Pitfalls of Venous Imaging

Current Practice of Vascular Ultrasound
Spring 2014

No Financial Disclosures

DEEP VEIN THROMBOSIS

- 600,000 new DVT cases a year
- Responsible for 200,000 deaths (more than combined deaths from AIDS and breast cancer)
- Leading cause of preventable in-hospital mortality

www.vascularweb.org, 1-6-06
Schreiber, D. Deep venous thrombosis and thrombophlebitis. www.emedicine.com

Diagnosis of DVT

- Lower extremity: most often made by ultrasound, venography, CT, IVUS
- Upper extremity: increasing incidence, line associated. Diagnosis by US, venography, MRV, CT
- Ultrasound: major diagnostic modality
- Current usage of venography in support of interventions

Venous ultrasound equipment

- High resolution Duplex scanner
- Multifocal 4-7 MHz linear array transducer
  - Siemens
  - Phillips
  - GE
- Typical system cost $150,000 to 250,000

Duplex Ultrasound

- Diagnostic method of choice for the diagnosis of DVT
- Advantages:
  - Safe
  - Cost effective
  - Reproducible
  - Readily available
  - High sensitivity and specificity
Diagnostic Criteria

- Compressibility
- Altered blood flow patterns
- Echogenic material within the vein

COMPRESSION

- Veins should be easily compressible and collapse completely.
- Venous compression is always done in the transverse plane.

COMPRESSIBILITY

The walls of the vein will not coapt when there is thrombus present within the lumen.

INTERPRETATION

Lack of compressibility remains the most sensitive and specific criterion for the ultrasonographic diagnosis of DVT.

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<td>Raghavendra</td>
<td>14/14</td>
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<td>Langsfeld</td>
<td>10/10</td>
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<td>Douzat</td>
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Accuracy of Compression for AK DVT

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<td>TOTAL</td>
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Is Compression Ultrasound Safe?

- Rare cases of PE reported
- Association with examination made in 1/3rd of reported cases
- History of recurrent PE in 2/3

Echogenic Material Seen Within the Vessel Lumen

Normal Venous Flow Patterns

- Normal blood flow pattern
  - Spontaneous
  - Phasic
  - Ceases with the Valsalva Maneuver
  - Augmentation with distal compression

Spontaneous Blood Flow

- Flow is present in medium-sized and large veins with the patient at rest.

Absence of Spontaneous Blood Flow

- The absence of spontaneous flow may result from thrombus at the site of the examination or from an obstruction proximal or distal to that point.

Absence of Spontaneous Blood Flow

- Left External Iliac Occlusion
Phasic Blood Flow

Lower extremity veins:
- Blood flow decreases during inspiration.
  - Increased abdominal pressure
- Blood flow increases during expiration.
  - Decreased abdominal pressure

Upper extremity veins:
- Blood flow increases during inspiration.
  - Decreased thoracic pressure
- Blood flow decreases during expiration.
  - Increased thoracic pressure

Phasic Blood Flow

- Continuous Flow (absence of phasic flow)
  - Indicates the presence of a substantial obstruction.
  - Usually seen distal to the obstruction or at the site of a partial obstruction.

- Phasic flow can still be present when thrombus does not substantially obstruct the vein.

Normal Valsalva Response

- Bloodflow Ceases with the Valsalva Maneuver

Abnormal Valsalva Response

Augmentation with Distal Compression
Absence of Augmentation with Distal Compression

- Supine positioning
- 5-7 MHz transducer in the transverse plane
- Start at the common femoral vein, compress every 2-3 cm
- Image the popliteal vein behind the knee
- Compression/non-compression gray scale images, color images and duplex Doppler signals with augmentation of the CFV, Femoral vein, popliteal vein, PTV, peroneal veins, anterior tibial veins

Floating Thrombus

Lower Extremity DVT
Controversial Issues

- No reporting standards
- Not routinely reported
- Variable accuracy

Findings Suggestive of Acute DVT
- Intraluminal material with low level echogenicity
- Dilated vein

Acute vs. Chronic DVT
- Intraluminal material does not appear well adhered to the wall of the vessel

Findings Suggestive of Acute DVT
Chronic DVT
- Small vein containing highly echogenic material
- Thin echogenic band within the lumen of the vein.
- Thickened vein walls.
- Collateral circulation

Saphenous Thrombophlebitis
- Potentially deceptively benign
- Marker of hypercoagulable state
- Location of leading edge
- Surveillance for deep extension
- Treatment for deep extension or sometimes close proximity

LIMITATIONS
- Venous duplex is not indicated for all patients with extremity swelling. High rate of negative studies.
- Distal femoral vein deep and difficult to evaluate. False positive results.
- A duplicate venous segment may result in false negative exams
- Extrinsic compression can be misinterpreted as DVT
- Poor venous distention, hypovolemia
- Mistaken vein identity
Case

- Patient is a 46 year old male Emergency Room patient with an extensive psychiatric history who presents with right lower extremity pain and swelling. He states that he has been in pain for the last week. He presents with a redness on the anterior/medial aspect of his popliteal fossa and complains of a previous pain in the groin area in the past.
Case: Two months later

Patient is a 46 year old male Emergency Room patient who presents with a history of DVT, diagnosed on 7/14/13 in the right lower extremity in the common femoral and femoral veins. He is now presenting with pain again in the right lower extremity.
Case: Go back two months and a week
There is a small caliber radiopaque structure that appears to track along the right femoral and superficial femoral arteries to the level of the adductor canal and distally into the region of the vastus medialis. The etiology of this is uncertain.

**IMPRESSION:**
No evidence of a soft tissue hematoma or mass is identified in the thigh.

- Chronically ill 52 yo WM with prolonged hospitalization with sepsis, renal failure and pneumonia
- Massive lower extremity edema prompts venous duplex
- Portable study at bedside with laptop duplex imager
Case

- With recent interventions and thrombocytopenia, IVC filter placed for prophylaxis of PE
- Finally sent to Rehab Facility where venous ultrasound is “negative” 3 weeks later
Case

- 39 year old WM
- Pain L popliteal fossa
- No swelling
- History otherwise negative

Case

Case

Case

Case
Popliteal Vein Aneurysm

- Rare entity: 2011 review 181 cases reported  
  Park, AnnVasc Surg 2011
- Early reports suggest 70-80% present with pulmonary embolism  
  Pearce, Surg. 1993
- Possible association with iliac vein compression  
  Gaweesh, Phlebology. 2013
- Treatment is surgical followed by anticoagulation.

Case

- 42 yo WF with left leg edema
- No previous history trauma
- No medical issues

Case

Dx: May-Thurner Syndrome