Faculty Disclosures

- Nothing to disclose.
- No conflicts of interest.

Vascular Access

- IV most common procedure in ED
- Difficult access
  - Time consuming
  - Treatment delay
  - Painful
  - Alternatives: central line placement
- Ultrasound (US) readily visualizes vascular structures, can assist with vascular access
Overview

• Brief literature review
• Learn how to locate vessels with US
• Learn the techniques for central and peripheral line placement with US-guidance
• Understand limitations and pitfalls
• Hands-on practice with vascular access phantoms

The Literature

• Shortens time to placement
• Improves success rates
• Fewer needle stick attempts
• Enhances patient comfort

Central Line Placement

• Institute of Medicine 1999 recommended US-guidance for central line placement
• Increased success, decreased complications when compared with blind approaches
• US Agency for Healthcare Research & Quality: one of the top 11 means of increasing patient safety in the US

RCT 25 US-Guided, 25 traditional
• Decreased attempts (1 vs 3)
• Decreased time for placement (6.3 vs 14.4 m)
• No change in overall success (80% vs 64%)
• Small sample size

New Literature

- Placement by ED Technicians (Bauman 2009, Schoenfield 2010)
- Factors associated with success
  - Increased vessel diameter (Panebianco 2009)
  - Vessels >0.4 cm, depth 0.3-1.5 cm (Wittig, 2010)
- No difference in infection rates (Adhikari 2010)
- Less sustainability of PIV’s (Dargin, 2010)

Technique

- Prep site and probe
- Tourniquet (PIV)
- Locate vessels by US
- Compression: arteries vs. veins
- Needle placement
- Secure catheter

Technique: Probe

- Linear, high frequency: 7.5 MHz+
- Probe marker to YOUR LEFT
- Needle redirection
- Dual operator: the IV Person’s LEFT

Preparing the Probe

- Sterile lube
- Gel
Preparing the Probe


Technique: Static vs. Dynamic

- Static “quick look”
- Identify vessel, mark skin
- Dynamic: real-time guidance
  - Visualize vessel during catheter placement


Single vs. Dual Operator


Long-Axis

In Plane

Long-Axis

Short-Axis

Short-Axis

Out of Plane

Arteries vs. Veins

- Compression technique
- Veins collapse, arteries do not
- Arterial pulsations
- Color Doppler
**Technique: Compression**

**Technique: Doppler**

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**Needle Placement (Short-Axis)**

- Needle Approximation
  - Estimation of placement depending on vessel depth (short-axis)
  - Only visualize catheter as enters vessel
  - “Following the Tip”
  - Move the transducer as advance catheter
  - Visualize needle tip along entire path

**Needle Approximation**

*Depth = Distance away from the probe*

Enter at 45 degree angle... $a^2 + b^2 = c^2$
Errors with Placement

Unable to visualize needle/catheter until it penetrates the vessel

“Following the Tip”

Beam Tracks Needle Tip

“Following the Tip”

Beam Tracks Needle Tip

Successful Placement

Tenting

Ring-down Artifact
Types of Lines

Central Lines: IJ, Femoral, (Subclavian)
Peripheral IV’s
IO Lines

IJ Anatomic Variations

IJ: Transverse

IJ: Transverse
Peripheral IV’s

- Same principles as central line placement
- Maintain angle of entry
- Use long catheters when available
- Identify vessel in short axis, then confirm in long axis
- Immobilize extremities
Peripheral IV’s: Antecubita

Peripheral IV’s: Pitfalls

- Vessels still collapse and roll
- Flash not always seen
  - Confirm placement in 2 views
  - Flush with saline
- Catheter kinks are frequent
  - Maintain angle of entry (ie. gauze)
  - Use larger gauge and longer catheters when available

Peripheral IV’s: Saphenous

Intraosseous Placement

Intraosseous Placement

Summary

- US-guidance for central & peripheral lines
- Single vs. dual operator methods
- Static vs. real-time guidance
- Transverse vs. longitudinal views
- Approximating entry vs. “following the tip”
- Operator preference
- Practice, practice, practice!