Ultrasound Guidance Needle Techniques

Dr TANG Ho-ming
AED/UCH

USG Guidance Needle Techniques

• Commonly used in EM
  1. Vessel cannulation-peripheral & central
  2. Foreign body removal
  3. Peripheral nerve/plexus block
  4. fluid drainage
Basic principle-needle tip visualization

• Direct visualization is most important for success & safety
• Insertion angle & gauge of needle are primary factors
• Steeper the angle of insertion, more difficult to visualize - >20° needle nearly cannot be identify
• Large bore needle makes visualization easier
  – Larger surface of reflection
  – Less flexible and bend out of plane of sound beam

Insertion Angle & Echogenecity

smaller angle, better chance of needle tip visualization
Visibility of Needle Tip

- Echo background- lower the gain may improve the needle tip visibility
- Specially designed commercial needle- special coating or dimpling to increase echogenicity (Hakko™ Medical Co. Ltd)

*Choose smaller angle of insertion, larger gauge needle if possible*
USG guided central venous cannulation of IJV

• Advantages over blind landmarks techniques
  • Aberrant anatomical relationship of IJV to ICA in 3%¹
  • Direct visualization of needle tip & guidewire
  • thrombosed IJV
  • Avoidance of other structures
• Studies confirmed increase successful rate in first attempt, reduce time of insertion & complications in difficult patients & situations²
• Competence with reasonable period of training
• Mandatory in USA³ (AHRQ)


USG guided IJV Cannulation

• ‘4 P’s
  • Pre-scan- identify the vessels & important structures
  • Preparation- patient, equipments & personnel. Sterile field, CVC kit & probe. An assistant may be needed
  • Puncture- transverse vs longitudinal methods
  • Pass the needle under the USG guidance
Pre-scan: short axis

• Identify the optimal route of entry
• Important to identify thyroid, ICA & IJV
• Include all these in the image
• Choose the needle of the right length!

Preparation

Commercially available long sleeve probe cover
**Probe Preparation**

Large sterile glove to replace commercial sleeve
but cord not sterile
Jelly inside & outside the glove (use sterile jelly for outside surface)

**Operator-Patient-Machine**

• Machine-patient-operator-to facilitate eye-hand coordination-
  body needs not to move toe the monitor
• A drip stand can help to hold the cord-essential to steady your hand!
• Keep the most comfortable posture for yourself
Puncture-transverse vs longitudinal

- Longitudinal – easier but need space for probe and needle placement
- Beware of small caliper vessel – apparent ‘in’ though ‘off plane’ insertion (slice thickness artifact)
- Transverse method – more difficult, need more eye-hand coordination. esp for deep vessel
- Useful in limited space at ROI-short neck with long footprint linear probe

Puncture- transverse method

- Keep IJV at the centre of screen and puncture the skin at the middle of probe-better for finding the needle during procedure
- Needle identified as ring-down artifact, shadowing or by jiggle the needle. Sliding or fanning the probe may help
- Specially etched or coated needle tip to enhance US echo
Puncture- transverse method

- Direct visualization important
- Do not advance needle blindly

Puncture- Longitudinal method

- Direct visualization important
- Do not advance needle blindly
Passage of needle with USG Guidance

- Do not advance needle blindly
- Needle tip must be identify before push
- Swing or jiggle the needle may help to identify the tip, but in tiny degree of movement
- Keep the hand holding the probe ‘stony’ still in longitudinal method. Move only the needle
- Remember the angle of insonation while pushing in the needle

Pitfalls

- Needle tip not seen
  - Use less steep angle of puncture. Smaller angle of insonation (> 20° needle becomes much harder to see)
  - Larger bore needle?
  - Lower the gain. Is the surrounding structures too white?
  - Jiggle the needle. Look for movement of tissue surrounding the needle
  - Swing (slight degree, look for important structures) the needle NOT the probe!!
  - Remember to keep the hand holding the probe stony hard!!
Pitfalls

- The needle appears to be in the vessel and a flash of blood can be aspirated but the catheter cannot be threaded into the vessel
  - The needle tip may be against the vessel wall or a valve. Reconfirm the tip and redirect under direct USG visualization.

Peripheral venous cannulation

- May be difficult, esp shock
- May apply tourniquet to distend the vein
- Doppler to differentiate from artery, peripheral vein commonly shows no flow or need augmentation to demo
- Newly formed clot may be anechoic and compressible!
In the Vein or Artery?

• May not be possible by anatomical landmark
• B mode – vein is compressible (not too hard! superficial arteries also), thinner wall, not pulsatile
• Color doppler – red not always represents artery! Beware the settings
• Spectral doppler – tracings are different for vein and artery
• Other maneuvers- sniffing in central vein or augmentation in peripheral

Spectral doppler of vein vs artery
USG Guided Drainage

- Follow the same 4 ‘P’ steps
- Puncture at the most dependent/largest compartment of the collection
- Keep probe perpendicular to skin surface to estimate the depth of puncture
- Avoid important structures - pre-scan is important
- Important structures may move – real time USG guidance can help

USG guided FB removal

- Can be very time consuming & fruitless – set a time frame
- May need a standoff pad for superficial FB
- Slowly sweep the probe in order not to miss a small FB – artifact signal would be small also
- Edema or pus collection around the FB make the artifact more prominent – easier to find
- Pre-scan important to avoid puncture the important structures around
US guided nerve/plexus block

- Hot topic in recent years
- Visualization of nerve fibers easier-advances in technology and availability
- Wide knowing-doing gap, sound anatomical knowledge
- A lot of techniques in B mode optimization, probe manipulation, eye-hand coordination (anisotropy)
- Practice makes perfect

US guided nerve/plexus block

- Distinct advantages over landmark +/- nerve stimulator (up to 20% failure rate with NS)
- Direct nerve visualization increase efficacy and reduce the dose of LA
- Less adverse effect. eg. Less inadvertent iv LA injection or nerve damage. Low volume interscalene block
Limitations

• Not too deep (4-5 cm)
• Not behind bone
• Area of ROI may restrict the accessibility of probe with long footprint
• Operator dependent, Learning curve

USG Guided Techniques

Practice makes perfect
Thank You