Insertion of IV and IO access- Pediatrics

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- Key messages
- Choose the site carefully, aiming to avoid an excessive number of attempts. Defer to another staff member after three unsuccessful attempts.
- Use aseptic technique.
- Aim to provide pain relief (oral sucrose, non-pharmacological measures).
- Secure the successfully inserted cannula carefully by using a splint and appropriately placed tapes. The distal fingers or toes and insertion site must remain visible for regular inspection.
- Resite promptly with signs of phlebitis, induration or swelling.
- Consider elective resiting after 48-72 hours to minimise infection. Remove unused cannulas, which can act as a source of infection.

Equipment for IV cannulation

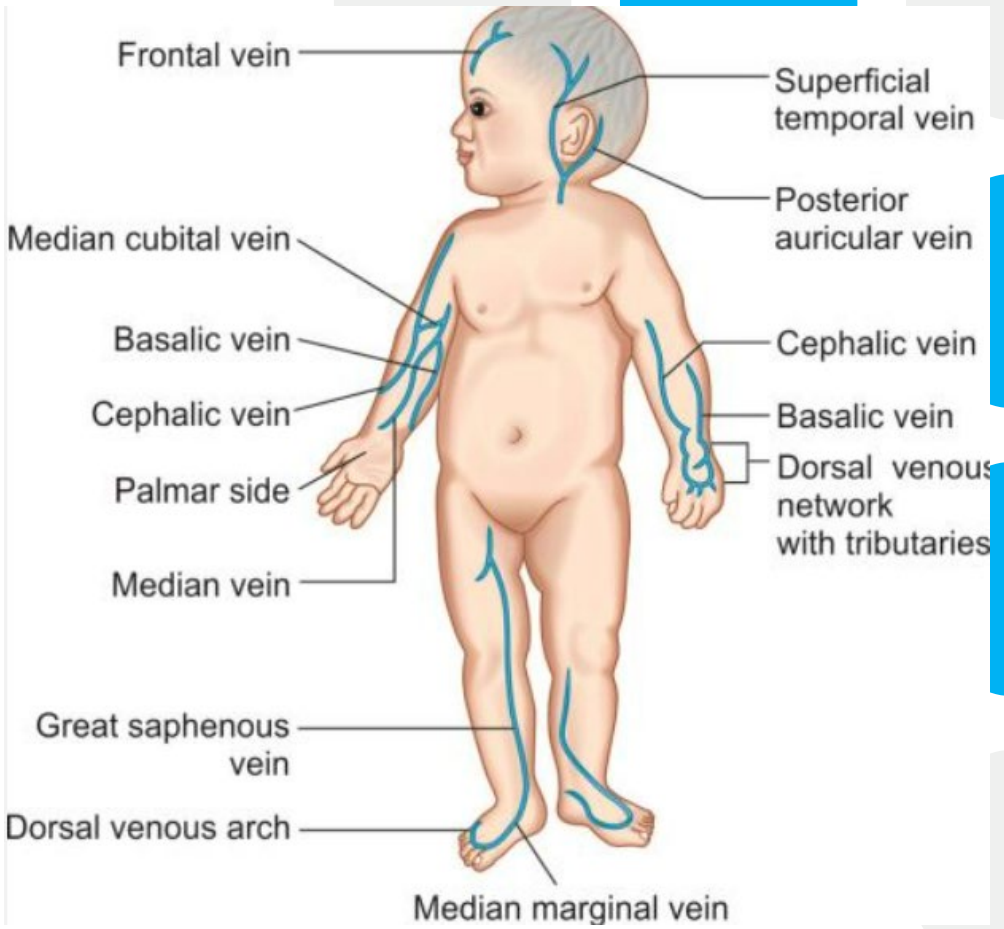
- clean trolley
- gloves (use standard precautions for all procedures where contact with blood possible)
- basic dressing pack
- Appropriate pediatric/infant cannula catheter
- blunt end drawing up needle
- 0.9% sodium chloride for flush
- skin antiseptic solution
- extension tubing
- tapes
- splint
- sterile occlusive dressing to cover the insertion point such as Tegaderm

Technique for IV cannulation

- Veins in children and babies are smaller than adults
- A premature or sick infant may require multiple cannulations during a prolonged stay in hospital
- Therefore, treat veins with respect!

Finding a suitable vein for cannulation

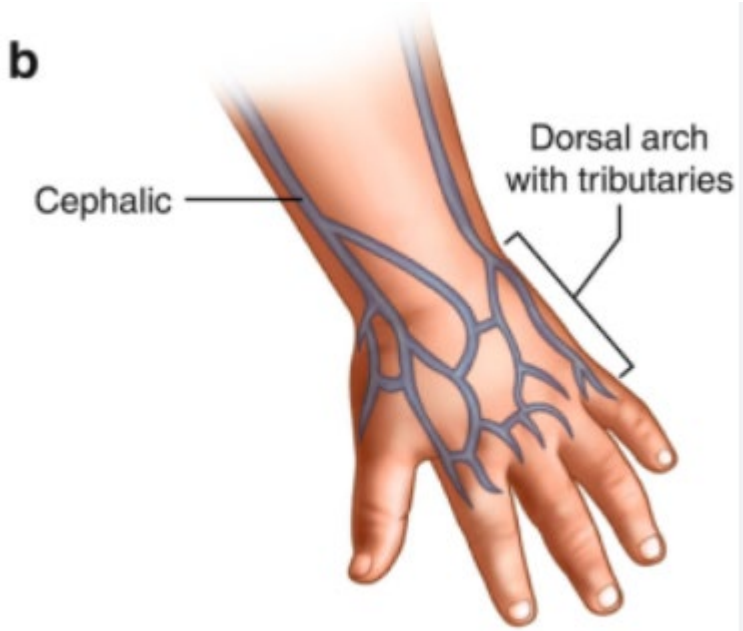
- Position the baby so you can see and have access to all limbs while ensuring that he/she is warm and well oxygenated
- Ensure good light: An angled procedure light is often used
- Take time and look at all the usual sites and choose the best option
- Choose the vein carefully. A good vein
  - runs straight
  - fills and empties
  - is easy to splint
- Repeat the process of looking if the attempt fails



The preferred sites for IV cannulation

1. **Hand and wrist**

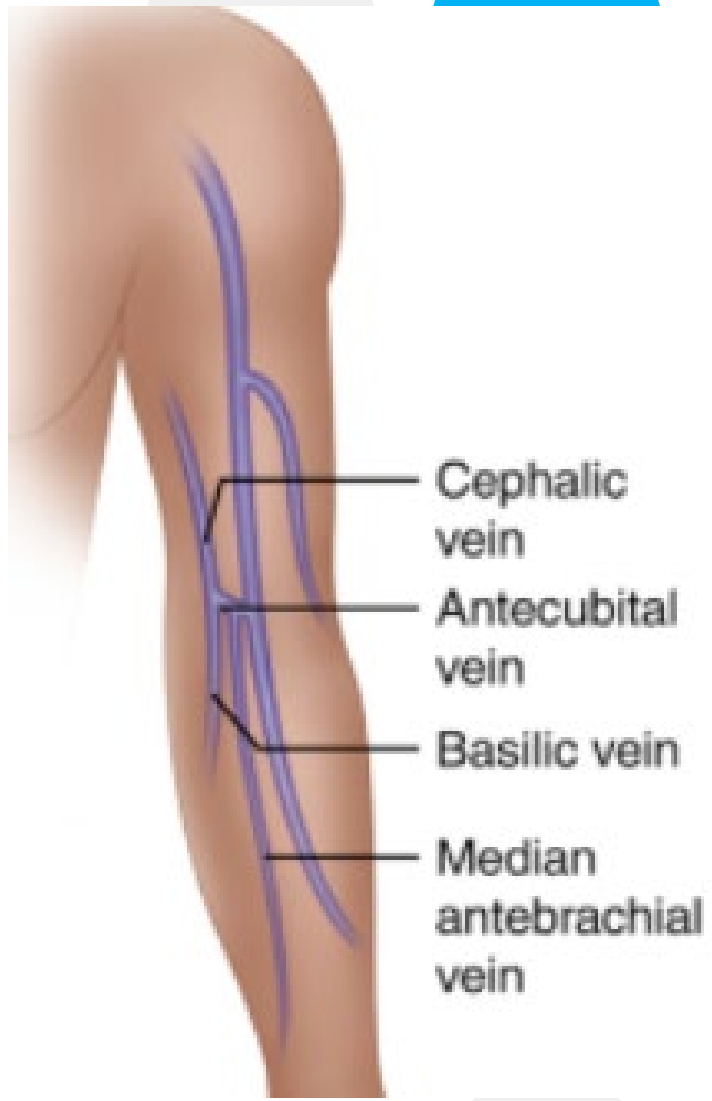
- Dorsal arch veins: on the back of the hand, or the back of the wrist. Skin entry should be more distally. IVs inserted here are easily splinted and any infiltration easily spotted, so these veins are the preferred site.
- Cephalic vein, in anatomical snuffbox: Usually large and can often be felt better than seen. It is one of the veins to try if you must cannulate ‘blind’ in a large baby. Cannulas in this position tend to last quite well, making this a good secondary site.
- Wrist (anterior aspect): Veins are usually quite small and fragile. easily cannulated, but do not last long. Should not be used for noxious substances (eg Dopamine, Vancomycin), as they are prone to ‘burn’.



The preferred sites for IV cannulation

2 **Cubital fossa**

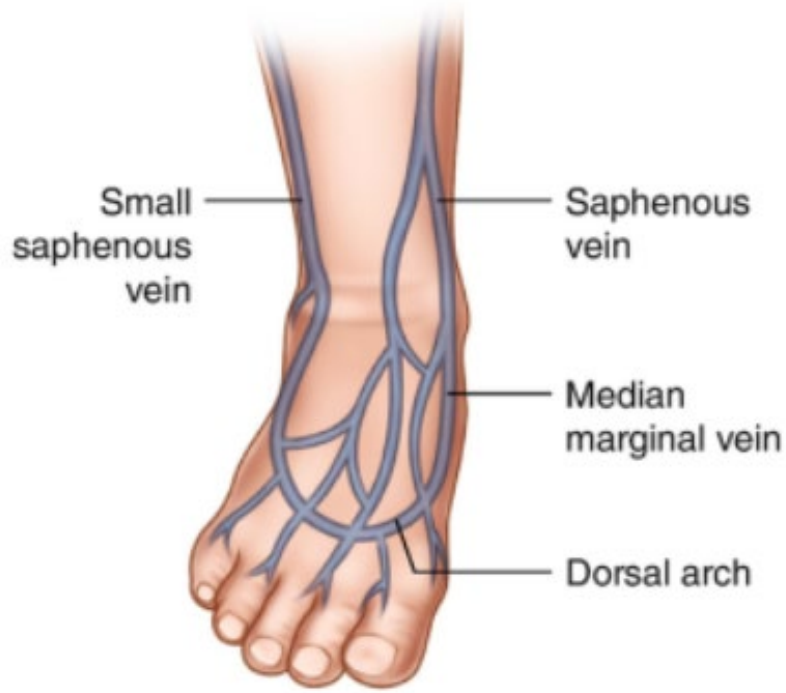
- Median antecubital, cephalic and basilic veins: generally easy to hit and tend to last quite well if splinted properly. Can also be used for PICC lines (Peripherally inserted central catheters).
- These should be avoided in any infant likely to need long term IV therapy, so that a PICC line is inserted by experienced personnel.
- The median nerve and brachial artery are bo The preferred sites for IV cannulation th in the same anatomical vicinity and therefore vulnerable to damage.



The preferred sites for IV cannulation

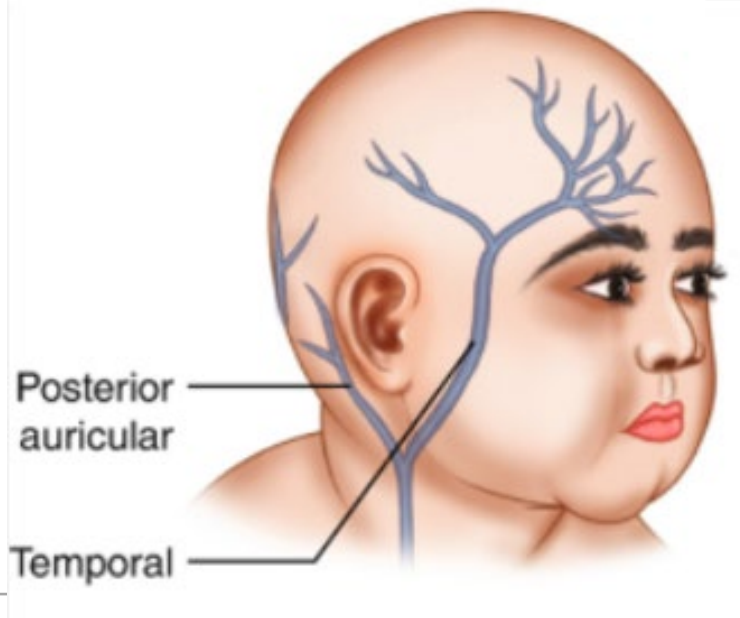
3 **Foot and leg**

- Dorsal arch: small, but easily cannulated and last surprisingly well. The vein on the lateral aspect, running below malleolus, is easy to access, but must be splinted carefully and watched for infiltration. Also veins leading up to short saphenous are often good options.
- Saphenous vein at ankle: runs reliably just anterior to medial malleolus and is large and straight. It is easy to access and lasts well although is not always readily visualised. Can also be used for PICC lines. 5.Leg
- Saphenous vein at knee: runs just behind the medial aspect of the knee and it curves around the top of the tibia. Access is easy and lasts well if properly splinted. Also good for PICC line, so avoid if child needs long term intravenous therapy

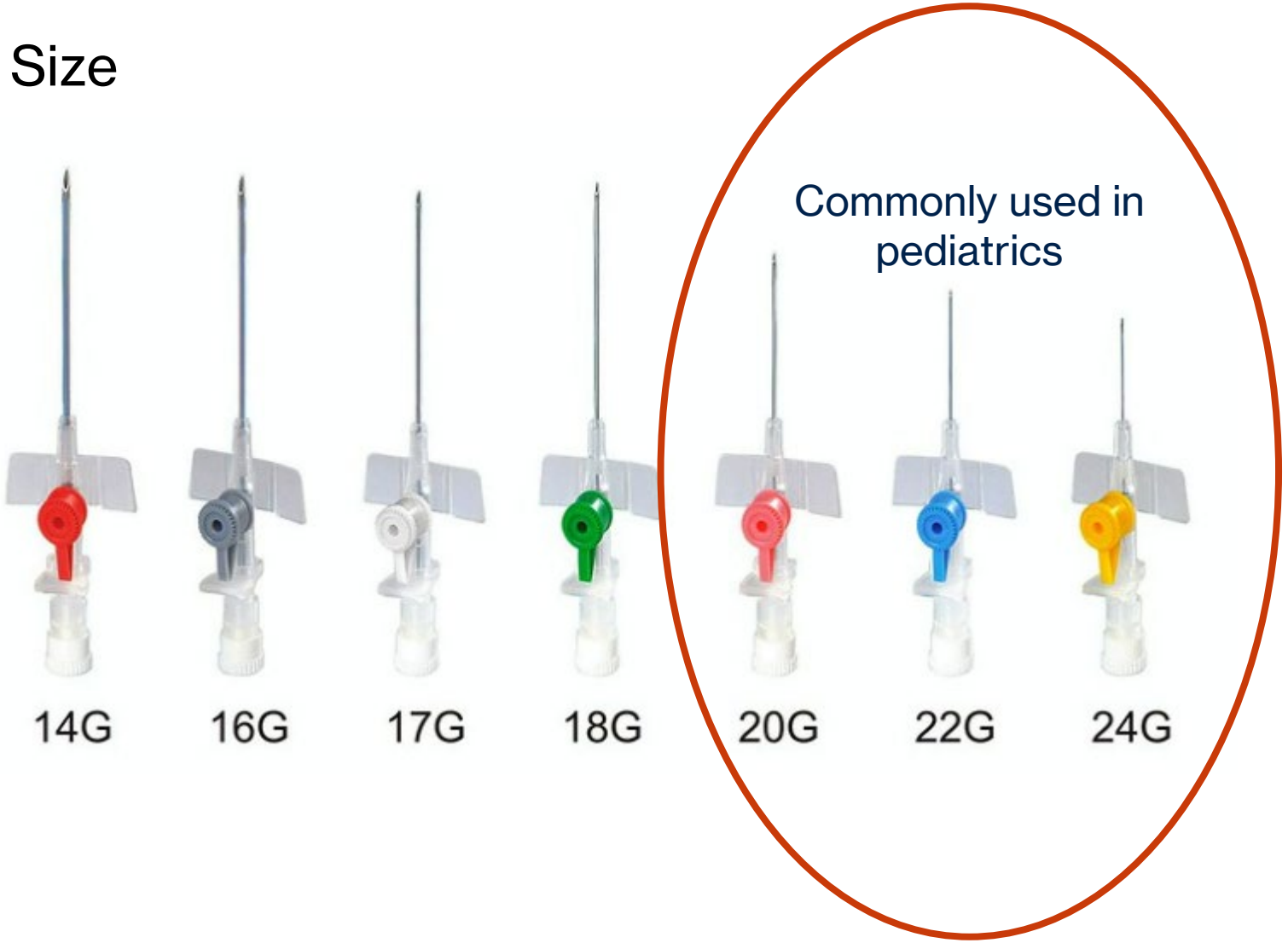


The preferred sites for IV cannulation

4 **Scalp in infants and neonates:** should only be used once other alternatives are exhausted. Shaving of the head is usually required.



- Cannula Size



Procedure

Consider pain relief consistent with the condition of the child or infant. Pain relief options are:

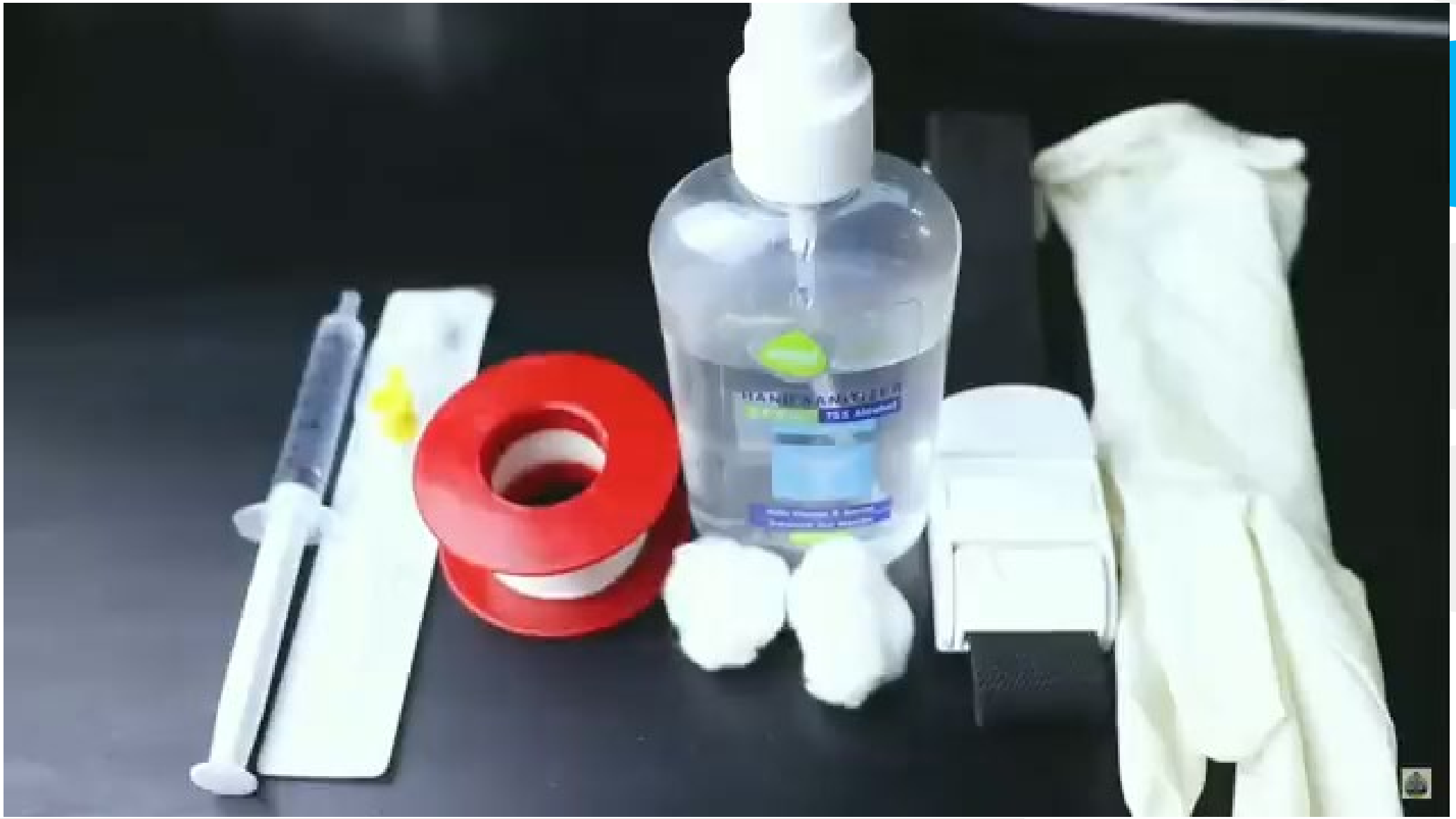
- application of local anesthesia cream (if procedure is not urgent)
- oral sucrose
- non-pharmacological settling techniques (distraction, parent presence...)

Procedure: cont..

- Once through skin, advance directly over the vein, rather than from the side.
- Advance in a stop-start fashion, until you get a flashback of blood.
- Stop when blood appears. Lift tip of needle slightly before advancing another 1-2mm. Check if bleeding into chamber continues, which confirms that the needle tip is still in the vein. Hold base of needle steady, push the canula off needle, either with the other hand or with the index finger of the same hand. Advance up the vein as far as it will easily go (preferably to the hub).
- If bleeding has stopped after initial small advance of the cannula/needle unit, it is likely that the needle tip is out of the other side of the vein. Pull the needle back slightly into the cannula, blood might come up the cannula. If so, attempt to advance the cannula up the vein, leaving the needle in the cannula, but pulled back a little, to stiffen it.
- Release the tourniquet. Flush with 0.9% Normal Saline to check patency. If the cannula has not been fully advanced, flushing may also help to then advance it further up the vein.
- Remove any blood spills near insertion site before strapping.
- Without touching the insertion site use available tape to secure the cannula.
- Splinting of the limb is very important for immobilizing particularly in infants and small children

Potential complications of IV cannulation

- Phlebitis: The likelihood of phlebitis and sepsis secondary to IV cannulas can be reduced by electively replacing the cannula every 48-72 hours. This will depend to some extent on the availability of other sites. But ensure that the new one is placed before the old one is removed.
- Cellulitis
- Sepsis
- Tissue necrosis
- Air embolus (incorrect priming).



Cannula insertion in a small infant

https://www.youtube.com/watch?v=hjbTGzFRAJE

Intraosseous access in children

IO Access
An Introduction

- In an acute resuscitation situation, after the airway is secured and adequate breathing and gas exchange are established, the next priority is to obtain vascular access.

- IO access can be initiated in patients of any age as rapid and equally effective alternatives to intravenous (IV) peripheral lines.

- IO access is considered more appropriate than attempted placement of central lines in situations when immediate resuscitation is essential. [18, 19] In addition, IO needles provide rapid access to the central circulation, with good bioequivalence to IV infusion. [20, 21]

IO Access
An Introduction

- IO needle placement does not constitute definitive therapy; rather, it allows the administration of life-saving medications and fluids in a context where intravascular access is vital. Often, definitive IV access is easier to obtain once a bolus of fluids and medications has been administered via the IO needle.

- IO needles may be left in place in the marrow for up to 72-96 hours; presumably, the longer the needle remains in place, the greater the risk of infection and dislodgment. In practice, the needle is usually removed as soon as another means of vascular access (either peripheral or central) is available, ideally within 6-12 hours.

Indications

- Any clinical situation where vascular access is emergently needed but not immediately available via a peripheral vein.

- IO access provides a means of administering medications, glucose, and fluids, as well as (potentially) a means of obtaining blood samples. Such a situation would include any resuscitation; cardiopulmonary arrest; shock, regardless of etiology; life-threatening status epilepticus; or lack of venous access resulting from burns, edema, or obesity.

- In comparison with child and infant peripheral IV access, central lines, or umbilical lines, IO access is safer, is associated with fewer complications, can be implemented with less delay, and requires less skill and practice on the part of practitioners who may use the techniques only rarely. [13]

Contraindications

- Ipsilateral fracture of the extremity, because of resulting extravasation and risk of compartment syndrome
- Previous placement or attempted placement in the same leg or site (eg, sternum), because of consequent extravasation into soft tissue compartments through the previous puncture site

- Osteogenesis imperfecta, because of the likelihood that puncture of the bone may cause a fracture

- Osteopetrosis, because of the risk of fracture

- Obvious overlying infection at the proposed puncture site, because of the risk of seeding infection (a relative contraindication)

Equipment

- Several needle types are available
- The traditional needles are inserted manually, but powered needle insertion devices are becoming more popular.

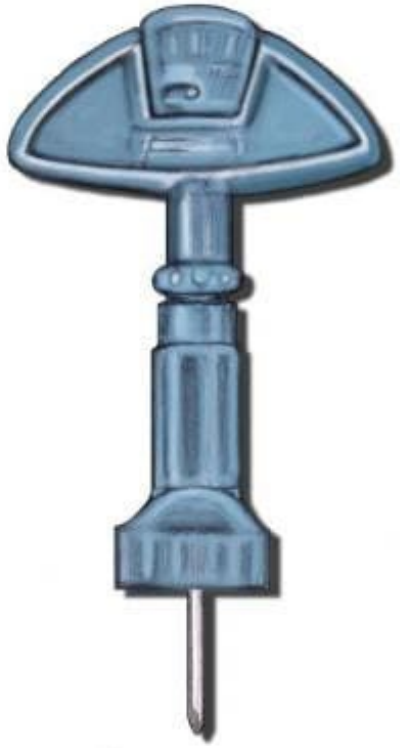
Cook-type intraosseous needle.

Cook-type intraosseous needle.

Cook-type screw-tip intraosseous needle (Sur-Fast needle).

Jamshidi intraosseous needle.

Illinois sternal iliac intraosseous needle.



EZ IO (Vidacare).
3 Sizes

Bone Injection Gun (BIG) spring-loaded intraosseous insertion device (Waism[illegible])

Sternal needle: F.A.S.T.1 system (Pyng Medical Corporation).

Technique
Intraosseous Needle Insertion Methods

- In neonatal settings or neonatal intensive care unit (NICU) settings, the spinal needles are used,

- The intraosseous (IO) needle should have a needle stylet to reduce the likelihood of bony spicules or a clot clogging the needle.

- The IO needle should have some means for the operator to gauge the distance to which the needle has penetrated, either with markings on the shaft or a covering flange that prevents insertion deeper than a predetermined distance.

Technique
Intraosseous Needle Insertion Methods

- Once the bony cortex has been penetrated, the needle usually need not be advanced more than 1 cm to provide stability and access to the marrow cavity.

- The traditional needles (Cook, Jamshidi) are placed manually; the site, force required, and depth of insertion are determined by the operator.

- Powered insertion devices are used with increasing frequency in pediatric patients in US hospitals—in emergency departments (EDs), critical care units (CCUs), and even operating rooms (ORs).

- 2 devices have been approved by the US Food and Drug Administration (FDA) for use in adult and pediatric patients: the Bone Injection Gun (BIG) device (Waismed) and the EZ IO (Vidacare).

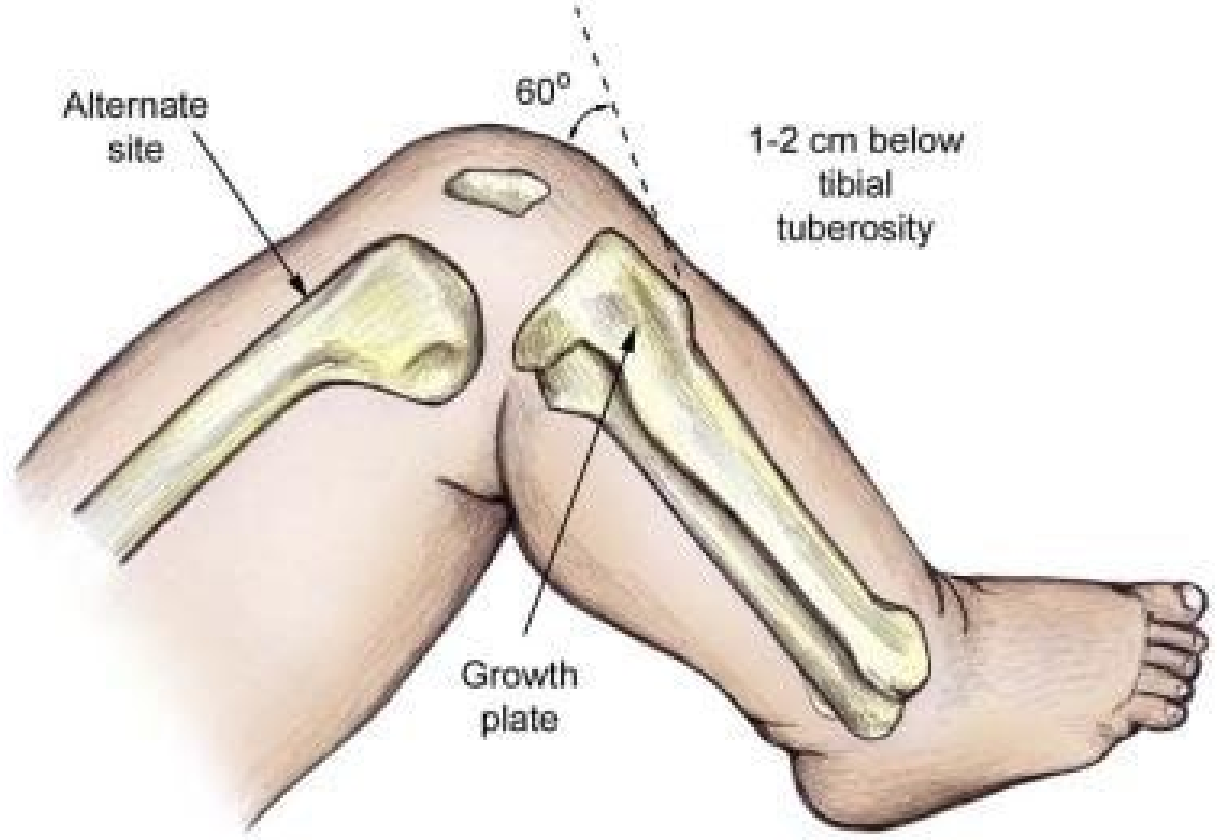
Technique
Intraosseous Needle Insertion Methods

- The BIG device, has a spring-loaded handle that injects the IO needle to a preset depth, determined by the patient's age.
- In the US, the EZ IO is now widely used in field and transport settings (eg, emergency medical service situations). It has a battery-powered drill handle that powers the needle insertion; the length of the needle is determined by the patient's weight in kilograms, and the depth of insertion is determined by the operator (as with the manual devices).
- Both the BIG device and the EZ IO are approved for use at the following sites:
- Proximal and distal tibia (in both pediatric and adult populations)
- Humeral head (in adult populations)
- Neither device requires special removal equipment. Training videos are available on the respective Web sites (Vidacare and Waismed).

Intraosseous Needle Insertion Sites

- The insertion site of choice in children and infants is the proximal tibia; the distal tibia and distal femur are alternatives
- The proximal tibia provides a flat wide surface and has only a thin layer of overlying tissue, which allows easy identification of landmarks.
- Additionally, the proximal tibia is distant from the airway and chest, where cardiopulmonary resuscitation (CPR) is often in progress.

Intraosseous needle insertion sites in infant or small child.

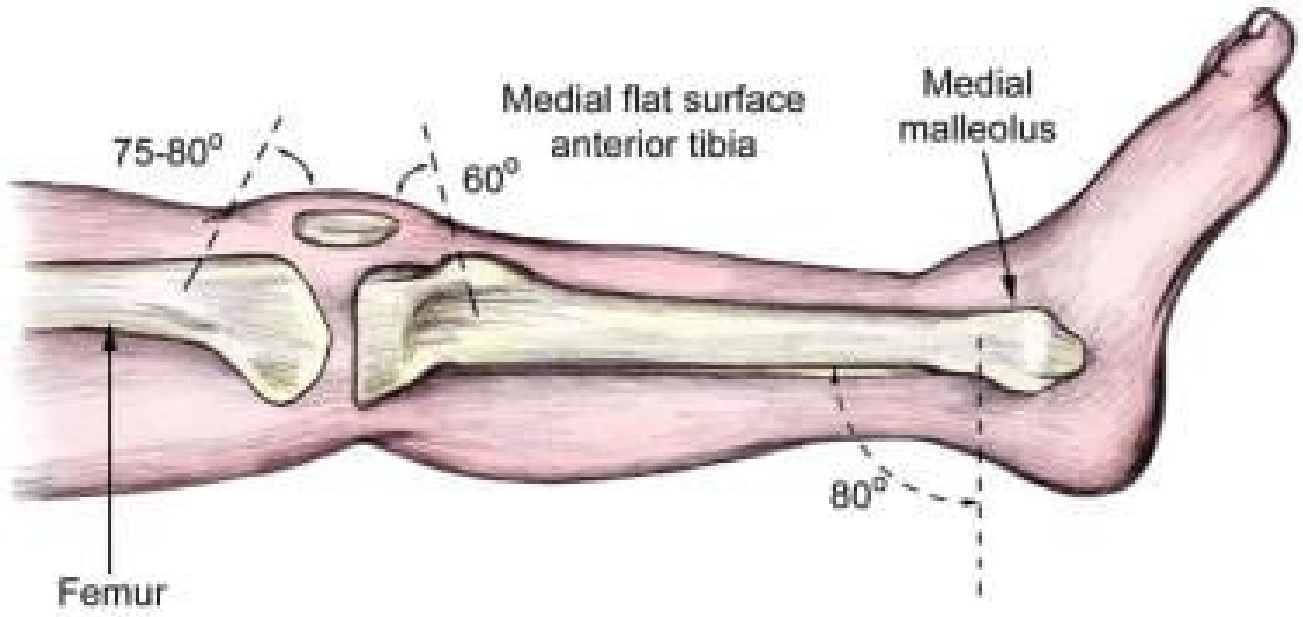


Intraosseous Needle Insertion Sites

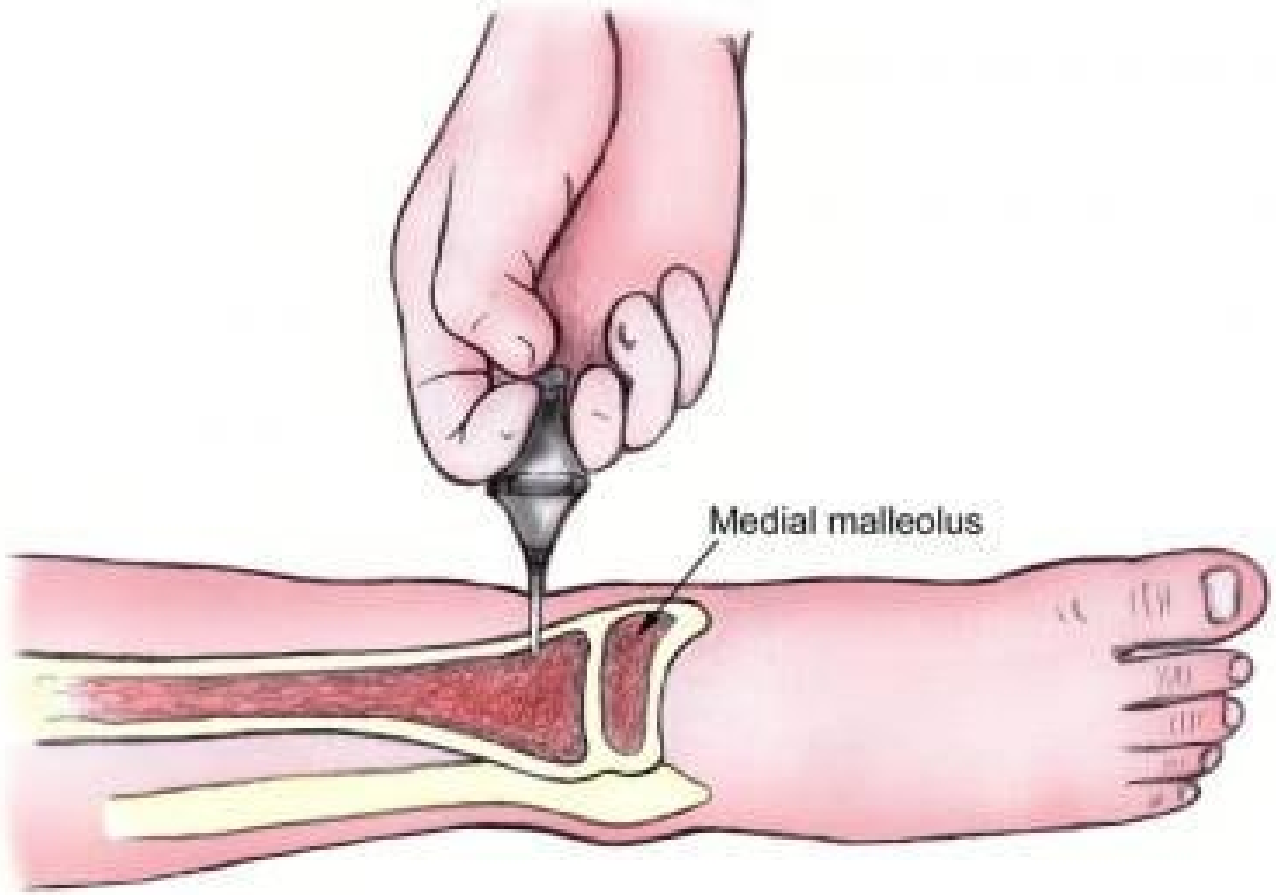
- With increasing age, the cortical thickness of long bones, particularly the tibia, increases, making penetration more difficult and forceful; thus, in older children and adults,

- Using the distal tibia or the proximal humerus may be advantageous because it also provides reliable and evident landmarks, has a relatively thin cortex, and is distant from ongoing CPR

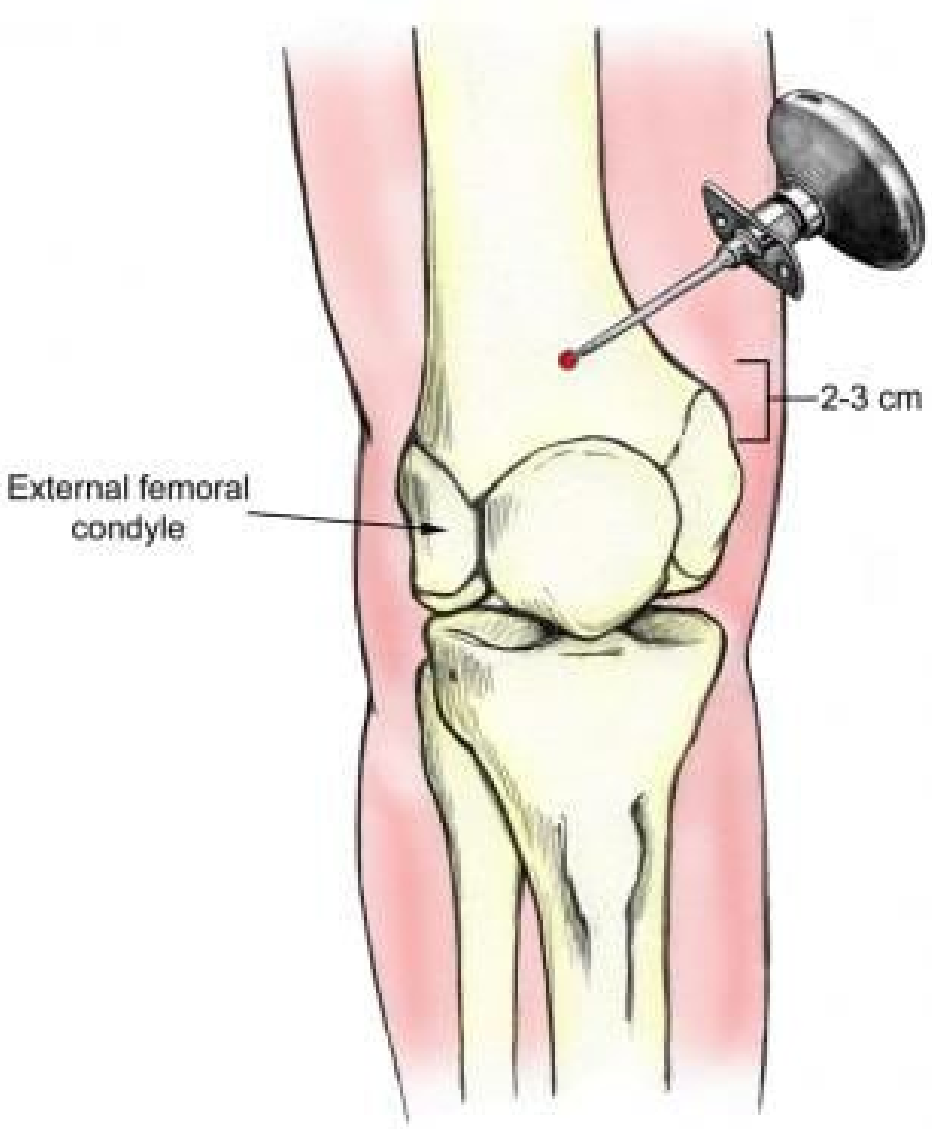
Intraosseous needle insertion sites in older child, adolescent, or adult.



Distal tibia intraosseous needle insertion site.



Distal femur intraosseous needle insertion site.



Failure of IO Placement

- Failure to achieve effective IO placement may be the result of 1 or more of the following:
- Incorrect identification of landmarks
- A bent needle, which is more common with longer needles or spinal needles
- Clogging of the needle with marrow, clot, or bone spicules, which can be avoided by frequent flushing of the needle or by continuous infusion
- Through-and-through penetration of both anterior and posterior cortices caused by excess force after the needle has penetrated the cortex, which renders the punctures useless because of fluid extravasation and which may cause a compartment syndrome
- Subcutaneous or subperiosteal infiltration, caused by incomplete placement of needle or by a dislodged needle
- Fractures caused by excess force or by fragile bones (eg, marked osteoporosis or osteopenia, osteopetrosis, or osteogenesis imperfecta), which allows leakage, extravasation, and potential compartment syndrome to occur
- Penetration of the mediastinal structures or space with the potential for pneumothorax, vascular injury, lung injury, in the case of a sternal needle

Complications of IO Placement

- Local infection (cellulitis and osteomyelitis are quite rare) - The incidence was less than 0.6% in a literature review of 4000 cases over 35 years (though it was found that the rate may increase with prolonged placement) and less than 3% in another large review
- Compartment syndrome secondary to fluid extravasation
- Local hematoma
- Pain
- Potential for growth plate injuries (though this has not been reported in animals or humans [29])
- Fat embolus - This is rarely reported in adult patients and has not been reported when an IO needle is placed in the tibia rather than in other sites, such as the ilium or sternum
- Bone embolus (though this has not been reported in humans)
- Mediastinitis after sternal IO puncture

Video demonstration

The End