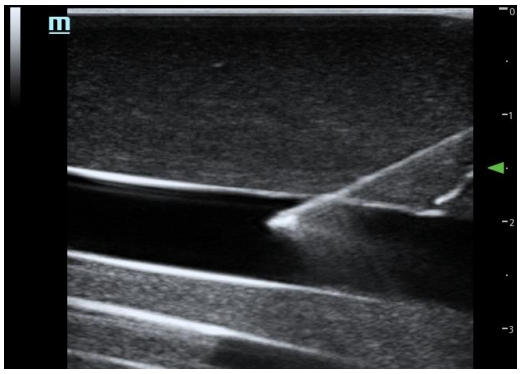
Clinical Skills Mastery Programme

Ultrasound guided peripheral venous access

Educational Reading Pack



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NHS Lothian Clinical Skills Mastery Programme
Ultrasound Guided Peripheral Venous Access Reading Pack

Contents

Note on Intended Audience and Prior Skills

This programme is aimed at clinicians and practitioners who are experienced in intravenous cannula insertion but are novice users of ultrasound to guide this.

Practitioners should already be competent inserting peripheral intravenous cannulas with a 'one-handed technique', as this is essential to free the other hand to hold the ultrasound probe.

NHS Lothian Clinical Skills Mastery Programme

Welcome to the NHSL Mastery Programme Ultrasound Guided Venous Access Reading Pack. We hope you find this pack a valuable learning resource to compliment your simulated practice sessions.

In order to optimise your learning, you must read this pack and watch the associated videos before your first simulation session.

The NHSL Mastery Programme has been developed to enhance the technical and non-technical skills of clinicians undertaking complex clinical procedures.

Each procedural skill will be approached via a combination of written and video educational resources with subsequent simulated practice, facilitated by appropriately-skilled trainers.

Acknowledgements

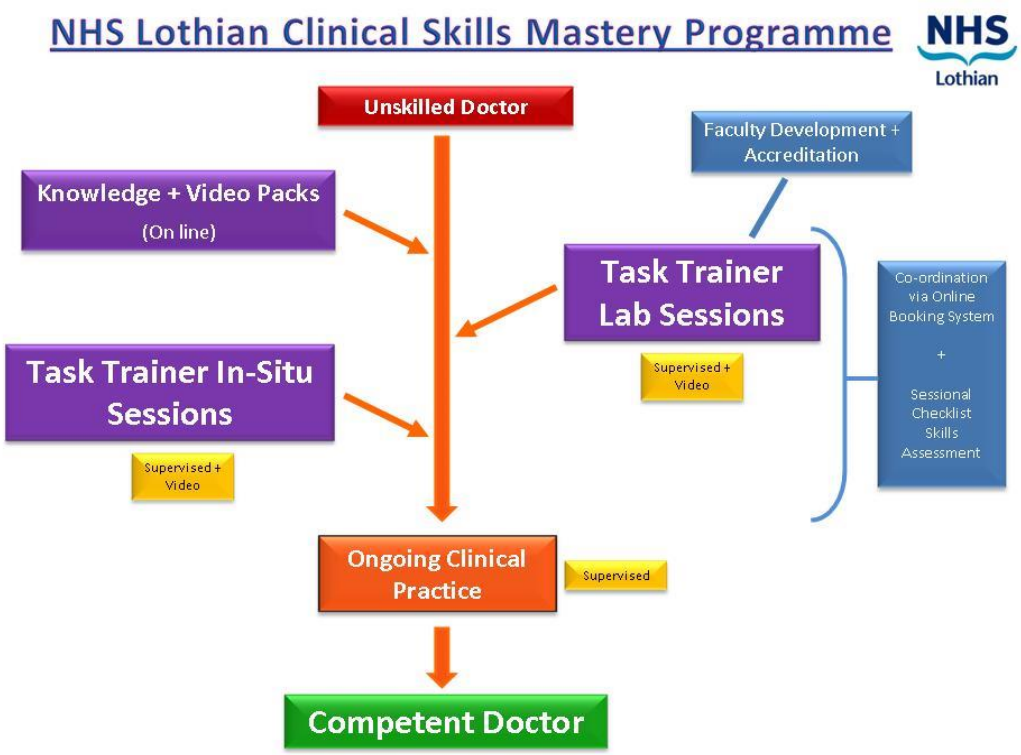
The authors would like to thank the following people for their generous contributions to this pack and many other aspects of this programme:

Joe Roberts, Simulation Technician, NHS Lothian
Nathan Oliver, Simulation Manager, NHS Lothian
Scott Inglis, Senior Clinical Physicist, NHS Lothian
Thalia Monro-Somerville, Consultant Anaesthetist and Intensivist, NHS Lothian
Simon Edgar, Director of Medical Education and Consultant Anaesthetist, NHS Lothian

Methods

The flow diagram (below) describes the envisaged path to procedural competency for clinicians in NHS Lothian. This involves a sequence of:

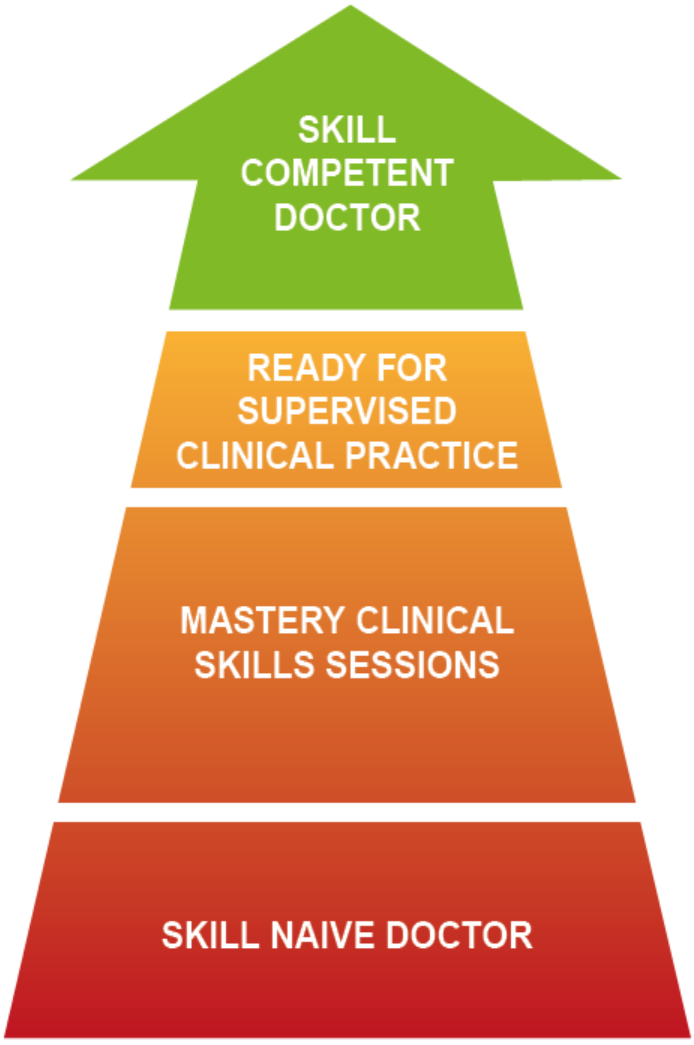
- Knowledge Packs: combination of written and video educational resources for each procedural skill, with a consistent emphasis on patient safety.
- A 2-phase supervised simulated procedural training programme, including checklist-based formative assessment throughout.
    - Task trainer in skills lab (non-clinical)
    - Task trainer in-situ (clinical environment)
- Training of faculty with accreditation through the regional Clinical Educator Programme.



NHS Lothian Clinical Skills Mastery Programme

We recognise that the traditional model of "see one, do one, teach one" is no longer acceptable. Our new approach allows development of fundamental skills in a manner that minimises risk to patients.

In addition, this novel approach allows refreshment of old skills, minimising the effects of potentially harmful skill decay.



WPBA provision
- **Real-life practice under direct supervision until independently competent**

- **Mastery Assessment Session**
- **DOPS / Mastery certificate provision upon achieving passing standard**

- **Self Directed or Peer Assisted Deliberate Practice**
- **Peer Observation**

Resources on www.med.scot.nhs.uk
- **Reading pack**
- **"How to drive the ultrasound" video, Demo of mastery session and exemplar skill performance video**

NHS Lothian Clinical Skills Mastery Programme

General Principles

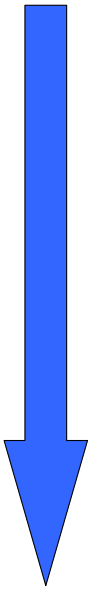
Complex procedural skills can be daunting prospects initially. It is not uncommon for novices to become overwhelmed when performing such procedures, resulting in avoidable error or harm.

It can be helpful to fragment the task into discrete, manageable parts, ensuring one is complete before moving onto the next.

Our Mastery Procedural Phases (shown below) is one method of approaching any complex skill. This will be discussed more in the videos and simulation skills sessions.

Procedural Phases

1. **Preparation, Assistance and Positioning**
   Non technical skills + clinical decision making
2. **Asepsis + Anaesthetic**
3. **Procedural Pause**
   3 Point Check
4. **Insertion**
5. **Anchoring + Dressing**
6. **Completion**
   Documentation / Communication / Trouble shooting



Learning outcomes

After reading and viewing the content contained within this pack the clinician should gain the following:

- An understanding of the indications for ultrasound guided peripheral venous access
- An understanding of the basic functions of the ultrasound machine
- An understanding of how to identify veins using ultrasound
- An understanding of how to insert a peripheral venous cannula using ultrasound guidance

Introduction and Indications

Obtaining peripheral venous access is a core skill for doctors and other healthcare practitioners. Some patients may present a challenge to obtaining peripheral venous access for a variety of reasons, for example:

- Obesity or lymphoedema
- Previous Intravenous recreational drug use
- Poor veins due to multiple medications or procedures e.g. chemotherapy
- Any other reason for poor peripheral vasculature

Historically the anaesthetic team have sometimes been called to assist with gaining venous access in these patients and may use ultrasound (US) to help locate a vein and insert the cannula. Increasingly clinicians in many other areas are also using ultrasound in this way. As more clinicians gain this skill, patients with difficult IV access are less likely to experience delays in treatment and the discomfort of multiple attempts. Additionally, fewer referrals to other teams are required and

There is no universally accepted indication for when to utilise US in gaining peripheral venous access. For the purposes of this learning programme, it is suggested that US guided peripheral venous access *should be considered when two initial attempts at peripheral venous access have been made unsuccessfully, in the presence of the above conditions.*

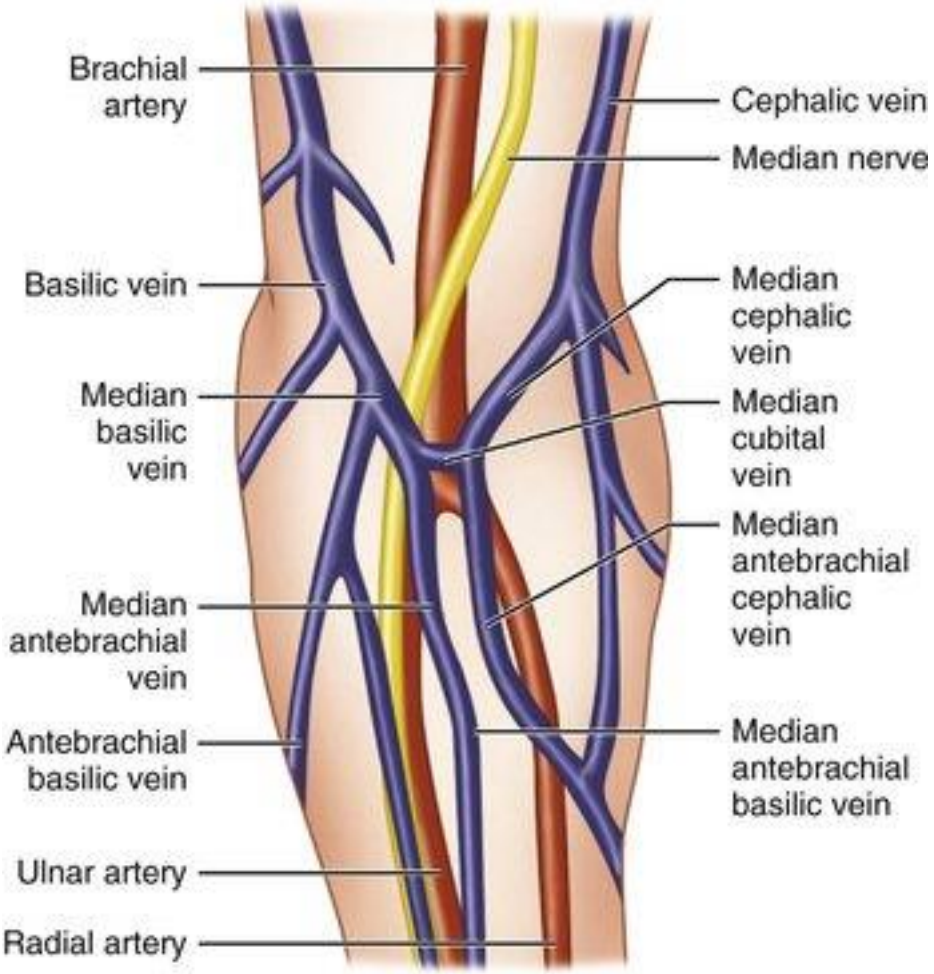
Prior to undertaking this procedure, it is also worth considering:

- Does the patient really need IV access, or is there an acceptable enteral or intramuscular / subcutaneous alternative for their treatment?
- Is the patient unstable and requiring very urgent access, in which case you may need to consider intra-osseous access?
- Is the patient likely to need longer-term access, in which other options such as a PICC line could be considered?
- Have other factors that affect success been optimised? (eg clinician factors such as fatigue, hunger etc, patient positioning, optimal venous filling / vasodilation etc)

Upper Limb Venous Anatomy

The usual sites for cannulation in the upper limb are the back of the hand and the antecubital fossa – as veins tend to be visible here. However, other veins may be visible using the ultrasound, shown in the diagram below. Ultrasound tends to be most useful for finding veins that cannot be seen or palpated easily, usually between the mid-forearm and the proximal 1/3 of the humerus. As shown, there are various other structures in the antecubital fossa to be aware of (nerves and arteries) – so be careful when cannulating here.

Veins of the upper limb (Left)



How to use the ultrasound machine
- see accompanying video presentation

Ultrasound works by transmitting high-frequency sound waves through tissue, which bounce back and are interpreted by the probe. The more solid a tissue is, the more waves bounce back to the probe it will therefore show up as brighter on the screen.
Therefore, blood is black (i.e. in veins and arteries) as it is “anechoic”, bone is white, and other tissues will be somewhere in-between.

Like cars or phones, ultrasound machines have common features but vary in how you use there. You should familiarise yourself with the ultrasound machine in your clinical area. Know how to switch it on, how to select a probe, and how to adjust the image.

For US guided peripheral venous access, the best probe to use is the linear probe. This gives the best images for relatively superficial structures like veins in a limb.

Linear ultrasound probe

There are two functions of the ultrasound machine that are particularly worth knowing about:

- Depth – this can be adjusted to get the best view possible on the screen. The image should be deep enough to show everything you need to see, but not too deep as this reduces the visible detail. For peripheral veins, this does not usually need to be any more than 3cm. A depth marker on the right side of the screen lets you measure how deep the vein is.

- Gain – this is like the ‘brightness’ function on a computer monitor. It increases the signal, so gives a more detailed picture of the structures. It also increases the noise, so will give more detail of things you also don’t want to see. You should adjust the gain so that you can see things clearly, whilst blood in vessels still looks dark.

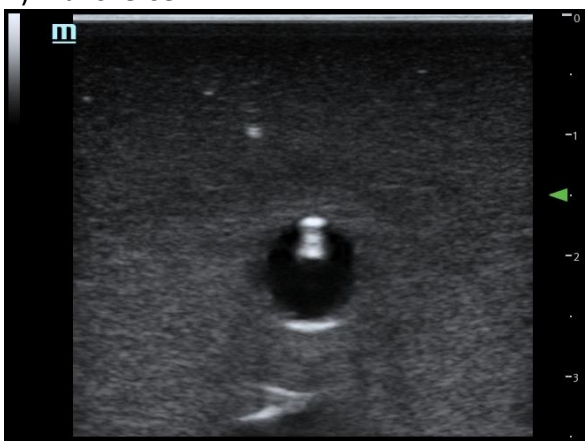
Some machines let you select a 'pre-set' image setting (such as 'vascular' or 'superficial venous'). These work well in most circumstances.

The ultrasound probe can be used in two orientations or axes. There are advantages and disadvantages to both

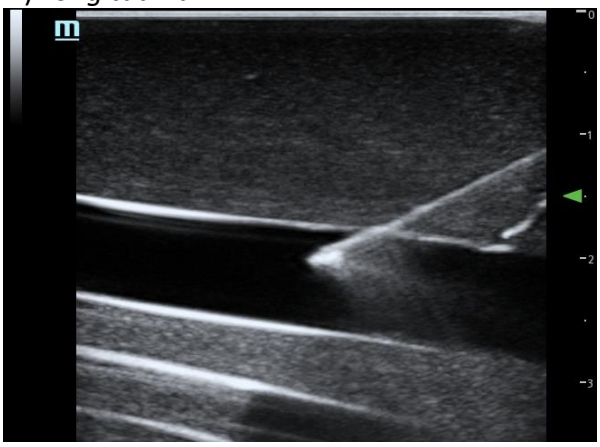
1) Transverse orientation (short axis) – used to find veins and guide the needle into the vein

2) Longitudinal orientation (long axis)– can be used to show the position of the needle within the vein

1) *Transverse*



2) *Longitudinal*

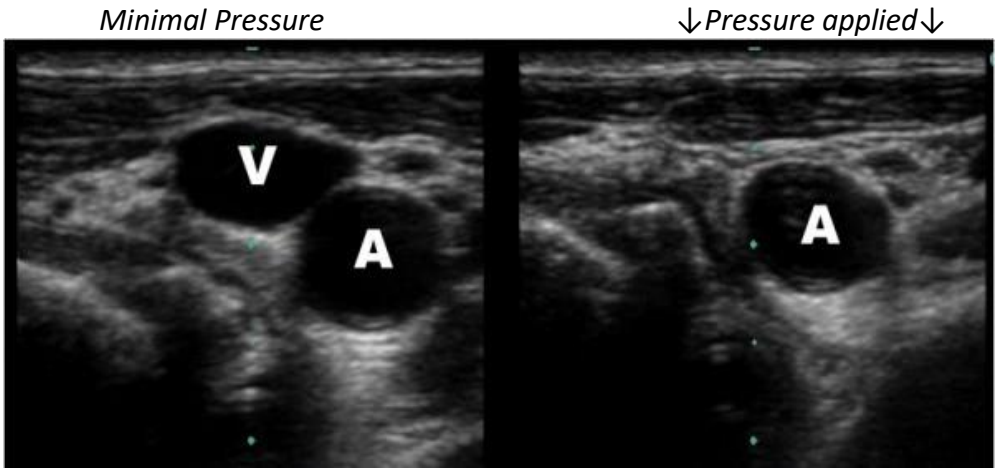


Transverse orientation	Longitudinal orientation
+ Good for scanning for potential veins	+ Can see whole needle position at once
+ Easier to line up needle with vein	
+ Can see structures either side & above / below a vein, important if vein is near an artery	- Harder to line up needle and probe with vein
- Not clear which bit of needle you are seeing	- Does not work for veins that are not straight

How to use ultrasound to find a vein:

1. "Orientate" your probe (by tapping on one side with a finger) so that the left side of the screen matches the left side of the probe
2. Scan around areas where veins are likely to be (see above notes for anatomy).
3. When you find a vein, make sure to differentiate it from an artery by compressing it gently with the ultrasound probe
    - veins compress, arteries do not
    - arteries are pulsatile

Vein and artery on ultrasound – vein is compressible



What makes a vein easier to cannulate with ultrasound?

If ultrasound is required, the patient is unlikely to have "good" veins – however the following will make a vein easier to cannulate

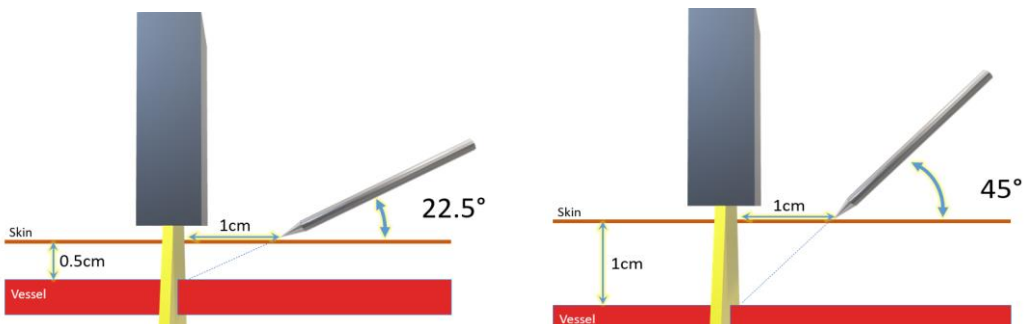
1. Depth <2cm
2. Size – Larger rather than smaller
3. Not immediately adjacent to an artery
4. Straight rather than tortuous

How 'drive' the needle and probe

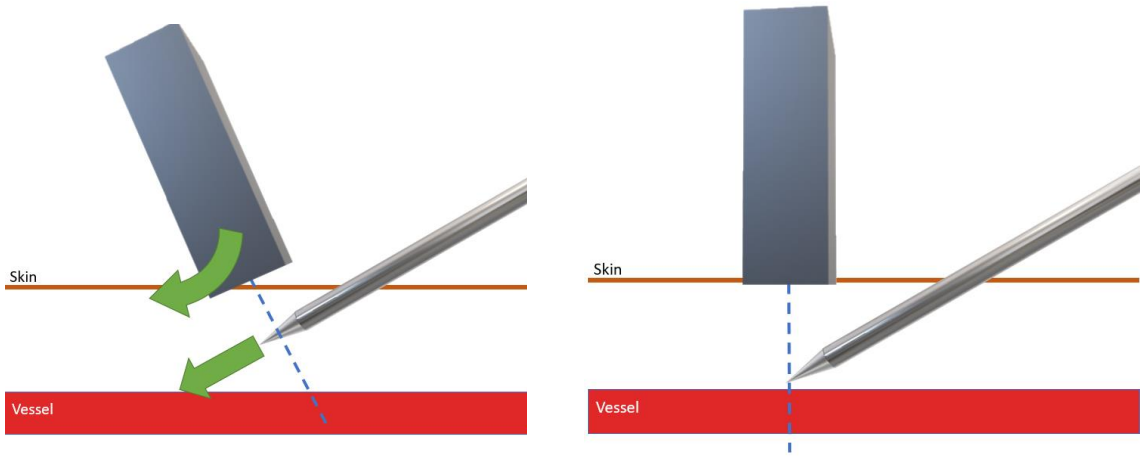
- See accompanying video

1. Start with the probe in transverse orientation - showing a "cross section" of the vein in the middle of the screen

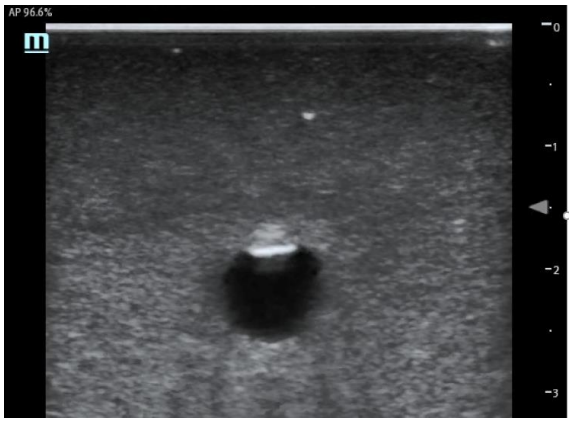
2. Work out an approximate angle of insertion. This will vary depending on how deep the vein is. Deeper veins require you to insert the needle into the skin more distally to maintain an appropriately shallow angle of insertion into the vein.



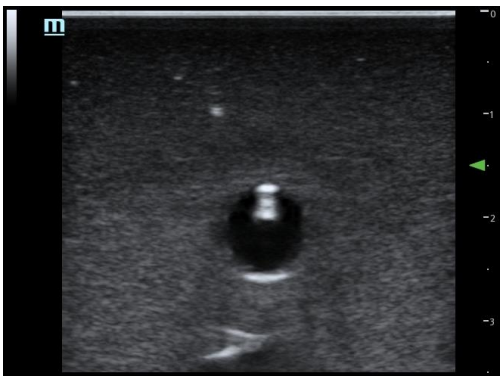
3. Advance the needle slowly, whilst tilting the angle of the probe to keep the tip visible on the US screen. Keep the vein fixed in the middle of the screen and move the needle left and right, rather than moving the probe left and right.



4. At the point where the needle tip reaches the vessel wall you should be able to see it 'indenting'



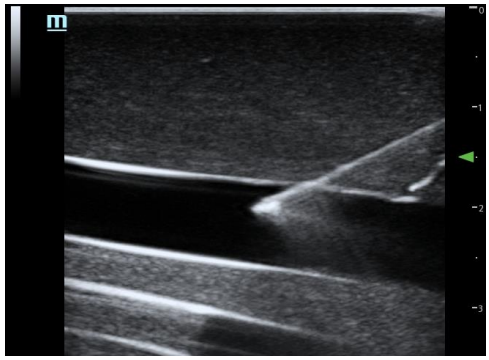
5. When the tip of the needle enters the vessel, you will get flashback into the collecting chamber of the cannula. You can then complete cannulation in one of two ways:



a) Either flatten the angle of the cannula and cannulate the vessel as normal – this is less technically challenging, but it is harder to be certain of the position of the needle within the vessel so the chance of success is not as high.

OR

b) Alternatively, rotate the probe 90 degrees so that the vessel and needle are both visible in longitudinal axis. This allows you to advance the cannula further into the vessel, ensuring the sheath of the cannula is within the vessel without the needle going through the back wall.



Equipment and Resources

- Assistant (ideal, but optional)
- Pillow for arm positioning
- Sharps bin
- Gloves and apron
- Chlorhexidine / alcohol swabs for cleaning skin
- Peripheral venous cannula
- 0.9% saline flush and 10ml syringe
- PVC dressing
- Ultrasound machine with linear probe
- Probe cover
- Ultrasound gel – including sterile gel for the patient
- Disposable tourniquet
- Equipment for taking bloods if being done at the same time

Insertion Procedure

Preparation, assistance and positioning:

- Obtain informed consent – explain procedure to patient, verbal consent is acceptable.
- Consider contraindications.
- An assistant is not essential, but can help with patient positioning
- Position the ultrasound machine so it in position easy to see – ideally in line with the limb you are cannulating so movements on the screen line up with movements of the needle.
- Arrange cannula equipment.
- Apply tourniquet and scan for veins, being sure to differentiate from arteries and identify nearby anatomical structures. Once a vein has be chosen remove the initial scanning gel.
- Apply probe cover to US probe, and sterile gel to outside of the probe cover

Procedural pause:

- Run through procedure in your head to confirm the order of things.
- 3-point check of patient, assistant, and yourself.
- Final equipment check.

Asepsis and anaesthesia:

- This is not a sterile procedure, but a chlorhexidine / alcohol wipe should be used, and the ultrasound probe cover is mandatory along with sterile (single use) aqua-gel on the outside.
- Consider infiltrating local anaesthetic if large cannula being used (1ml 1% or 2% lidocaine through orange needle as a bleb onto the skin), followed by gentle massage of the area to displace the volume prior to cannulation.

Insertion:

- Apply the linear ultrasound probe in transverse view. Keep the view of the vein still and in the centre of the ultrasound screen, while inserting your cannula underneath the middle point of the US probe.
- Use the ultrasound probe to guide cannulation of the vessel, as described above
- If cannulation is unsuccessful, remove tourniquet, remove needle and press on area with cotton wool.

Anchoring and dressing:

- Apply sterile adhesive cannula dressing.
- Consider extra precautions to secure cannula e.g. bandage. This is particularly important if the position of the cannula (eg on medial aspect of upper arm) or other patient factors (eg impaired consciousness) mean it is more likely to be knocked out

Completion and documentation:

- Dispose of sharps.
- Clean US machine and probe.
- Send any blood samples.
- Document cannula on invasive devices chart (if in use). If the cannula was difficult and ultrasound was required it is worth documenting this in the notes to ensure future care providers are aware of the difficulty.

Checklist

Pre-procedure	Attempt 1		Attempt 2	
	Yes	No	Yes	No
Identifies correct patient and verbally consented				
Considers indications and contra-indications				
Lists correct equipment				
Describes optimal patient, operator, and ultrasound position				
Sets up ultrasound machine including probe cover and sterile water-soluble gel				

Wash hands, non-sterile gloves and apron				
Applies tourniquet				
Performs scan to identify appropriate vein				
Procedural pause				
Confirms insertion point				

Procedure

Infiltrates local anaesthetic if using				
Inserts cannula using ultrasound guidance, with needle visible on ultrasound throughout				
Obtains flashback				
Advances cannula and removes needle				
Removes ultrasound from procedure area				
Secures cannula with dressing				
Flushes cannula with 10ml saline				

Post procedure

Disposes of sharps and tidies equipment				
Cleans ultrasound machine				
Document on invasive device chart				

Throughout

Maintains infection control precautions				
Clear communication to patient				
Maintains view of vein and cannula on ultrasound				
Safe sharps management				

Comments: