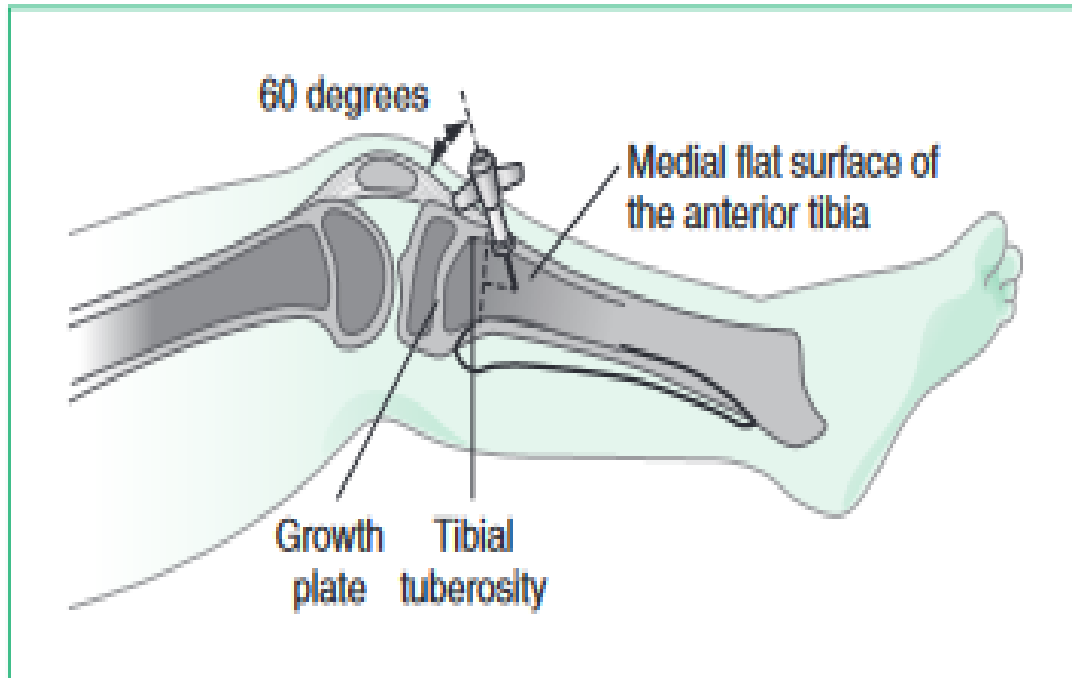


## **Intraosseous (IO) Access**

1. **Indications:** Obtain emergency access in children during life-threatening situations. This is very useful during cardiopulmonary arrest, shock, burns, and life-threatening status epilepticus. IO line can be used to infuse medications, blood products, or fluids. The IO needle should be removed once adequate vascular access has been established.
2. **Complications:**
  - a. Complications are rare, particularly with the correct technique.
  - b. Complications include extravasation of fluid from incomplete or through and through cortex penetration, infection, bleeding, osteomyelitis, compartment syndrome, fat embolism, fracture, epiphyseal injury.
3. **Sites of entry** (in order of preference):
  - a. Anteromedial surface of the proximal tibia, 2 cm below and 1–2 cm medial to the tibial tuberosity on the flat part of the bone
  - b. Distal femur 3 cm above the lateral condyle in the midline.
  - c. Medial surface of the distal tibia 1–2 cm above the medial malleolus (may be a more effective site in older children).
  - d. Proximal humerus, 2 cm below the acromion process into the greater tubercle with the arm held in adduction and internal rotation.
  - e. Anterosuperior iliac spine at a 90-degree angle to the long axis of the body.
4. **Procedure:**
  - a. Prepare the selected site in a sterile fashion.
  - b. If the child is conscious, anesthetize the puncture site down to the periosteum with 1% lidocaine (optional in emergency situations)

- c. Choose between a manual IO or drill-powered IO insertion device:
  - i. For manual IO needle: Insert a 15- to 18-gauge IO needle perpendicular to the skin at an angle away from the epiphyseal plate, and advance to the periosteum. With a boring rotary motion, penetrate through the cortex until there is a decrease in resistance, indicating that you have reached the marrow. The needle should stand firmly without support.
  - ii. For drill-powered IO needle: Enter skin with the needle perpendicular to the skin, as with the manual needle, and press the needle until you meet the periosteum. Apply easy pressure while gently depressing the drill trigger until you feel a "pop" or a sudden decrease in resistance. Remove the drill while holding the needle steady to ensure stability prior to securing the needle. Use an EZ-IO AD for patients >40 kg, and use EZ-IO PD for patients >6 kg and <40 kg.
- d. Remove the stylet and attempt to aspirate marrow. (Note that it is not necessary to aspirate marrow). Flush with crystalloid solution. Observe for fluid extravasation. Marrow can be sent to determine glucose levels, chemistries, blood types and cross-matches, hemoglobin levels, blood gas analyses, and cultures.
- e. Attach standard IV tubing. Any crystalloid, blood product, or drug that may be infused into a peripheral vein may also be infused into the IO space, but increased pressure (through pressure bag or push) may be necessary for infusion. There is a high risk for obstruction if continuous high-pressure fluids are not flushed through the IO needle



Intraosseous needle placement using standard anterior tibial approach. Insertion point is in the midline on medial flat surface of anterior tibia, 1-3 cm (2 fingerbreadths) below tibial tuberosity. (From Dieckmann R, Fiser D, Selbst S. Pediatric Emergency and Critical Care Procedures. St. Louis: Mosby; 1997.)

## **Peripheral Intravenous Access**

1. **Indications:** Blood sampling and access to peripheral venous circulation to deliver fluid, medications, or blood products.
2. **Complications:** Thrombosis, infection.
3. **Procedure:**
  - a. Choose an intravenous (IV) access site.
  - b. Apply tourniquet around the extremity proximal to this site.
  - c. Prepare site with alcohol or chlorhexidine.
  - d. Insert IV catheter, bevel up, at an angle almost parallel to the skin, advancing until a flash of blood is seen in the catheter hub. Advance the plastic catheter only, remove the needle, and secure the catheter.
  - e. After removing tourniquet, attach a syringe and apply gentle negative pressure to withdraw blood for serum sampling. Then, attach T connector filled with saline to the catheter, flush with normal saline (NS) to ensure patency of the IV line.