPERFICIAL SYSTEM CONTINUED

• Anterior Circumflex Vein (ACV).
• Courses across the knee or thigh unlike the Anterior Accessory Saphenous Vein.
• Can arise directly off of the SFJ (AACSV) or in the proximal thigh or even mid thigh.

SUPERFICIAL SYSTEM CONTINUED

• Posterior Circumflex Vein (E)
• Can connect off of the cranial extension of the SSV (2)
• Originates off of the lateral venous plexus and connects into the GSV in the inner thigh.

SUPERFICIAL SYSTEM CONTINUED

• Superficial Saphenous Vein (A) – Courses anterior to the GSV or SSV out of the saphenous compartment.
SAPHENOUS QUICK REVIEW

Great Saphenous and Small Saphenous Veins
Accessory Saphenous Veins – Run along the GSV anteriorly or posteriorly.
Circumflex Saphenous Vein – Cross either anteriorly or posteriorly across or under the thigh.
Small Saphenous has a cranial extension up to 40% of the time
Posterior Circumflex is very common
Duplicate GSV – Both are in the fascial layer and often connect at the knee.
Other anatomical variations of the following – simply describe.

OVERVIEW OF PERFORATORS

• Perforators form communications between the superficial and the deep systems.
• Normal venous flow of the lower extremity travels from the superficial veins through the perforators into the deep veins.
• The SFJ and SPJ are actually perforators!

PERFORATORS

• Paratibial Perforators connect into the native Great Saphenous Vein
• Posterior Tibial Perforators connect into the posterior branch of the Great Saphenous Vein in the calf.

TIBIAL

• 1, 2, 3, 4 and 5.
• Use your fingers to estimate disease when performing physical exam before study.
• Start at the medial malleolus.

GASTROCNEMIUS PERFORATORS

• Paratibial Perforators
• Posterior Tibial Perforators
• Use your fingers to estimate disease when performing physical exam before study.
• Start at the medial malleolus.
LATERAL PERFORATORS

- Lateral perforators are very common
- Can often be identified by physical exam

Image with the patient standing or in RT and scan along the fascial boundary of muscle. Look for breaks in the later or evaluate with color (PRF low).

THIGH PERFORATORS

- Thigh perforators are typically found in the mid and mid distal thigh, however can be found at any level.
- Thigh perforators should be identified if a patient has residual veins in the mid distal thigh post previous procedure or stripping.

The system is a fairly independent system although it may receive reflux off of the anterior circumflex in the thigh or varicosities off of the anterior branch of the great saphenous vein in the calf.
VEIN MAPPING (CONFUSION IN TERM)

• What is a vein mapping?
• Traditionally – Pre-operative mapping for procedure or harvest
• Term now used for venous duplex exam for venous insufficiency exam.
• Should we use this term?

LARGE PERFORATORS DUE TO DEEP SYSTEM

ILIAC VEINS - DUPLEX

ILIAC VEINS - IVUS

ILIAC VEIN STENTS 2 60 MM STENTS

PELVIC VARICOSITIES
TO STAND OR NOT TO STAND

- Why the debate?
- Can you evaluate the deep system standing?
- Does the function of the valves change based on positioning?
- So in reverse Trendelenburg the valves function properly?
- The 500 msec. monster

1. In human standing, gravity causes forward toppling about the ankle joint which is prevented by activity in the soleus and gastrocnemius muscles.

2. Engagement of these muscles while standing may actually shorten reflux times as they increase resistance.

REVERSE TREDELENBURG

- We don’t do it right most of the time!
- Get the arms down (no one stands with their arms up, but a lot of people put their arms up when lying on a stretcher). Major reason for false negatives
- Rotate the leg and have the knee slightly bent.

PITFALLS OF REVERSE TREDELENBURG

- Hands up
- Bed not in correct position or not available
- Shallow breathing
- Failure to identify anatomy (veins don’t bulge as much).

PITFALL OF STANDING

- Patient can and will fall
- Increased resistance in the calf muscle bed can shorten overall reflux times.
- Ergonomically not friendly
- Poor evaluation of the deep system
- Poor evaluation of the deep calf system

ERGONOMIC CONCERNS

- Reflux studies are long and hard on the lower back in any position
- Some people use two technologists – increases work force and should not be needed.
- Many facilities use laptop machines that do not have ergonomically designed monitors or keyboards.
- Most newer full size systems are ergonomically designed.
**AUTOMATIC CUFF INFLATOR**

- Automatic Cuff provides repeatable distal augmentation usually in the thigh and calf.
- Most protocols use 80 mmHg in the thigh and 100 mmHg in the calf.
- Can be used with the patient in RT.

**SUGGESTIONS**

- Perform the exam correctly in RT.
- Evaluate the deep system
- Correctly identify anatomy
- If normal in RT – Stand
- If small in RT – Stand
- If you can’t squeeze with your left hand request an automatic inflator
- Be a clinician not a picture taker.

**CURRENT TRENDS**

Poll Randomized to get a feel of all of the various tools being used.
- Total Votes: 725 – 1/11/2015
- Could select one or all of choices presented

**DOPPLER LONG VS. TRANSVERSE**

- Total Votes: 132
- Doppler performed in longitudinal: 108 (82%)
- Doppler performed in transverse: 24 (18%)

Doppler orientation in transverse may put risk on interpreting physician.
Doppler performed in transverse reduces the amount of vein that can be hemodynamically evaluated by 86%!

**DOPPLER LONG VS. TRANSVERSE**

- Philips Linear probe 38 mm. in length 5 mm. in diameter.
- Example of a small diameter vessel with hemodynamically significant reflux >13,000 msec.
**DOPPLER LONG VS. TRANSVERSE**

- Orientation is not really Sagittal vs Transverse it is long axis vs short axis.
- There are certain times that the longest axis of the vein may be in transverse.

**EVALUATION OF VEINS**

- Deep evaluation including all calf veins – 60 votes 1/11/15
- Deep evaluation including calf veins but not muscular calf veins – 33 votes
- Limited evaluation of deep veins (CFV and Popliteal if no previous DVT) – 32 votes
- 125 total votes
- 48% of respondents evaluate all of the deep veins
- 26% evaluate all of the deep veins except the muscular calf veins
- 26% Perform a limited evaluation of the deep system!

**STANDING OR REVERSE TRENDELENBURG**

- Patient Standing – 62
- Patient in Reverse Trendelenburg – 49
- Poll is flawed – Either way there is a divide in venous testing.

**FAILURE OF US DURING PROCEDURES**

- During procedures the catheter distance needs to be measured and documented before endovenous ablation.
- Suggested by manufacturers 2.0 – 2.5 cm. from the junction. We place ours at 2.7 cm.
- We have had 2 EHITs in the past three years.
- Performed over 2,400 procedures during this time.

**FAILURE OF THE ULTRASOUND EXAM POST PROCEDURE**

- Many facilities look for EHIT and document that the GSV or SSV is closed, (endovenous heat induced thrombus)
- Should perform a complete venous duplex exam to rule out DVT.
- Evaluation should include that of the treated veins AND the residual tributaries and native vein for reflux.
- [90%] of the time the distal vein will still exhibit significant reflux! If you don’t see document or see it the physician doesn’t know….
- And they will come see me and I am tired!

**NO VISUAL VARICOSE VEINS**
NO VISUAL VARICOSE VEINS

Varicose veins are the result of venous insufficiency.
Take a history – This patient had severe pain in the legs, swelling of the ankles when not wearing support hose and if you look closely the skin was darkening in the distal calf.

USG SCLEROTHERAPY

SCLEROTHERAPY AND SOP

- Can be performed by RN, APN, PA or Physician
- Ultrasound guided sclerotherapy is changing the treatment of veins (for the good).
- Who is most qualified to perform ultrasound?
- Who has the best understanding of the hemodynamics involved?
- There is no certification for sclerotherapy
- Average nursing program has 2-3 classes on injectables.
- RN – 3 years of college, PA – 4 years of college and 2 years of schooling in which they spend 6 weeks in specialty.
- All can become RVT’s with no formal training.
- No pathway for the vascular professional
- Sclerotherapy and other treatments including concentrations and contraindications make up 28% of the RPhS registry.

REFERENCES & RECOMMENDED READING

- Rumwell, Claudia RN, RVT, McPharlin, Michalene, RN; Vascular Technology, 1998, Venous Evaluation, pgs 126-154