Venous Imaging For Acute DVT

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Conflicts of Interest

- None relevant to this lecture
- Sonosim
- Verathon
- Philips
- PocketSonics
- Headsense
- Orcasonics
Objectives

- Discuss justification for point of care approach
  - Selection of vessels
- Best approach
- Scanning technique
- Normal anatomy
- Appearance of pathology
- Distinction between acute and chronic DVT
Lower Extremity Thrombosis

- 260,000 cases per year
- Cause at least 50,000 deaths per year
- Imperative to diagnose DVT and prevent PE
- Most patients who die of PE die with in 30 minutes of having one
- Many ICU deaths found to have PE at autopsy
Clinician’s Dilemma

- What can clinicians do?
- Clinical diagnosis unreliable
- We suck at finding DVT on exam
- No better than 50% in some studies
- Can use prediction rules that rank risks
  - Improve results but still cannot rely upon
Clinician’s Dilemma

• In the real world may not be able to get vascular study at night or on weekend
• Why not just treat everyone?
  – Expensive
  – Patients sit on heparin, study could be false negative the next day
• How about low molecular weight heparin risks?
Jolly et al. 1996

- Two attending EPs trained by vascular lab
- EPs had hands on training
- Each proctored for 25 to 30 scans
- No mention of scan time but average is about 37 minutes
- A great step forward for clinician performed ultrasound but not practical
Standard Approach

- Radiology technologist scans entire leg
- Looks at every inch of vein
  - Blood flow
  - Compressibility of vein
  - Variations in blood flow with breathing and leg compression
Simplified Approach

- Look at common femoral vein
- Junction of femoral, deep femoral and superficial femoral veins
- Popliteal vein behind the knee
Simplified Approach

- Rationale behind cutting ultrasound corners
- LE DVT locations
  - Rare to find DVTs in isolated vein segments
  - This has been well studied
  - As DVTs form in large veins they tend to propagate
What About Calf DVT?

- Not all vascular labs check for them now
  - Why?
  - Accuracy may be as low as 30-40%
  - Some centers do not treat for calf DVTs
- This is why patients scanned for a DVT need a repeat examination if the first one is negative
- 20% of calf DVTs will propagate proximally
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Blaivas et al.

- 112 patients enrolled
- Proximal DVTs diagnosed in 34 patients
- ED and Radiology agreed in 110 out of 112
- One false positive
- Another “false positive” - but venogram dx DVT
- Two calf DVTs found by radiology without proximal DVT
Blaivas et al.

- Median time for examination 3 minutes 28 seconds (95% CI, 2:45 to 4:02; IQR 3:08)
- High correlation between ED and Radiology results; % agreement 98% (95% CI 95.4% to 100%), Kappa coefficient of agreement K = .9
Other Findings

- Augmentation and blood flow evaluation was not useful
- Doppler best for finding vascular structures in ultrasonographically challenged
- 3 saphenous vein thrombi found
- 6 Baker’s cysts found
Theodoro et al.

- Prospective single blinded study
- 156 patients
- Had radiology US 24/7
- Ordered radiology US, then did our own
- Compared time to disposition and results
Theodoro et al.

- 34 (22%) patients with DVT
- Triage to dispo for EM US 95 minutes
- Triage to dispo for rad US 220 minutes
- Difference of 125 minutes, P<0.0001
Bernardi et al.


- A prospective, randomized, multicenter study of consecutive symptomatic outpatients (n = 2465)
- Either 2-point (n = 1045) or whole-leg (n = 1053) ultrasonography
- The 2 diagnostic strategies are equivalent
So How Do We Get Started?
Common Femoral Vein

Superficial Femoral

Deep Femoral Vein

All of these are deep veins!!!
Femoral Vein

Femoral Artery
Common Femoral Vein
Superficial Femoral Vein
Deep Femoral Vein

All of these are deep veins!!!
Freely Floating Thrombus

- Thrombus that is free floating is at a very high risk for embolization
- Should view in longitudinal axis and avoid further compression after discovery
- Anticoagulate quickly and monitor patient
- Not a good patient to send home on low molecular weight heparin
Pelvic Vein DVT

- Less common but not rare
- Difficult when isolated (not in femoral or distal)
- Can image directly in some patients
- Success decreases as soft tissue burden increases
- Must rely on respiratory variation in femoral vein to rule out pelvic DVT
Upper Extremity DVT

• Thought to be very rare, 2%

• Not a threat? None embolized?

• Now 18% of all DVTs

• Up to 9% of UE DVTs may embolize
Upper Extremity DVT

- Addition of some difficult imaging, but mostly quite easy
- Areas where compression is not possible
- Areas where visualization is not possible
- Where no compression is possible have to use color and pulse wave Doppler
Interrogate the Subclavian with Doppler
Interrogate the Subclavian with Doppler
Upper Extremity DVT

Brachial Vein

Clot is easily detected
Inferior Vena Cava

• Don’t forget to look at the IVC
• Often overlooked
• We are used to poor IVC imaging due to our patient population
Inferior Vena Cava

- Direct visualization of thrombus is possible
- Clinches diagnosis, perhaps even more than LE DVT
Inferior Vena Cava

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IVC Filter Safe?

- Does Greenfield filter get you off the hook?
- Not really, filter can have thrombus at it and growing past it
Inferior Vena Cava

- Even in the presence of an IVC filter, propagation can occur and is worth evaluating for.
- IVC may be seen with enough detail.
Pitfalls
Node As DVT
Not Pressing Hard Enough
Not Pressing Hard Enough
Superficial Thrombosis

• Can be confusing clinically and sonographically
• Keep your anatomy in mind as well as the depth on the screen
Superficial Thrombosis

- Sometimes see physiology at work
- Blood sludging and local inflammation
Superficial Thrombosis

- Still helpful to compress
- Image in short and long axis if confusing
Chronic DVT
Chronic DVT?
Isolated DVT?
Suspected Pelvic DVT?
Summary

- Ultrasound is a great bedside tool
- LE DVT
- UE DVT
- Pelvic DVT
- QUESTIONS?