

The Benefits and Technique of Ultrasound Guided Central Vascular Access



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NICE National Institute for Health and Care Excellence

NICE guidelines suggest that ultrasound (US) guidance should be used for “all elective and considered for emergency central venous catheter (CVC) insertion”. [1]

The NICE guidelines highlight a 900 patient 2006 randomised study which compared US vs Landmark technique for internal jugular vein (IJV) CVC insertion, showing a reduction in complications of:

- Arterial puncture
- Carotid haematoma
- Haemothorax (HTX)
- Pneumothorax (PTX)
- Catheter-related infection

Along with reduced in needle puncture time [2]

A pictorial review of how to use US for IJV CVC access

Equipment

- Select the linear probe (high frequency >5MHz)
- Select ‘Vascular Access’ mode to optimise gain, depth and focus settings, where available
- CVC insertion equipment including probe cover and sterile gel



Figure A: Linear probe

US Technique

- Use transverse orientation of probe
- Hold probe in non-dominant hand and tether probe hand
- Use US to identify vessels, mark site then create sterile field



Figure x: Tethering the probe hand to the patient

US Identification of the IJV

- IJV is usually larger in diameter than the common carotid artery
- The walls of the IJV are thinner and less muscular
- The IJV is more compressible (fig B)
- The IJV is lateral to the common carotid
- The wave form of the IJV using Doppler is monophasic vs the pulsatile arterial wave form of the common carotid artery (fig C)

NB: the proximity of the common carotid to the IJV may lead to transmitted pulses in the vein wall

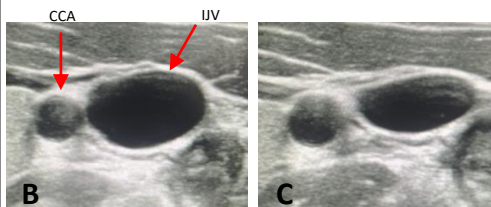
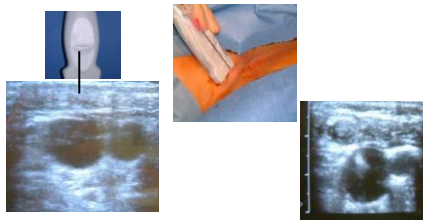


Figure B: common carotid artery (CCA) and internal jugular vein (IJV). Note the IJV is larger and has thinner walls

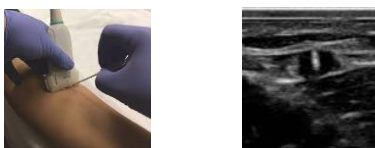
Figure C: veins are more compressible than arteries



Needle Insertion Options

1. Guidance under direct US visualisation (+/- using central line marker)
2. Not under direct US visualisation, aspirating as advancing

How to use US for Non palpable peripheral veins



Centre of the probe is centre of the picture

Long-Axis View for Confirmation



Figure G: Using longitudinal view to confirm position of guidewire

Evidence of the benefits of US guided vascular access

US-guided vs landmark guided technique for adult CVC insertion is associated with higher success rate and lower rates of PTX, artery puncture, catheter related infection, increasing needle attempts, carotid haematoma [2, 3]

The use of US for insertion of paediatric CVCs is superior to landmark technique and should be utilised [4]

1/3 critically patients have challenging peripheral venous access. The use of US guided cannula insertion is straightforward and can improve success rate of cannulation [5]

In trauma or unstable patients, evidence for the use of US guided vs landmark technique for subclavian vein catheterisation is limited [6]

References:

1. Adam J, Akehurst RL. 2 clinical need and practice: Guidance on the use of ultrasound locating devices for placing central venous catheters: Guidance. NICE. <https://www.nice.org.uk/guidance/ta49/chapter/2-clinical-need-and-practice>. Published October 4, 2002. Accessed November 23, 2022.
2. Bodenham AR. Can you justify not using ultrasound guidance for central venous access?. *Crit Care*. 2006;10(6):175. doi:10.1186/cc5079
3. Brass P, Hellmich M, Kolodziej L, Schick G, Smith AF. Ultrasound guidance versus anatomical landmarks for subclavian or femoral vein catheterization. *Cochrane Database Syst Rev*. 2015;1(1):CD011447. Published 2015 Jan 9. doi:10.1002/14651858.CD011447
4. Lau, C., Chamberlain, R. Ultrasound-guided central venous catheter placement increases success rates in pediatric patients: a meta-analysis. *Pediatr Res* **80**, 178–184 (2016). <https://doi.org/10.1038/pr.2016.74>
5. Blanco P. Ultrasound-guided peripheral venous cannulation in critically ill patients: a practical guideline. *Ultrasound J*. 2019;11(1):27. Published 2019 Oct 17. doi:10.1186/s13089-019-0144-5

Conclusion

Ultrasound is quick , safe imaging for vascular access , the golden message is **Centre of the probe is centre of the picture**