

Ultrasound Guidance Needle Techniques

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USG Guidance Needle Techniques

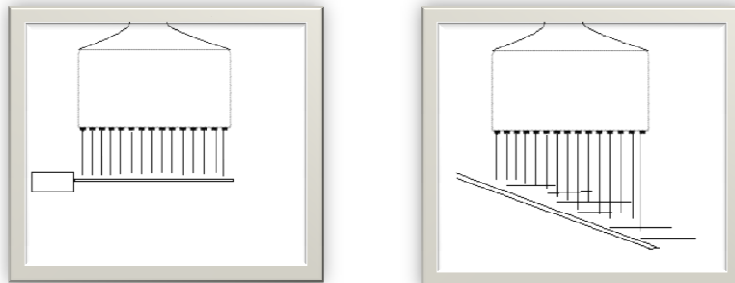
- Commonly used in EM
 1. Vessel cannulation-peripheral & central
 2. Foreign body removal
 3. Peripheral nerve/plexus block
 4. fluid drainage

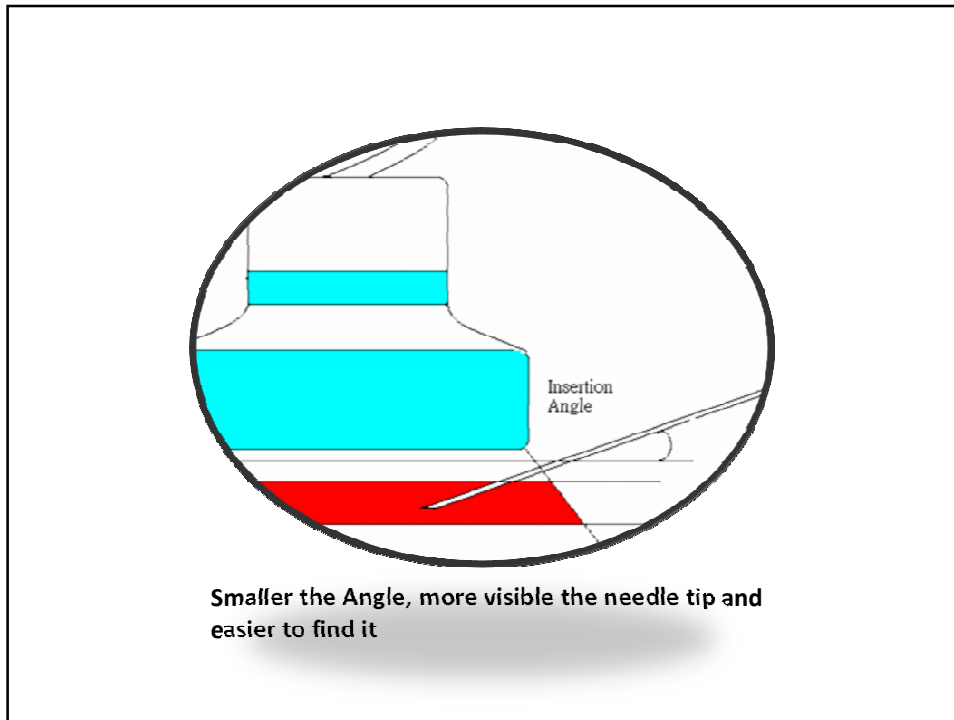
Basic principle-needle tip visualization

- 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 - $>20^\circ$ 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)

1. Denys BG, Uretsky BF: Anatomical variations of internal jugular vein location: impact on central venous access. Crit Care Med 1991; 19: 1516-1519.
2. Hind D, Calvert N, McWilliams R, Davidson A, Paisley S, Beverley C, Thomas S. Ultrasonic locating devices for central venous cannulation: Meta-analysis. BMJ 2003;327(7411):361-364.
3. www.ahrq.gov/clinic/ptsafety/chap21.htm

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

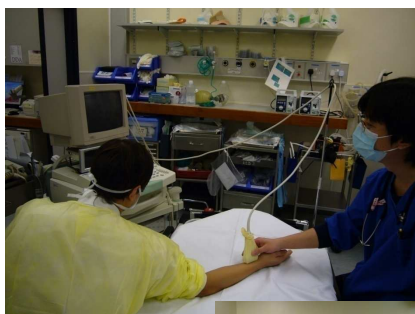


Probe Preparation

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

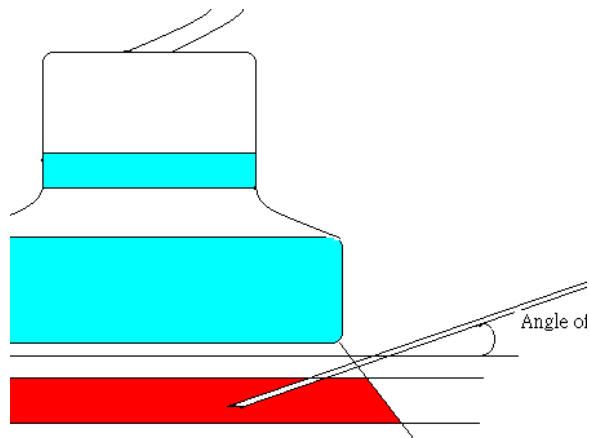
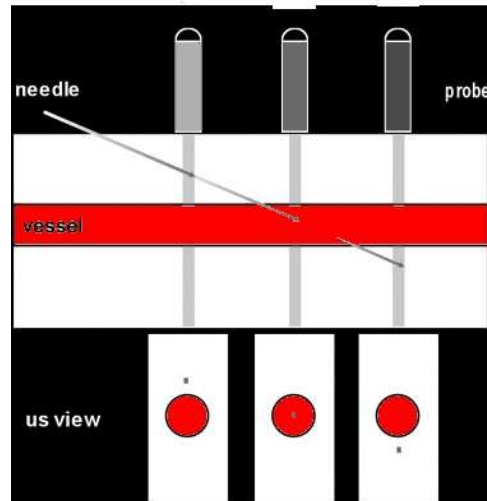
Puncture-transverse vs longitudinal

- Longitudinal – easier but need space for probe and needle placement
- Beware of small caliber 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



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 ($> 20^\circ$ needle becomes much harder to see)
 - Lager 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.

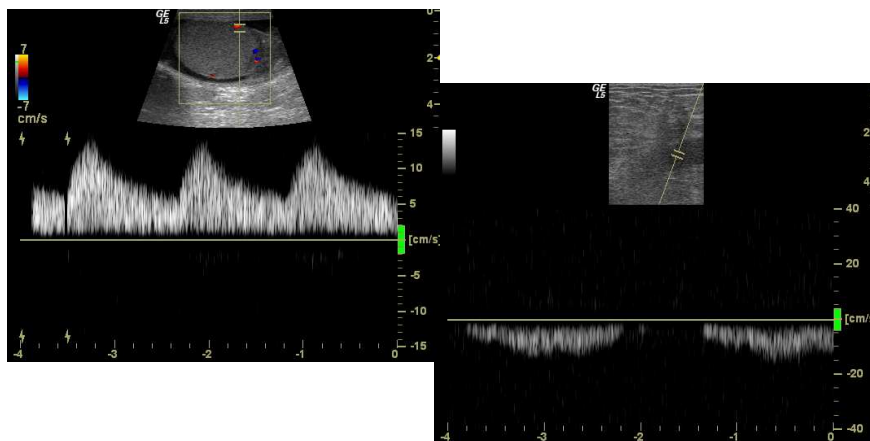
Peripheral venous cannulation

- 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