SCREENING COMPRESSION ULTRASOUND FOR LOWER EXTREMITY DVT

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DISCLOSURE INFORMATION

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COMPRESSION ULTRASOUND FOR DVT

Points for Discussion

- Anatomy of the lower extremity veins
- Clinical significance and diagnosis of DVT
- Technique of compression ultrasound
- Ultrasound features of lower extremity DVT
- Differences between a screening compression ultrasound and a complete diagnostic duplex examination for DVT
LOWER EXTREMITY VENOUS ANATOMY

Deep Veins
- External iliac vein
- Common femoral vein
- Deep femoral vein
- Femoral vein
- Popliteal vein
- Anterior tibial veins
- Peroneal veins
- Posterior tibial veins
- Plantar metatarsal vein

Superficial Veins
- Superficial epigastric v.
- Femoral v.
- Saphenous opening
- Great saphenous v.
- Small saphenous v.
Lower Extremity Deep Vein Thrombosis

Magnitude of the Problem

- Deep Vein Thrombosis
  800,000 patients / year

- Fatal Pulmonary Emboli
  50,000-200,000 patients / year

- Non-fatal Pulmonary Emboli
  150,000 patients / year

- Post-thrombotic Syndrome
  500,000 patients / year
Lower Extremity Deep Vein Thrombosis

Clinical Significance

- **Proximal or Above-knee DVT**
  - IVC, iliac veins
  - Common femoral, femoral, and popliteal veins
- **Distal or Below-knee or Calf DVT**
  - Axial calf veins – anterior tibial, posterior tibial and peroneal veins
  - Muscular calf veins – soleal and gastrocnemius veins

HIGH risk for pulmonary embolus

LOW risk for clinically significant pulmonary embolus
Lower Extremity Deep Vein Thrombosis

Clinical Presentation

- Leg pain and swelling are non-specific findings
- Clinical diagnosis is unreliable - history and physical examination are only “50%” accurate
- Risk of pulmonary embolism can be high
- Need for immediate anticoagulant therapy
- Objective diagnostic tests
  - Duplex ultrasound
  - CTV, MRV, Contrast venography
- Screening emphasizes detection of *proximal* DVT
COMPRESSISON ULTRASOUND FOR DVT

Technical Notes - Instrumentation

- High resolution B-mode ultrasound system
- Linear array transducers:
  - 3-5 MHz - Large legs
  - 5-10 MHz – Small legs
Diagnostic Criteria for DVT

- B-mode image
  1. *Visualization of thrombus* in the vein lumen
  2. *Non-compressibility* with direct probe pressure
- Doppler
  Not part of a screening compression ultrasound
Evaluate compressibility of deep veins at two points in the lower extremity

- Fully Compressible
  - Normal
- Non-compressible
  - Abnormal
- Non-diagnostic
  - Poor image
  - Vein not seen

Limited ultrasound examination or “Two-Point exam”
Technical Notes - Protocol

- Imaging and compression done in transverse view
- Adjacent artery helps to identify the vein
- Artery should not compress
Technical Notes - Protocol

- **Patient position**
  - Start supine for the common femoral vein
  - Prone or leg externally rotated for the popliteal vein

- **Common femoral vein**
  - Image from inguinal crease to the confluence of the deep femoral and femoral veins

- **Popliteal vein**
  - Image from the proximal popliteal fossa to 10 cm distal to the mid-patella
Technical Notes - Protocol
Common Femoral Vein
“Mickey Mouse” View

Vein is medial to the artery

Patient’s Right (for both sides)
Vein is *superficial* to the artery (closer to the skin)
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Technical Notes - Images

Left Common Femoral Vein - Normal

Right Common Femoral Vein - Thrombus

Compression
COMPRESSION ULTRASOUND FOR DVT

Technical Notes - Images

Right Common Femoral Vein

Right Popliteal Vein

Normal Compressions
Common Femoral Vein Thrombus

Popliteal Vein Thrombus

Direct Visualization of Thrombus
## Compression Ultrasound for DVT

### Results for Above-Knee (Proximal) DVT

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**95%**  **95%**
COMPRESSION ULTRASOUND FOR DVT

A Complete Venous Duplex Examination

- **B-mode Image**
  Identify vessels, visualize thrombus, test compressibility

- **Spectral Display**
  Flow direction, respiratory phasicity, augmentation maneuvers, reflux

- **Color-flow Imaging**
  Flow around partially occlusive thrombus
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A Complete Venous Duplex Examination
Doppler Flow Information

Femoral vein
Phasic with respiration
Normal

Femoral vein with occluded iliac vein
Continuous
Abnormal
Normal femoral vein augmentation by calf compression

Femoral vein reflux with Valsalva
COMPRESSION ULTRASOUND FOR DVT
A Complete Venous Duplex Examination

Common Femoral Vein Thrombus

Popliteal Vein Thrombus

Color-flow Around Thrombus
Acute
- Homogeneous, smooth
- Hypoechoic
- Soft, “spongy” (deforms with compression)
- Vein is dilated
- “Free floating” tail

Chronic
- Heterogeneous, irregular, synechiae
- Echogenic
- Stiff (not deformable)
- Vein normal or small size
- Thickened vein wall (recanalization)
- Collaterals present
Final Thoughts

- Screening for *proximal* lower extremity DVT with two point compression ultrasound is sensitive and specific
- Will not detect below-knee (calf) DVT
- May not detect non-occlusive proximal (IVC/iliac vein) thrombus
- Abnormal and non-diagnostic exams should be followed-up with a complete diagnostic venous duplex
- Normal exam can be repeated if clinical suspicion remains high (or request a complete duplex study)