Introduction to Emergency Ultrasound

Deep Venous Thrombosis

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Overview

- Clinical considerations of DVT's
- Anatomy of lower extremity veins
- Ultrasound exam technique
- Using doppler / duplex
- Pitfalls

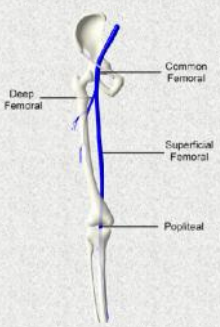
DVT

- Indication for study: clinical suspicion for DVT
- The Question!
  - NOT: Is there a DVT?
  - Is the vein patent?

DVT

- Annual incidence 2 million in the U.S.
- PE ~ 200,000 deaths a year
- 80% of symptomatic DVT proximal to or in the popliteal vein
  - associated with a higher embolization rate

Venous Anatomy



Ultrasound

- Sensitivity 95-99% above-the-knee
- No contrast or radiation
- Non-invasive
- Sensitivity <50% distal to popliteal vein
- Can't detect pelvic vein thrombosis
- Obesity can make exam impossible
  - Can't obtain image
  - Can't compress veins

Transducer Selection

- Linear probe preferred
  - 7.5-10mHz
  - Optimal image
  - Best for tissue compression
- Convex probe
  - Lower frequency for greater imaging depth
  - Obese patients

Ultrasound Exam

Complete Study:
- 30-40 minutes
- Evaluate vein one probe width at a time
- Compression + Doppler / Duplex

Abbreviated Study:
- 3-5 minutes
- Rapid survey
- Document selected spots (CFV, SFV/DFV, Pop)
- Compression only
- Suggested for Emergency Physician

Patient Positioning

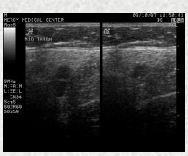
- Leg externally rotated at hip and slightly flexed at knee
  - leg dangled over the edge of the table
- Raise head of the patient 30-45°

Exam Technique

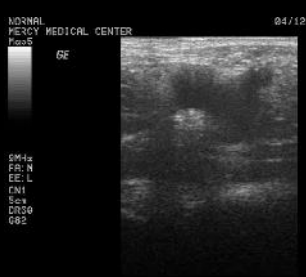
- Start near inguinal ligament @ CFV / CFA
- Orient probe transverse to vessels
- Slide probe distally, identify key branches:
  - Greater saphenous
  - CFV split into SFV and DFV
- When SFV disappears, jump to popliteal v.

Exam Technique

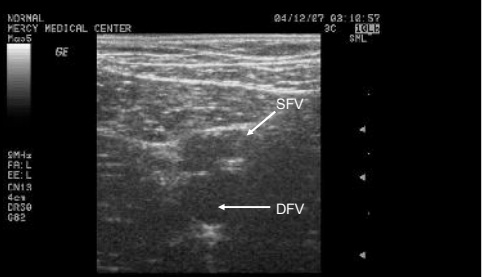
- Apply firm compression at various points
- Normal veins should completely collapse and may even disappear
- Document using split screen
  - uncompressed on left
  - compressed on right



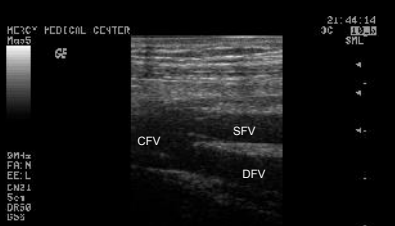
Proximal Venous Survey



Proximal Venous Anatomy

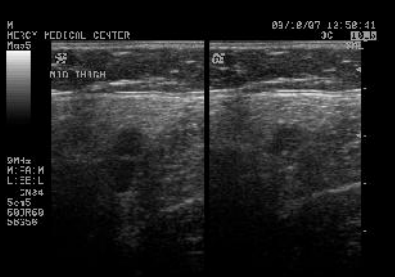


Proximal Venous Anatomy

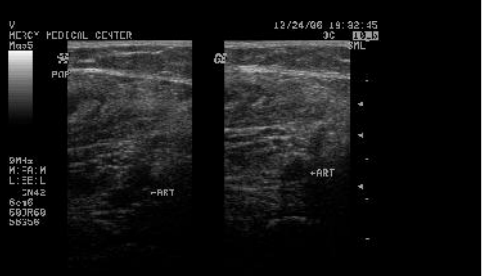


Popliteal Vein

Normal Compression

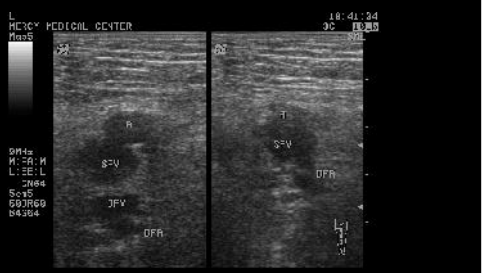


Normal Compression

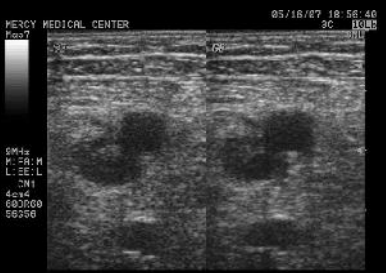


SFV DVT

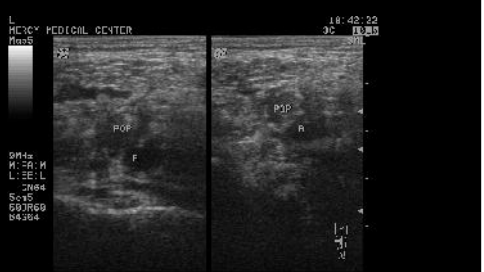
SFV DVT



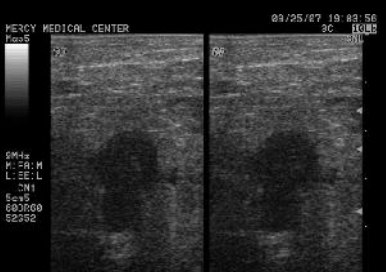
SFV DVT



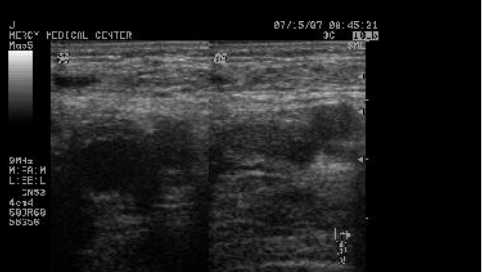
Popliteal DVT



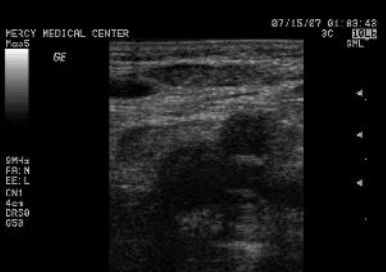
Popliteal DVT



Partial CFV DVT



Partial CFV DVT



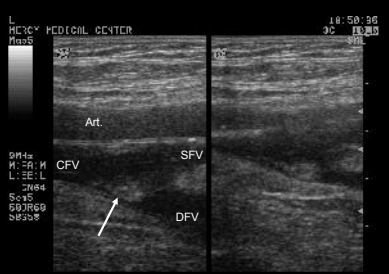
Interpretation

- Complete collapse = no DVT
- Incomplete collapse = maybe DVT
  - Can't compress vein due to obesity or pain
  - Can use doppler to confirm presence of thrombus

Visualizing a DVT

- Do not attempt to differentiate between acute vs. chronic DVT
- Vessels frequently appear to be filled due to artifact
- If vessel does not collapse completely, consider it abnormal

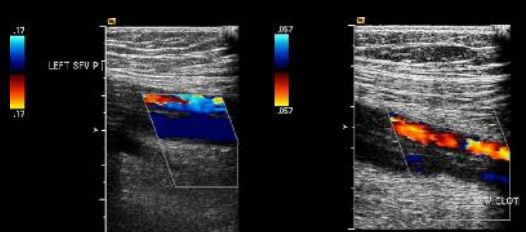
Visualizing a DVT



Doppler

- Not needed to rule-out DVT
- Most useful to confirm DVT in non-compressible vessels
- Measures flow in vessel
  - Color flow (Duplex image)
  - Spectral analysis (quantitative velocity measurement)

Duplex Ultrasound



Normal DVT

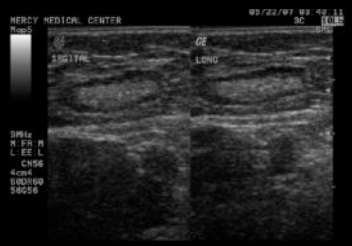
Pitfalls

- Pelvic DVT
  - Consider CT or MRI
- Calf vein DVT
  - Re-scan in 5-7 days
- Mistaking lymph node for a DVT
  - Lymph nodes have finite edges
  - No color flow in lymph nodes

Lymph Node

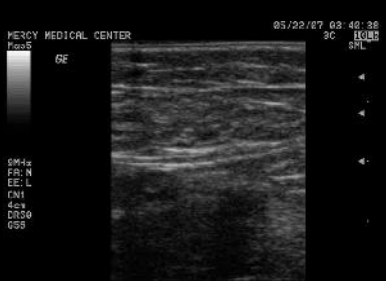
Like DVT, lymph nodes do not compress

Lymph Node



Lymph nodes have finite edges and are not closely associated with the femoral artery

Lymph Node



DVT Conclusion

- Simple knowledge of lower extremity veins is necessary for ultrasound
- Abbreviated compression ultrasound is optimal for ED use
- Doppler useful for non-compressible vessels but not needed for compressible
- Fully compressible vessels are negative for DVT