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EMERGENCY MEDICAL SERVICES POLICIES and PROCEDURES

INTRAOSSEOUS (IO) VASCULAR ACCESS

I. Purpose: To define the parameters required for prehospital Intraosseous (IO) vascular access and provide procedural guidance for the establishment of IO.

II. Authority: Health and Safety Code 1797.178, 1797.214, 1797.220, 1798 and California Code of Regulations, Title 22, Division 9, Sections 100145, 100166 and 100175.

III. Definitions: None

IV. Policy:

A. Intraosseous (IO) insertion and infusion may be performed by paramedics when IO access is indicated, and other forms of vascular access are unsuccessful and/or not readily available.

B. Indications

1. Patients with a suspected emergent medical condition requiring immediate intervention AND peripheral (intravenous) vascular access is difficult to obtain or has been unsuccessfully attempted.
2. SBCEMSA Approved IO Access Sites:
   a. Adult ≥ 18-years-old
      i. Proximal Humerus
      ii. Proximal Tibia
   b. Pediatric >3kg
      i. Proximal Tibia
      ii. Distal Femur

C. Contraindications

1. Fracture of targeted bone
2. Osteogenesis imperfecta
3. IO in the targeted bone within the past 48 hours
4. Previous, significant orthopedic procedure(s) at insertion site (e.g. prosthetic limb or joint)
5. Inability to identify anatomical landmarks
6. Pediatrics weighing less than < 3kg
7. Infection overlying the insertion site (cellulitis, infected ulcers/burns, etc.)

D. Potential Complications

1. Extravasation and compartment syndrome
2. Osteomyelitis/Sepsis (rare)
3. Epiphyseal plate or knee joint injury
4. Embolism

V. Procedure:

A. Training

1. Prehospital IO infusion may be performed after the paramedic has completed a competency review on the indications, contraindications, potential complications, procedure, and policy regarding its use.

B. Equipment

1. Equipment/Supplies Required:

APPROVAL:

SIGNATURE ON FILE
Nicholas Clay, EMS Agency Director

SIGNATURE ON FILE
Daniel Shepherd, MD, EMS Agency Medical Director

a. Non-sterile gloves
b. EZ-IO® (or other SBCEMSA-approved) intraosseous device, IO needle & extensions set
c. EZ-Stabilizer® (or other SBCEMSA-approved stabilizing device)
d. Betadine Cleanser
e. Luer lock syringe, 5mL
f. Normal Saline Flush (5-10mL) or primed IV line
g. Normal Saline bag with pressure device (pressure pump or bag)
h. 2% Xylocaine ® (lidocaine), if administering to a patient responsive to painful stimuli
    i. 0.5mg/kg (Max of 40mg) slow IVP over 60 seconds to be infused prior to the administration of fluids and/or medication for procedural pain management
i. Sharps container and biohazard waste container
j. Consider a longboard for stabilization of the extremity.

C. Procedure

1. Establishing IO vascular access shall not result in delay of patient transport.
    a. There shall be no more than two (2) attempts to establish IO in the field unless ordered by Base Hospital Physician.
        i. Only one (1) attempt per IO site, not to exceed two (2) total attempts per patient
            a. An “attempt” is defined as the IO needle puncturing the skin to establish intraosseous vascular access.
2. Explain the procedure to patient/family when possible.
3. Palpate the site to locate the appropriate anatomical landmarks for needle placement.
4. Gather equipment/supplies listed in “Equipment” section.
5. Determine the appropriate IO needle size.
    a. 15mm (PINK): Indicated for patients weighing approximately 3-39kg
    b. 25mm (BLUE): Indicated for patients weighing ≥ 3kg
    c. 45mm (YELLOW): Indicated for patients weighing ≥ 40kg; mandatory for Humeral IO
6. Prepare for insertion using an aseptic technique (refer to Attachment A, Attachment B, and Attachment C for comprehensive Humeral, Tibial, and Femoral IO Insertion Technique and Procedure).
7. Discard the IO needle in sharps container.
8. Secure the IO device using an approved stabilizer.
9. Apply primed IV tubing to the secured IO catheter and attempt to aspirate bone marrow using a 5mL Leur lock syringe; do not remove IO if unable to aspirate bone marrow.
    a. Patients Responsive to Pain:
        i. Prior to flushing with Normal Saline, consider priming IV tubing with Lidocaine (usually takes about 1mL fluid to prime IV tubing).
        ii. If administering smaller doses of Lidocaine (for pediatric patients), consider administering Lidocaine directly into the hub, and then connecting the IV tubing.
        Note: Slowly infuse lidocaine IO over 60 seconds, then proceed to Section V.C.9.
    b. Patients Unresponsive to Pain:
        i. Proceed to flush line as indicated in (Section V.C.9).
10. Flush line with 5-10mL of Normal Saline to break up marrow in the medullary space, and discard any used equipment/supplies in the corresponding biohazard container.

D. Documentation

1. The Paramedic performing IO vascular access must document the procedure in the Electronic Patient Care Report (ePCR) with the following information:
    a. Document the time the IO procedure was performed and verify the correct person is listed in “Crew Member Performing the Procedure.”
    b. Document the corresponding site (limb) where the IO was established, the size of the needle (15mm, 25mm, or 45mm respectively), and select whether the procedure was successful or unsuccessful.

i. If unsuccessful, note any complications or challenges in the "Procedure Comments" section of the procedure.

c. If peripheral vascular access (IV) was attempted prior to attempting an IO, a procedure shall be completed with the information in "Section D" of this document.

E. Quality Improvement

1. Each use of an IO vascular access (and corresponding ePCR) is subject to review by the SBCEMSA and the corresponding ALS providers.
2. SBCEMSA will work closely with Base Hospitals to ensure prehospital IO's are indicated, and performed in accordance with SBCEMSA Policy 533-04 and Policy-538.

F. Hospital Reporting

1. Base Hospital shall be notified about the procedure, location of access site, treatments administered through the IO vascular access site, and any complications experienced during the procedure (if any), as defined by SBCEMSA policy.
2. If there are complications with the IO vascular access device, a reasonable attempt to contact the Base Hospital should be made unless the patient is in extremis.
   a. Should this situation arise, Prehospital Provider should notify their on-duty supervisor immediately.
   b. Supervisor should notify SBCEMSA as soon as possible after the crew has reported this incident, and submit an Unusual Occurrence Form in accordance with Policy 116.

VI. References:

A. Policy 303 Mandatory Base Hospital Contact & Communication
B. Policy 533-04 Vascular Access
C. Policy 700 Documentation of Prehospital Care
D. Article: Resuscitation and the Humeral Intraosseous Line, Policy 116 Unusual Occurrence

VII. Attachments:

A. Attachment A (Humeral IO)
B. Attachment B (Tibial IO)
C. Attachment C (Femoral IO)

Attachment A - HUMERAL IO INSERTION

I. **Proximal Humerus Procedure – Indicated for patients ≥ 18-years-old**

A. Position the patient's targeted arm in the position as indicated for Humeral IO placement.

1. Positioning of the patient's arm can be safely and appropriately done using either of the approved techniques:
   a. "Hand-to-Abdomen" Technique: Move the patient's hand (on the targeted arm) so that the palm rests over the umbilicus, while still maintaining the elbow close to the body.
      i. This will result in adduction of the elbow and rotation of the humerus towards the body, effectively moving the biceps tendon away from insertion site.
   b. "Thumb-to-Bum" Technique: Move the patient's hand (on the targeted arm) so that the patient's thumb and dorsal aspect of the hand rest against the hip ("thumb-to-bum").
      i. This will result in flexion of the elbow and rotation of the humerus towards the body, effectively moving the biceps tendon away from insertion site.
      ii. This technique is preferred if utilizing Humeral IO during cardiac arrest; however, Humeral IO should only be utilized in a cardiac arrest if the following conditions are present:
         a. Indications are not met for Tibial IO **and** other peripheral vascular access is not readily available.
         b. Two (2) Tibial IO attempts have been performed unsuccessfully **and** a Base Hospital Order has been obtained to perform a third (Humeral) attempt at IO vascular access.

B. Locating the Insertion Site

1. Place your palm on the patient's shoulder anteriorly; the "ball" under your palm is the general target area.
   a. You should be able to feel this ball, on all patients, by pushing deeply
2. 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 (Refer to **Figure 1**).
3. Place your thumbs together over the arm; this identifies the vertical line of insertion on the proximal Humerus (Refer to **Figure 2**).
4. Palpate deeply up the humerus to the surgical neck.
   a. This may feel like a golf ball on a tee – the spot where the "ball" meets the "tee" is the surgical neck.
   b. The insertion site is 1-2 cm above the surgical neck, on the most prominent aspect of the greater tubercle.

C. Insertion of the Humeral IO

1. Aim the needle set at a 45-degree angle to the anterior plan and posteromedial.
2. Push the needle set tip through the skin until the tip rests against the bone.
   a. **The 5 mm mark must be visible above the skin for confirmation of adequate needle set length**
3. Gently drill into the humerus approximately 2cm or until the hub is close to the skin; the hub of the needle set should be perpendicular to the skin.
4. Carefully remove the IO needle. The catheter should feel firmly seated in the bone.

D. Securing the IO and Disposal of Used Equipment

1. Safely discard the used IO needle in the sharps container, and discard any equipment/supplies in the corresponding biohazard container.
2. Secure the device in place using an approved stabilizer.
   a. Use a longboard or sling to further immobilize the extremity prior to transport.
3. Attach appropriate saline lock and/or Normal Saline bag with primed IV tubing.
   a. Ensure that the pressure bag is located on the Normal Saline bag
   b. Aspirate for blood/bone marrow
      i. The inability to withdraw/aspirate blood from the catheter hub does not mean the insertion was unsuccessful.
   c. Flush with 5-10mL of Normal Saline.
4. Safely discard the used IO needle in the sharps container, and discard any equipment/supplies in the corresponding biohazard container.

E. Prehospital personnel cannot remove Humeral IO once placed unless otherwise directed by Base Hospital Physician.

II. Reference Diagrams:

FIGURE 1: Hand-to-Abdomen (Umbilicus) Technique, Ulnar Hand Placement, and Insertion Site

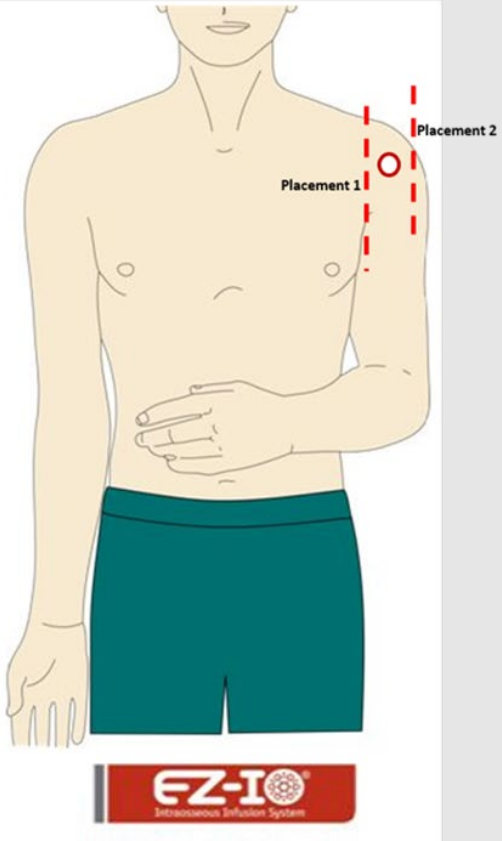
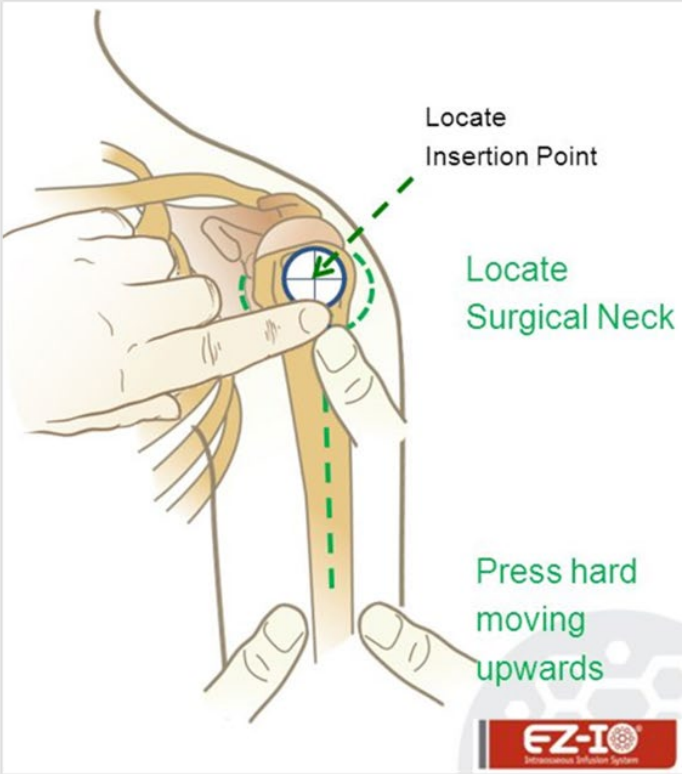


FIGURE 2: Thumb Placement and Site Identification Technique, and Visualization of Humeral Insertion Site ("Golf ball & Tee")



Attachment B - TIBIAL IO INSERTION

I. Proximal Tibia Procedure – Indicated for patients weighing ≥ 3kg

A. Extend the patient's targeted leg until it is fully extended and accessible for the procedure.

B. Locating the Insertion Site

1. Adult Placement:
   a. Insertion site is approximately 2cm medial to the tibial tuberosity, or approximately 3cm below the patella and approximately 2cm medial, along the flat aspect of the tibia (See Figure 1).
2. Pediatric Placement (weighing ≥ 3kg):
   a. Pinch the tibia between your fingers to identify the medial and lateral borders.
   b. Insertion site is approximately 1cm medial to the tibial tuberosity (just below the patella, approximately 1cm) and slightly medial (approximately 1 cm), along the flat aspect of the tibia (See Figure 2).

C. Insertion of the Tibial IO

1. Aim the needle set at a 90-degree angle to the flat aspect of the tibia.
2. Push the needle set tip through the skin until the tip rests against the bone.
   a. **The 5 mm mark must be visible above the skin for confirmation of adequate needle set length.**
3. Drilling Technique
   a. Adults: Gently drill into the tibia approximately 1-2cm after entry into the medullary space or until the needle set hub is close to the skin.
   b. Pediatrics: Gently drill, immediately release the trigger when you feel the loss of resistance as the needle set enters the medullary space; avoid recoil – do NOT pull back on the driver when releasing the trigger.
4. Carefully remove the IO needle. The catheter should feel firmly seated in the bone.

D. Securing the IO and Disposal of Used Equipment

1. Secure the device in place using an approved stabilizer and
   a. Use a longboard or sling to further immobilize the extremity prior to transport.
2. Attach appropriate saline lock and/or Normal Saline bag with primed IV tubing.
   a. Ensure that the pressure bag is located on the Normal Saline bag.
   b. Aspirate for blood/bone marrow
      i. The inability to withdraw/aspirate blood from the catheter hub does not mean the insertion was unsuccessful.
   c. Flush with 5-10mL of Normal Saline.
3. Safely discard the used IO needle in the sharps container, and discard any equipment/supplies in the corresponding biohazard container.

E. Prehospital personnel cannot remove Tibial IO once it has been inserted into the bone unless otherwise directed by Base Hospital Physician.

II. Reference Diagrams

Figure 1: Tibial IO Insertion Site - Adult

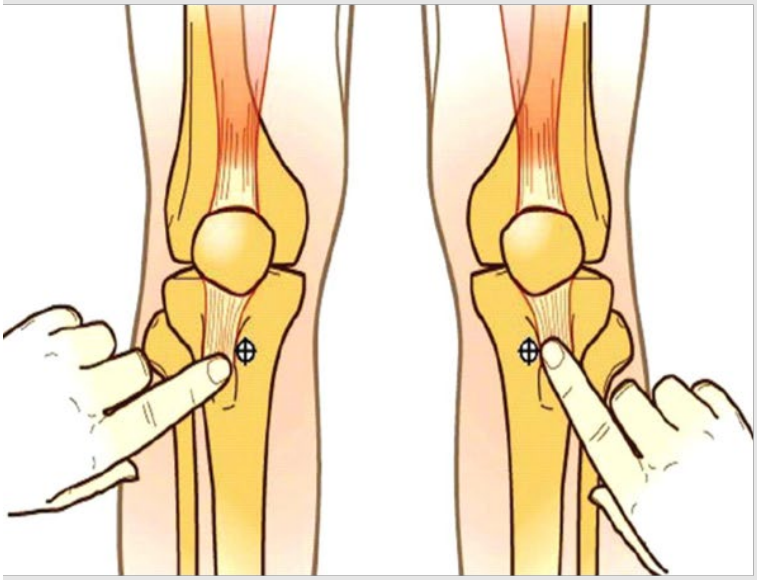


Photo Credit: Vidacare Corporation®

Figure 2: Tibial IO Insertion Site – Pediatric

Photo Credit: Teleflex Incorporated®

Attachment C - FEMORAL IO INSERTION (Infant/Child Only)

I. Distal Femur Insertion Procedure – Indicated for patients weighing ≥ 3kg

A. Extend the patient's targeted leg until it is fully extended, ensuring that the knee does not bend, and is accessible for procedure.

B. Locating the Insertion Site

1. Pediatric Placement (weighing ≥ 3kg):
   a. Identify the patella by palpation.
   b. Insertion site is just proximal to the patella (maximum 1cm) and approximately 1-2cm medial to the midline (See Figure 3 and Figure 4).

C. Insertion of the Femoral IO

1. Aim the needle set at a 90-degree angle to the center of the bone.
2. Gently press the needle through the skin until the tip rests against the bone.
   a. **The 5 mm mark must be visible above the skin for confirmation of adequate needle set length.**
3. Drilling Technique
   a. Pediatrics: Gently drill, immediately release the trigger when you feel the loss of resistance as the needle set enters the medullary space; avoid recoil – do NOT pull back on the driver when releasing the trigger.
4. Carefully remove the IO needle. The catheter should feel firmly seated in the bone.

D. Securing the IO and Disposal of Used Equipment

1. Safely discard the used IO needle in the sharps container, and discard any equipment/supplies in the corresponding biohazard container.
2. Secure the device in place using an approved stabilizer and
   a. Use a longboard or sling to further immobilize the extremity prior to transport.
3. Attach appropriate saline lock and/or Normal Saline bag with primed IV tubing.
   a. Ensure that the pressure bag is located on the Normal Saline bag.
   b. Aspirate for blood/bone marrow
      i. The inability to withdraw/aspirate blood from the catheter hub does not mean the insertion was unsuccessful.
   c. Flush with 5-10mL of Normal Saline.
4. Safely discard the used IO needle in the sharps container, and discard any equipment/supplies in the corresponding biohazard container.

E. Prehospital personnel cannot remove Femoral IO once it has been inserted into the bone unless otherwise directed by Base Hospital Physician.

II. Reference Diagrams

Figure 3: Distal Femur IO Site (Peds Only)

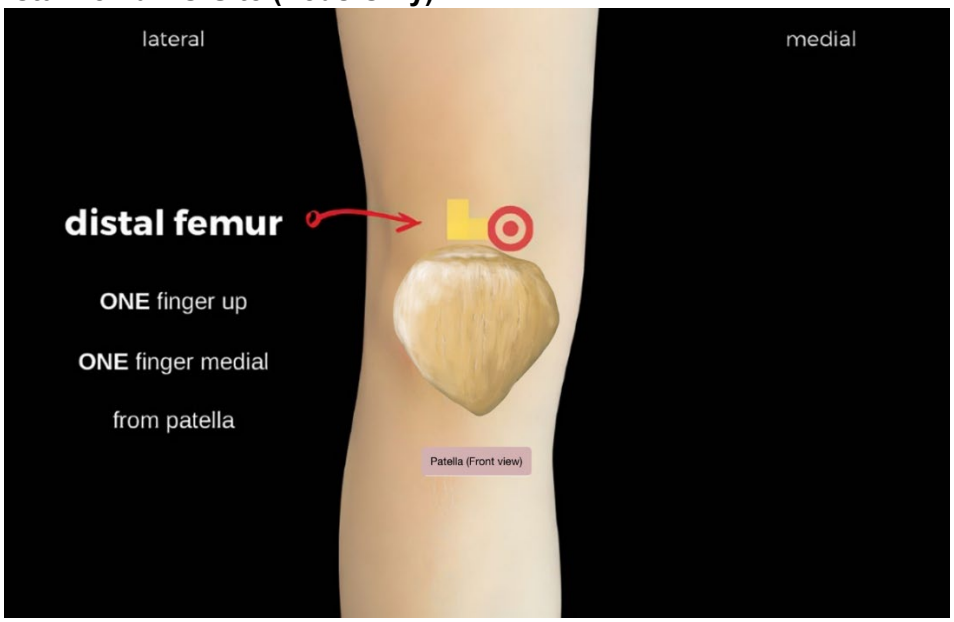


Figure 4: Distal Femoral Site on Infants and Children