

Intra-osseous needle insertion

Intra-osseous infusion is a safe, simple and reliable method of giving fluid and drugs in an emergency when venous access is not possible (e.g. in shock).

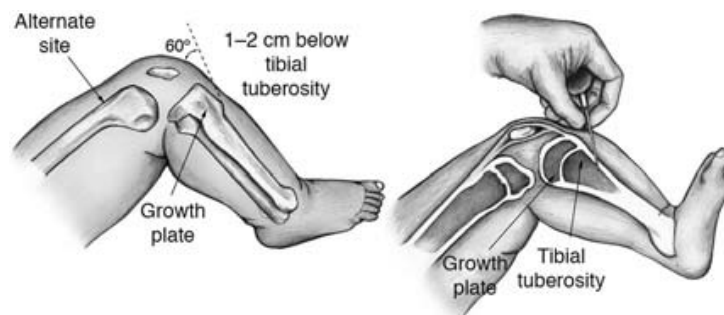
Site for needle

The first choice for the puncture is the proximal tibia. The site for needle insertion is in the middle of the antero-medial surface of the tibia, at the junction of the upper and middle third, to avoid damaging the epiphyseal plate (which is higher in the tibia), 2–3 cm below the tibial tuberosity. An alternative site for needle insertion is the distal femur, 2 cm above the lateral condyle.

Intra-osseous needles (15- to 18-gauge)

If a purpose-made intra-osseous needle is not available, a number of alternatives can be used, including bone-marrow needles, short lumbar puncture needles or a large-calibre venepuncture needle. For example, a green needle can be used in a neonate. The disadvantage of venepuncture needles is that they may carry a fragment of bone into the marrow. This is not dangerous, but it may block the needle. Also the bevel of these needles is long, and extravasation of fluid is more likely than with a purpose-made intra-osseous needle.

FIGURE 8.4.B.9 (a) Intra-osseous needle tibial site (X). (b) Section through bone. Image reprinted with permission from Medscape Reference (<http://emedicine.medscape.com/>), 2014, available at: <http://emedicine.medscape.com/article/940993-overview>.



Other equipment needed

This includes the following:

- 1 a sterile 2-mL syringe containing 1–2% lignocaine to be used whenever the patient is conscious (otherwise the procedure will be very painful)
- 2 two sterile 5-mL syringes
- 3 sterile 20- or 50-mL syringes and ideally a three-way tap.

Procedure

- 1 Place padding under the child's knee so that it is bent at 30 degrees from the straight (180-degree) position, with the heel resting on the table.
- 2 Locate the correct position (described above and shown in Figure 8.4.B.9).
- 3 Wash your hands and put on sterile gloves. (To avoid osteomyelitis, the procedure must involve strict asepsis using an antiseptic solution and sterile gauze to clean the site, with the operator wearing sterile gloves.) Clean the skin over and surrounding the site with an antiseptic solution.
- 4 Infiltrate with lidocaine down to the periosteum if the child is conscious.
- 5 Ask an assistant to stabilise the proximal tibia by grasping the thigh and knee above and lateral to the cannulation site, with the fingers and thumb wrapped around the knee but not directly behind the insertion site.

- 6 Insert the needle at a 90-degree angle with the bevel pointing towards the foot. Advance the needle slowly using a gentle but firm twisting or drilling motion.
- 7 Stop advancing the needle when you feel a sudden decrease in resistance or when you can aspirate blood. The needle should now be fixed in the bone and stand up by itself.
- 8 Remove the stylet.
- 9 Aspirate the marrow contents (which look like blood), using the 5-mL syringe, to confirm that the needle is in the marrow cavity and to provide bone marrow/blood for the following tests when appropriate: blood glucose, haemoglobin, group and cross-matching, blood culture and urea and electrolytes. Hb, glucose and electrolyte measurements may not be accurate after infusions have been previously given. Note that failure to aspirate bone-marrow contents does not mean that the needle is not correctly placed.
- 10 Attach the second 5-mL syringe filled with Ringer- lactate or Hartmann's solution or 0.9% saline. Stabilise the needle and slowly inject 3 mL while palpating the area for any leakage under the skin. If no infiltration is seen, start the infusion.
- 11 Attach the 50-mL syringe, usually containing Ringer- lactate or Hartmann's solution or saline, but compatible blood or 10% glucose can be used if hypoglycaemia is suspected, and push in the infusion fluid in boluses. It is not possible to infuse fluid through the intra- osseous needle using a standard IV giving set. The fluid has to be pushed in under light pressure, and if large volumes are needed (e.g. when giving boluses of fluid to treat shock) then 20-mL or 50-mL syringes should be used.
- 12 Check that the calf does not swell during the injections of fluid.
- 13 Secure IV access as soon as possible.
- 14 When the needle has been removed, cover with a sterile dressing.

Do not place distal to a major fracture or where there is infection.

Give prophylactic antibiotics after the immediate emergency has been managed.

All drugs and fluids that are given IV (including 10% glucose) can be given into the bone marrow, and they will reach the heart and general circulation as fast as if they had been given through a central vein.

Remove the intra-osseous needle as soon as venous access is available. In any case, it should not be in place for more than 8 hours.

Complications

These include the following:

- dislodgement
- misplacement (penetration through posterior cortex, failure to penetrate cortex), resulting in:
 - haematoma
 - tissue necrosis
 - compartment syndrome
 - skin infection
 - osteomyelitis
 - tibial fracture in babies.

The scalp vein needle as an intra-osseous device

In infants, a green 'butterfly' (scalp vein) needle can be used as an intra-osseous needle with the same precautions as above.

Battery-powered intra-osseous device

The EZ-IO drill is a powered device that enables rapid insertion of an intra-osseous needle.

Unfortunately the disposable needles are extremely and prohibitively expensive for low resource settings.

Various sizes of needle are available (see Figures 8.4.B.10 and 8.4.B.11) for different-sized patients.

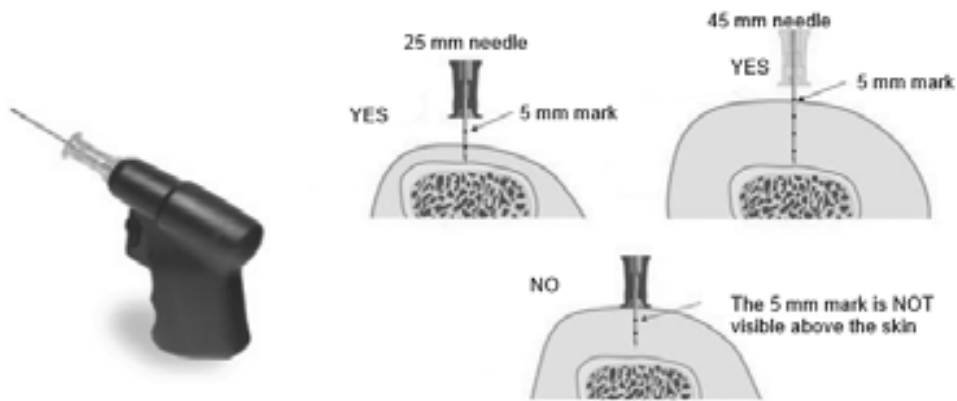


FIGURE 8.4.B.10 EZ-IO power drill and needles.

The landmarks are as before, using the upper end of the tibia. In adults in particular, the upper outer aspect of the humerus can also be used.



FIGURE 8.4.B.11 Site for EZ-IO needle in the proximal humerus in an adult or large child.

The procedure is less painful for the conscious patient due to its rapidity, the drilling effect and the sharpness of the needles. The EZ-IO needles are available in two sizes, for patients under 40 kg and over 40 kg.

The procedure for insertion is as follows:

1. Take universal precautions for sterile procedure.
2. Clean the site.
3. Choose an appropriate size of needle and attach it to the drill. It will fix magnetically.
4. Remove the safety cap from the needle.
5. If the patient is conscious, control their movement during insertion.
6. Hold the drill and needle at 90 degrees to the skin surface and push through the skin without drilling, until bone is felt. Ensure that at least 5 mm of the needle is visible at this point. Squeeze the drill button and drill continuously, applying gentle steady downward pressure until there is sudden loss of resistance – there is a palpable ‘give’ as the needle breaches the cortex. Release the trigger and stop insertion at this point. If the driver stalls and will not penetrate the bone you may be applying too much downward pressure. If the driver fails (this is rare) remove it, grasp the needle kit by hand and twist it into the bone marrow.
7. Remove the drill and unscrew the trochar.
8. Aspirate the bone marrow if possible directly from the needle.
9. Attach the pre-prepared connection tube containing sterile Ringer-lactate or

Hartmann's solution or 0.9% saline before any infusion is given. Do not attach a syringe directly to the EZ-IO catheter hub except when drawing blood with the needle set stabilised by hand (sterile).

10. There is an optional device for securing the needle, but this is not essential.
11. Proceed with the required therapy. It should be noted that rapid infusion of fluid may be painful for the conscious patient.
12. Apply a sterile dressing.
13. When removing the catheter, attach a Luer lock syringe, and continuously rotate it clockwise while slowly and gently applying traction to the catheter. Do not rock or bend the catheter during removal.
14. Do not leave the catheter in place for more than 24 hours.

FIGURE 8.4.B.1:

