# Vascular access

## Key Teaching Objectives

Each candidate should receive practical instruction on the following:

1. Intraosseous access and infusion including EZ-IO use
2. Umbilical Vein Catheterisation

Some overseas centres may wish to include the following:

3. Demonstration of scalp vein insertion
4. Venous cutdown

During the course of this station the indications for and complications of each of the manoeuvres should be revised.

## Equipment Required

### 1. Intraosseous access

Intraosseous trainer or ALS baby with leg pads
5ml syringes x 3
50ml syringes x 2
Intraosseous needles x 3
Blue food dye x 1
Jug
0.9% Saline 500ml
Intraosseous trainer [Humerus and tibia].
EZ-IO Driver
10ml syringes x 2
10ml amp normal saline
EZ-Connect® extension tubing
EZ-IO needle sets
Giving set
Pressure bag
3 way tap

### 2. Umbilical vein access

Artificial Umbilical cords x 3
Baby Umbi X3
Umbilical catheters x 6

Umbilical tape x 2
Large waterproof trays x 1

Gloves
Plastic aprons

## Environment

The room should be divided into two: one station should be set-up for intraosseous access and infusion, and one for umbilical access. Care should be taken to protect floor and tables where food dye is being used. Each station will require one or two tables, which should be set-up in such a way as to allow free access on all sides.

## Plan

## Set

"During this session you are going to be taught the sites and equipment available for intraosseous and umbilical vein access and you will be given the opportunity to practice these skills."

## Dialogue

This station is taught using the 4-part technique described in the Pocket Guide to Teaching for Medical Instructors. The following techniques should be taught:

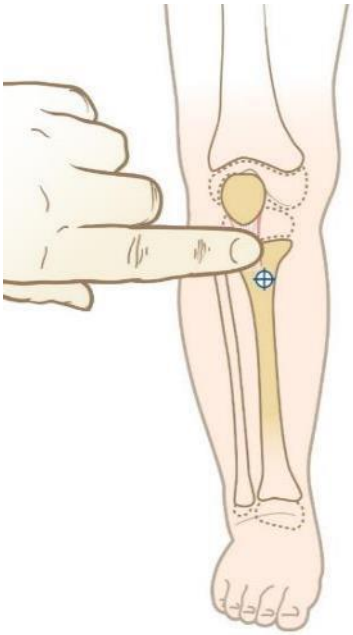
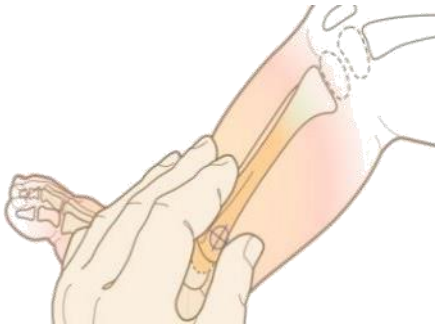
## Intraosseous Insertion

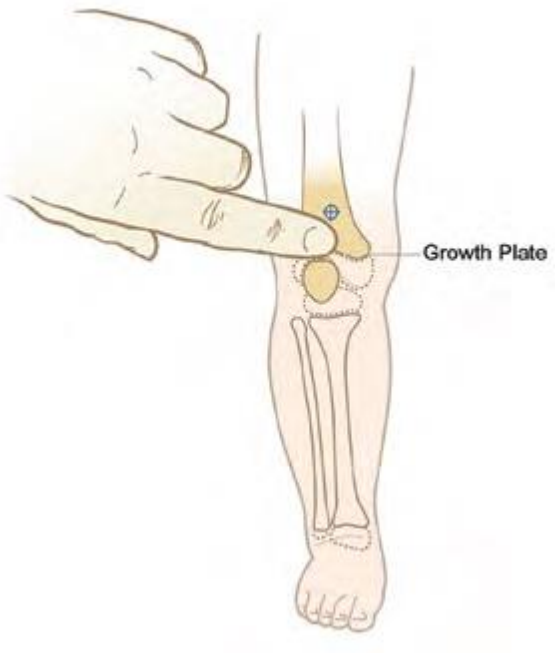
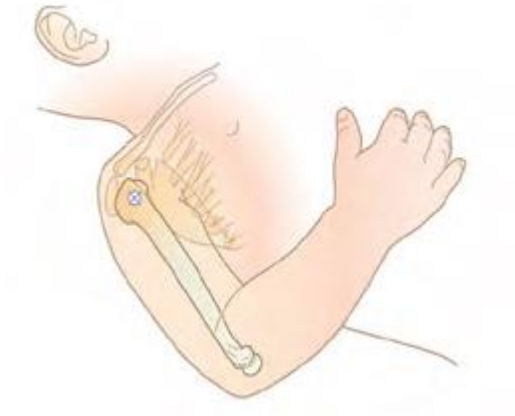
**Indications:** Vascular access in an infant or child where peripheral intravenous access has failed and emergency medications and fluids are time critical.

**Contraindications:**

- Fracture of target bone
- Infection at area of insertion
- Inability to identify landmarks
- IO access or attempted IO access in target bone within previous 48 hours
- Prosthesis or orthopedic procedure near insertion site

The landmarks for the upper and lower tibial, lower femoral and humerus sites are shown below. The proximal tibia is the recommended site in paediatrics due to the easier identification of the landmarks.

| Proximal Tibial | Distal Tibia |
|---|---|
|  |   |
| Insertion site is approximately 1 cm medial to the tibial tuberosity, or just below the patella (approximately 1 cm) and slightly medial (approximately 1 cm), along the flat aspect of the tibia. | Insertion site is located approximately 1-2 cm proximal to the most prominent aspect of the medial malleolus. |

| Distal Femur | Proximal Humerus |
|---|---|
|  |  |
| The insertion site is approximately 1 cm proximal to the superior border of the patella and approximately 1-2 cm medial to midline. | The insertion site is above the surgical neck, on the most prominent aspect of the greater tubercle.<br><br>*See below for more detailed instructions for locating site* |

## A. Using a handheld needle

**Note: The handheld technique is the preferred technique in neonates**

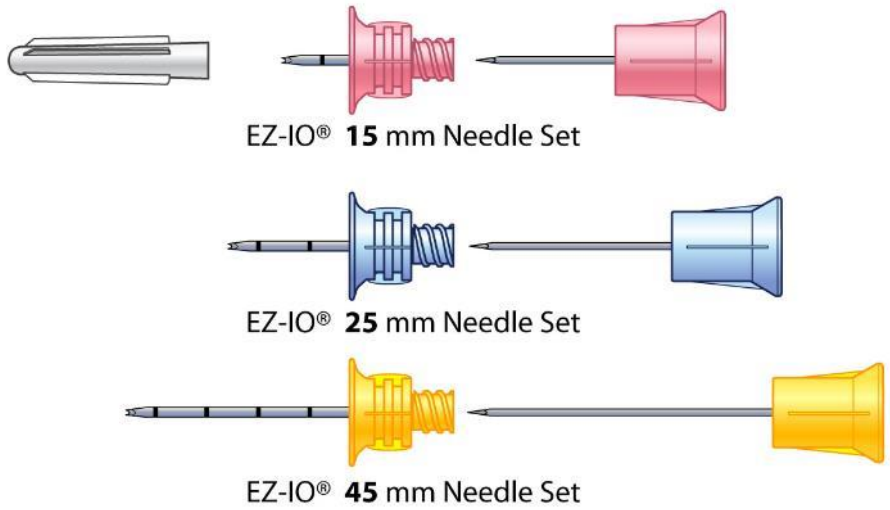
1. Identify the infusion site
2. Clean the skin over the chosen site
3. Insert the needle at 90° to the skin, emphasise the rotational motion
4. Continue to advance the needle until a give is felt as the cortex is penetrated, a clear give is felt
5. Attach the 5 ml syringe and aspirate or infuse to confirm correct positioning with as minimal movement as possible. Flush with 2-5 mls 0.9% sodium chloride.

## B. Using a Powered Device

The EZ-IO drill is a powered device which enables rapid insertion of an intraosseous needle. The same landmarks are used as for manual insertion and the procedure is less painful for the conscious victim due to its rapidity.
The EZ-IO needles are in three sizes:

- 15 mm needle – may be suitable for neonates and young infants
- 25 mm needle – for infants and younger children
- 45 mm needle – for older children and use for humeral access at any age

**With the needle set inserted through the soft tissue and touching bone, the 5 mm mark (at least one black line) must be visible outside the skin for confirmation of adequate needle set length prior to drilling.**




The procedures for insertion is as follows:

1. Universal precautions. Prime connection line.
2. Identify the infusion site and clean
3. Choose appropriate size needle and attach to drill - it will fix magnetically.
4. Hold the drill and needle at 90 degrees to the skin surface and push through the skin without drilling, until bone is felt
5. Push the drill button and drill continuously and push until there is loss of resistance - there is a palpable give as the needle breaches the cortex.
6. Remove drill and unscrew trochar (holding the needle in place with as minimal movement as possible)
7. Aspirate marrow if possible
8. Use EZ-Stabilizer® Dressing to secure needle and stabilize the extremity
9. Attach pre-prepared (primed with NS) connection tube and flush with 2-5 mls 0.9% sodium chloride
10. Proceed with required therapy.

Verify placement/patency prior to all infusions. Compartment syndrome, which can result from undetected infiltration/extravasation, is a serious complication. The IO insertion site should be monitored frequently for signs of infiltration/extravasation."

## Intraosseous Fluid Infusion

- Fluid will not run through the IO by gravity
- Attach a 3 way tap to the primed connection piece. To this tap attach the filled 50 ml syringe and a fluid giving set attached to a bag of 0.9% sodium chloride
  - Turn the tap so fluid is drawn into the syringe from the bag
  - Turn the tap so the fluid bolus can be pushed though the cannula

It should be noted that rapid infusion of fluid may be painful for the conscious patient and if this proves to be the case 0.5mg/kg of 2% lignocaine may be infused slowly to combat this.

## Humeral access

1. Place the patient's hand over the umbilicus: Causes medial rotation of elbow and humerus. Provides greater prominence of insertion site.
2. Place your palm on the patient's shoulder anteriorly.
   a. The area that feels like a "ball" under your palm is the general target area.
   b. You should be able to feel this ball, even on obese patients, by pushing deeply.
3. Place the ulnar aspect of your hand vertically over the axilla and the ulnar aspect of your other hand along the midline of the upper arm laterally.
4. Place your thumbs together over the arm; this identifies the vertical line of insertion on the proximal humerus.
5. Palpate deeply up the humerus to the surgical neck. This may feel like a golf ball on a tee – the spot where the "ball" meets the "tee" is the surgical neck.
6. The insertion site is above the surgical neck, on the most prominent aspect of the greater tubercle.

## Emergency Umbilical Vein Access

1. Loosely tie the umbilical tape around the artificial cord.

2. Cut the cord with a scalpel, leaving a 1cm strip distal to the tape. (this can be demonstrated but not practiced)

3. Identify the umbilical vein. 3 vessels will be seen in the stump. Two will be small and contracted (the arteries sited inferiorly), and one at the head end will be dilated (the vein).

4. Fill a 5 fr gauge catheter with 0.9% saline.

5. Insert the catheter into the vein, and advance it approximately 5cm.

6. Tighten the umbilical tape to secure the catheter. A purse string suture may be used later to stitch the catheter in place.

Optional

**Scalp vein cannulation**

Scalp vein trainer (optional)
IV cannulae 18-25 g x 2
Rubber tubing x 1

**Venous cutdown**

Venous cutdown feed x 2
Small BP Scalpel handles x 2
Scalpel blades size 15 (boxes) x 1
Curved haemostats x 6
Strong black cotton x 3
Cannulae 14-25 x 2

## Assessment Technique

A record of candidates' performance during the station should be kept for faculty reference.

**Extra information:**

https://www.cahs.health.wa.gov.au/~/media/HSPs/CAHS/Documents/Health-Professionals/Neonatology-guidelines/Umbilical-Venous-Catheter.pdf?thn=0