

**Medical Procedure**  
**Intraosseous Cannulation****Date: 07/01/2023**  
**Policy #7090****I. Purpose:**

A. To establish indications, guidelines, and the standard procedure for establishing intraosseous cannulation in the pre-hospital setting.

**II. Authority:**

A. Health and Safety Code, Section 1797.220, 1798. Title 22, Section 100170.

**III. Background:**

A. Intraosseous (IO) cannulation provides a safe and reliable method for rapidly achieving a route for administration of medications, fluids, and blood products in a non-collapsible vascular space.

**IV. Policy:**

A. IO cannulation is restricted to EMT-P providers under the following conditions:

1. Indications, when a patient requires urgent medication administration:
  - a. A failed attempt at intravenous access
  - b. It is determined that an IV attempt would not be successful
2. Absolute contraindications:
  - a. Fracture or suspected vascular compromise of the selected bone
  - b. Congenital deformity or history of osteogenesis imperfecta
  - c. Previous IO attempt at the chosen site
  - d. Previous joint replacement at site
  - e. Proximal significant laceration or wound infection from insertion location
  - f. Inability to locate anatomical landmarks for insertion
  - g. Patient <3 kg
3. Relative contraindications:
  - a. Skin infection or burn overlying the area of insertion
  - b. History of osteoporosis

**V. Procedure:**

A. Equipment:

1. Povidone-based solution or alcohol wipe
2. IV of NS attached to 250 mL bag in pediatric patients
3. IV of NS attached to 1000 mL bag in adult patients
4. 10 cc syringe filled with normal saline
5. Sterile gloves

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6. Adhesive tape
  7. EZ Stabilizer, or device equivalent
  8. Pressure bag for IV fluid administration
  9. Intraosseous needle (suitable up to 8 years old)  
-OR/AND-
  10. Automated IO insertion device (EZ-IOPD) for 3-39 kg (15 mm)
  11. Automated IO insertion device (EZ-IOAD) if over 40 kg (25 mm)
  12. Automated IO insertion device (EZ-IOAD) if over 40 kg (45 mm) for redundant tissue or humeral site
  13. Lidocaine 2% for injection
- B. Locate and prepare the insertion site. Select extremity without evidence of trauma or infection as able.
1. For children, place supine with a rolled towel under the knee, restrain if necessary.
- C. Put on gloves and thoroughly prepare the area with the antiseptic solution.
- D. Locate insertion site:
1. In small children (3-12 kg):
    - a. Tibial tuberosity cannot be palpated as a landmark, so the insertion site is two finger-breadths below the patella in the flat aspect of the medial tibia.
      - i. Insertion angle for the tibia should be 90 degree to the bone
  2. In larger children (13-39 kg):
    - a. Proximal tibia: the insertion site is located on the flat aspect of the medial tibia one finger breadth below the level of the tibial tuberosity. If tibial tuberosity not palpable, insert two finger-breadths below the patella in the flat aspect of the medial tibia.
      - i. Insertion angle for the tibia should be 90 degree to the bone
    - b. Do not use the humerus site in pediatric patients less than 15 years old or 40 kg.
  3. For adults, OR pediatrics > 40 kg AND 15 years old:
    - a. The proximal tibial site is one finger-breadth medial to the tibial tuberosity.
      - i. Insertion angle for the tibia should be 90 degree to the bone
    - b. Proximal humerus – Insertion site is located directly on the most prominent aspect of the greater tubercle. Slide thumb up the anterior shaft of the humerus until you

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feel the greater tubercle, this is the surgical neck. Approximately 1 cm (depending on patient anatomy) above the surgical neck is the insertion site.

- i. Insertion angle for the humerus should be 45 degree to the bone
- E. Stabilize extremity.
- F. For manual insertion, pierce the bony cortex using a firm rotary or drilling motion (do not move needle side to side or up and down). A distinct change in resistance will be felt upon entry into the medullary space.
- G. Remove the stylet and confirm intramedullary placement by injecting, without marked resistance, 10 mL normal saline.
- H. Attach IV tubing to the intraosseous hub.
- I. Anchor needle to overlying skin with tape or EZ Stabilizer.
- J. If unable to establish on first attempt, make on attempt on opposite leg, no more than two (2) attempts total.
- K. Monitor pulses distal to area of placement.
- L. Monitor extremity for signs of swelling or cool temperature which may indicate infiltration of fluids into surrounding tissues.
- M. For adult patients who awaken and have pain related to infusion, slowly administer SO - LIDOCAINE 10-20 mg IO. May repeat 20 mg dose up to 60 mg LIDOCAINE IO.
- N. For pediatric patients with pain related to infusion, slowly administer SO - LIDOCAINE 0.5 mg/kg IO (max dose 20 mg).

**VI. Possible complications of procedure of IO insertion:**

- A. Local infiltration of fluids/drugs into the subcutaneous tissue due to improper needle placement.
- B. Cessation of the infusion due to clotting in the needle, or the bevel of the needle being lodged against the posterior cortex.
- C. Osteomyelitis or sepsis
- D. Fluid overload
- E. Fat or bone emboli
- F. Fracture
- G. **Pediatric patients:** It is possible to injure the growth plate and cause permanent growth abnormalities. For patients fifteen (15) years and under, take special care to avoid the growth plate areas in the tibia. The growth plates exist in children and adolescents on the long bones.

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Each long bone has at least two growth plates at its extremity: one (1) at each end. Humeral IOs are contraindicated in patients < 15 years old.

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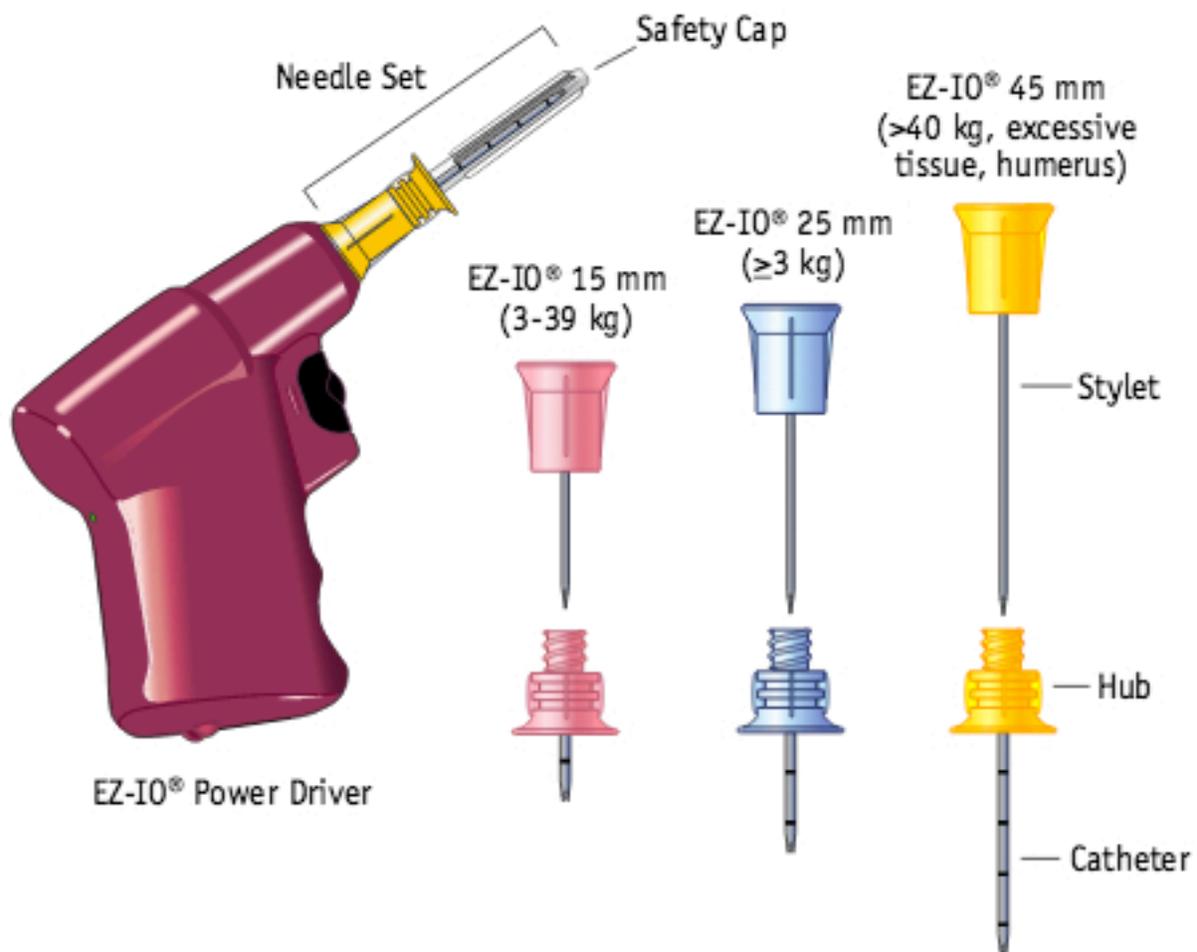
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Katherine Staats, M.D. FACEP

EMS Medical Director

**Medical Procedure****Intraosseous Cannulation****Date: 07/01/2023****Policy #7090****EZ-IO® NEEDLE SETS: DESCRIPTION**

- Comprised of Catheter with Luer-lock connection, Stylet, Safety Cap.
- 15 gauge, 304 stainless steel in 15 mm, 25 mm and 45 mm lengths.
- Sterile, non-pyrogenic, in protective packaging.
- Intended for use with EZ-IO® Power Driver.

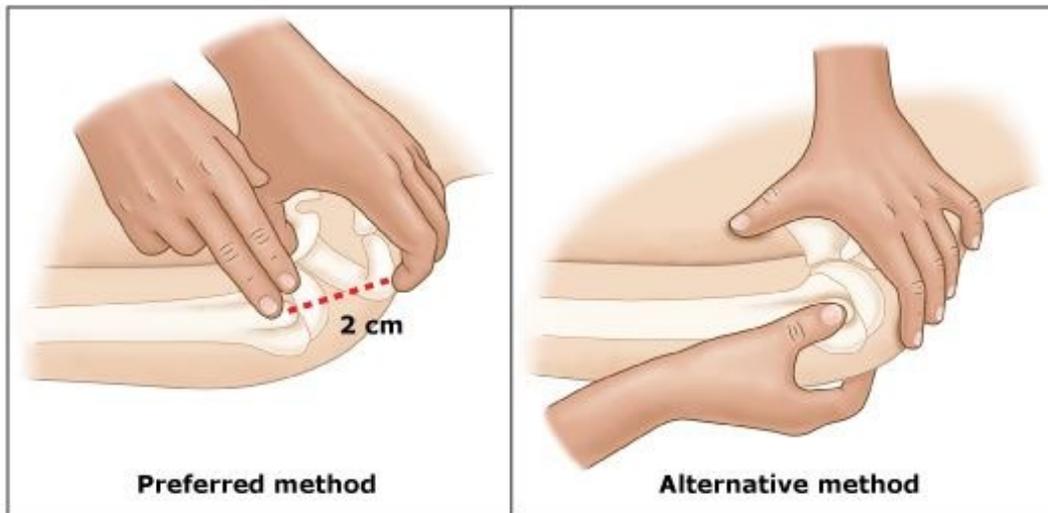
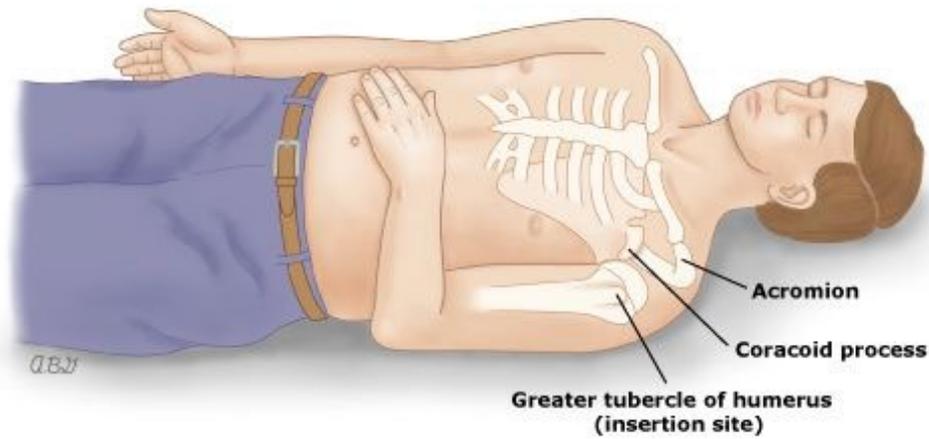
**EZ-IO® Power Driver and Needle Sets: Description**

EZ-IO needle sizes and recommended weights for each.

(Diagram from EZ-IO website.)

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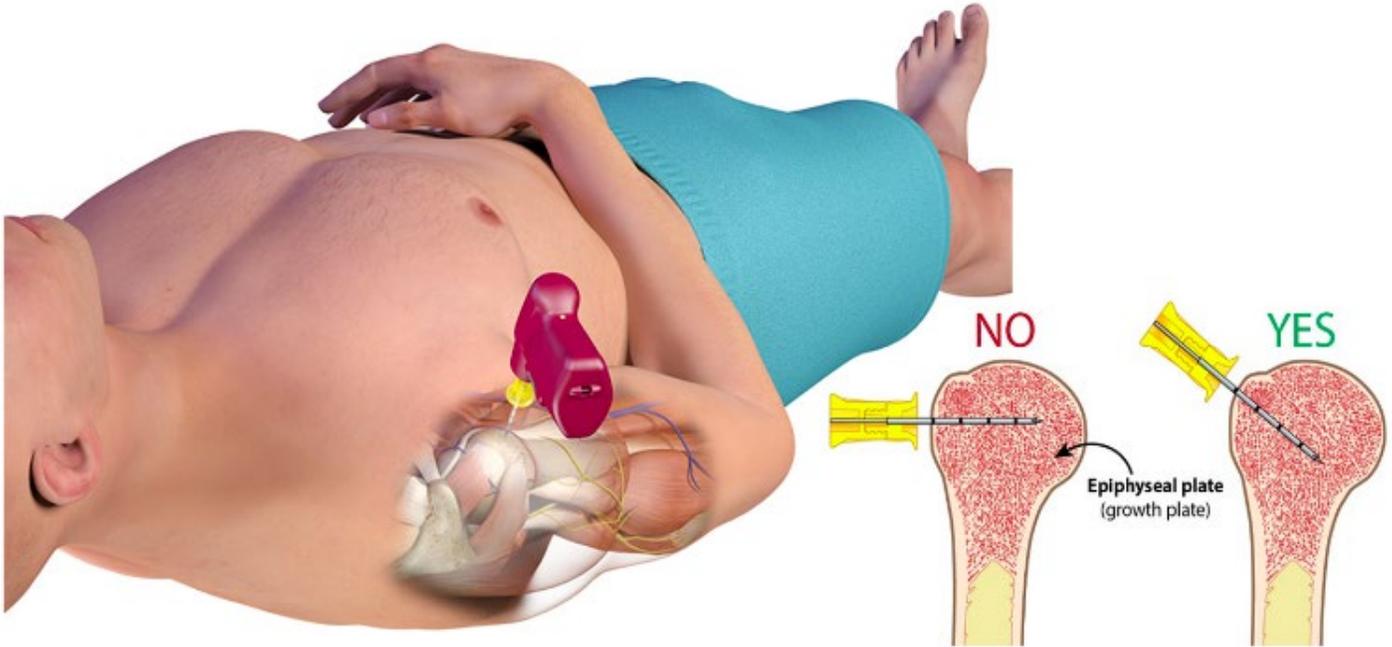
Humeral insertion site for patients > 40 kg and 15 years old.

(Diagram from UpToDate.com)

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Humerus: Insert needle set at a 45° angle to the anterior plane and posteromedial



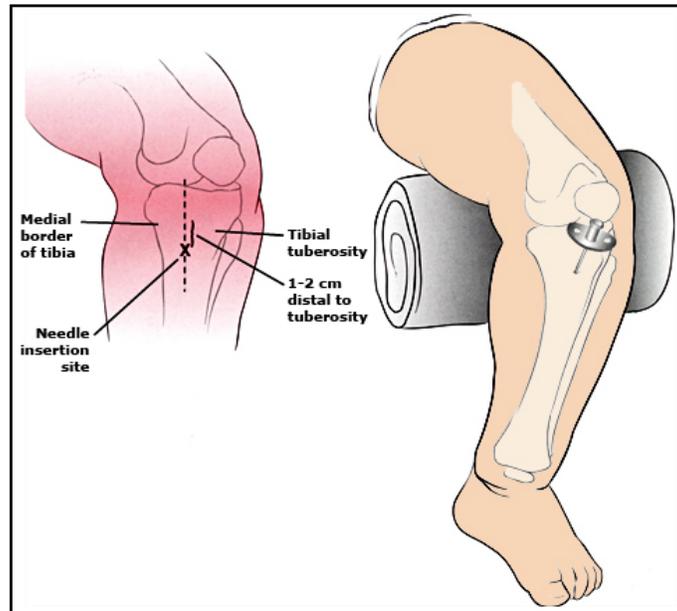
Humeral IO insertion angle for patients > 40 kg and 15 years old.  
(Diagram from Teleflex)



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Proximal tibial insertion site for patients > 15 years old.

(Diagram from EZ-IO website.)



Proximal tibial insertion site for pediatric patients < 15 years old.

(Diagram from UpToDate.com)