

**The University of Texas Medical Branch**  
**Intraosseous (IO) Overview** (Jan 2017)

**General Principles**

1. The basic principle of intraosseous infusion is the vascularity of the bone. The IO space is connected to the central circulation through a system of noncollapsible bony sinusoids and vessels.
2. **Indications** for the insertion of an intraosseous catheter include short-term treatment when intravascular access cannot be achieved.
3. **Contraindications** for the insertion of an intraosseous catheter include:
  - a. Placement in a fractured bone or in a limb with vascular injury
  - b. Compartment syndrome
  - c. Cellulitis or burns at the site
  - d. Underlying bone disease, such as osteoporosis
  - e. Previous orthopedic procedures, such as prosthetic limb or joint
  - f. Soft tissue infection
  - g. Excessive tissue and/or absence of adequate anatomical landmarks
  - h. Once a bone has been punctured by an IO attempt it cannot be used again for a time period of 48 hours

**Insertion of the IO Catheter**

Individuals who may insert an intraosseous catheter include:

- 1.) Trained physicians who have completed the required Intraosseous catheter training under the direction of a credentialed faculty member
- 2.) Specially-trained nurses who have completed required training may insert IO's in emergent/urgent patient scenarios, such as resuscitation.

Aseptic technique and standard precautions shall be utilized.

**Administration of Medications & Monitoring**

Nurses who have completed required training will assume primary responsibility for the following:

- a. Administration of medications via the intraosseous catheter
- b. Monitoring of the IO site for signs of complications
- c. Notification of the ordering provider if any complications develop

Flushing the catheter prior to use will help facilitate flow: NO FLUSH = NO FLOW

10 ml of 0.9% normal saline for adult patients

5 ml of 0.9% normal saline for pediatric patients

After a bolus drug administration, flush the catheter with 3-10 cc of 0.9% normal saline

Dosage of medications or infusions are considered to be equivalent when comparing intraosseous and intravenous.

Administration of medications via intraosseous access is considered preferable in comparison to endotracheal administration, due to a more predictable pharmacologic effect from the intraosseous route.

Fuids or medications that can be safely administered via peripheral IV may be infused through the IO. One exception is chemotherapy agents; the IO should not be used for chemotherapy. Caution should be used with repeat doses of hypertonic fluids.

Avoid rocking the EZ-IO catheter during use

### **Pain Management In Conscious/Awake Patients:**

#### **Pain Management in the Conscious/Awake *Adult* Patient:**

- 1.) Infiltration of the area with 1% lidocaine may be used prior to insertion if indicated.
- 2.) Pain is also a consideration after insertion and before medication/fluid administration. There are somatic pain sensors within the skin and periosteum of bone, and visceral pain sensors within the intraosseous space.

If indicated, prior to IO syringe bolus (flush) or continuous infusions in alert patients, SLOWLY administer Lidocaine 2% without epinephrine (Preservative Free) through the EZ-IO hub (0.2 ml at a time until desired numbing effect accomplished in the IO space).

*Ensure that the patient has no allergies or sensitivities to Lidocaine.* With each administration, allow lidocaine to dwell for 1 minute, then flush the catheter.

Usual Dosage: 20-40 mg of 2% Lidocaine for adults (rate: over 2 minutes)

#### **Pain Management in the Conscious/Awake *Pediatric* Patient:**

The EZ-IO product vendor advocates Lidocaine IO for pain relief in Pediatric patients. ***However***, due to lack of appropriate evidence-based literature, Lidocaine will NOT routinely be given IO to Pediatric patients at UTMB for pain control. Pain management will be at the discretion of the physician managing the patient at the time of resuscitation.

### **Discontinuation of the IO Catheter**

1. The intraosseous catheter must be removed **within 24 hours of insertion**
2. Physicians and specially-trained nurses who have completed the required training will discontinue the intraosseous catheter
3. If the patient deteriorates and IO access is required again, bone that has been accessed cannot be accessed again for a time period of 48 hours

### **Documentation**

Documentation shall include:

- Indications and absence of contraindications (procedure note)
- IO site, use of anesthetic, adult or pediatric IO
- Patient tolerance of procedure, # of attempts (if more than one)
- Date and time of insertion
- Date and time of discontinuation
- Assessment of site for signs of infection and/or extravasation
- Patient and/or family teaching

## Procedure

### Equipment (required):

Gloves, mask with splashguard  
EZ-IO Driver and needle set  
Alcohol or betadine swab or chlorhexidine swab  
Extension set (packaged in the EZ-IO kit)  
Leurlock 10 ml syringe  
Normal Saline for flush  
Yellow wristband (packaged in the EZ-IO kit)  
Transparent dressing

### Equipment (might be required):

Lidocaine 1% (for conscious/alert patient)  
Lidocaine 2% preservative free (for conscious/alert patient)  
*If IV drip to be started:* IV tubing, solution, infusion pump and/or pressure bag

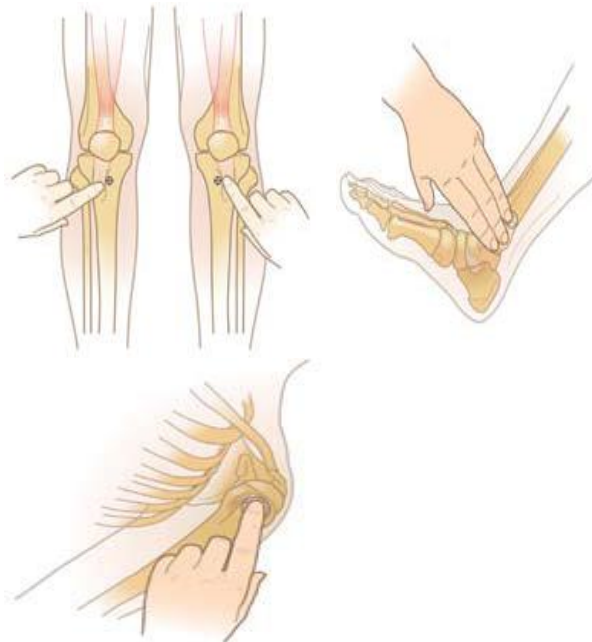
### Insertion Procedure:

1. Utilize standard precautions
2. Review Indications and Rule out Contraindications
3. Locate appropriate insertion site

(Note: site selection depends on patient age, size, anatomy, presenting condition, ability to locate anatomical landmarks, and clinical judgment and experience. There is some literature to suggest that in adults, the humerus may be preferred for flow rates, drug delivery, and management of infusion pain. If possible, avoid a humerus site on the same side as a mastectomy)

FDA approved sites:

- a. Proximal/Distal Tibia
- b. Proximal Humerus



4. Prepare insertion site using aseptic technique
5. Prepare the EZ-IO driver and appropriate needle set

*Needle size and length:*

- 1.) For patients weighing between 3-39 kg: 15 gauge, 15 mm long needles

- 2.) For patients weighing 40 kg and greater: 15 gauge, 25 mm long needle
  - 3.) For patients with excessive tissue and for the proximal humerus site in adults: 15 gauge, 45 mm long needle
6. Stabilize site and insert appropriate needle set
- Insertion Tips*
- a. Hold the EZ-IO driver (with the appropriate needle set attached) lightly in your dominant hand
  - b. Position driver at insertion site with needle set at **90-degree angle** to the bone. **Gently** power or press needle set until needle set tip touches bone.
  - c. Ensure at least 5 mm of the catheter is visible
  - d. Penetrate bone cortex by squeezing the driver's trigger and applying **gentle, steady downward** pressure (*Note: if the driver stalls and will not penetrate the bone you may be applying too much downward pressure*)
  - e. Release driver's trigger and stop insertion process when:
    1. A sudden "give" or "pop" is felt upon entry into the medullary space
    2. A desired depth is obtained
- For pediatrics*, the procedure is similar. Allow the driver to do the work. Do not "pulse" or intermittently push the trigger – complete the insertion in one "smooth motion". DO NOT PUSH – Gently guide instead. Stop when you feel the "pop"
7. Remove the EZ-IO driver from the needle set while stabilizing catheter hub
  8. Remove stylet from catheter, place stylet in sharps container
  9. Confirm placement
  10. Connect primed extension set (note: the volume of the EZ-Connect is approximately 1.0 ml). DO NOT ATTACH A SYRINGE DIRECTLY TO THE EZ-IO CATHETER HUB.
  11. Slowly administer appropriate dose of Lidocaine 2% (preservative free) **to conscious patients if indicated**
  12. Syringe bolus (flush) the catheter with normal saline (10 ml adults; 5 ml pedi)
  13. Administer medications, or initiate infusion
  14. Dress site (opside may be preferred to visualize the site) and secure tubing. The EZ-IO stabilizer dressing may also be used.
  15. Apply yellow wristband to patient. Add date and time of insertion to wristband
  16. Monitor site and patient condition. REMOVE CATHETER WITHIN 24 HOURS.

Successful placement of an intraosseous access is dependent upon factors such as appropriate identification of anatomical landmarks, the correct application of the device, and absence of factors preventing the reaching of the marrow space, such as morbid obesity.

#### Confirmation of Placement

The following are examples of ways confirmation of placement can be accomplished:

1. The catheter is firmly seated and does not move
2. You observe blood on the stylet tip prior to placing it in the sharps container
3. You note blood at the catheter hub
4. You are able to aspirate blood or marrow from the catheter

5. Drugs or fluids flow without difficulty (there may be some resistance with first flush, pressure bag needs to be utilized for fluids) – there are no signs of extravasation
6. You note the effects of administered drugs
7. X-ray confirmation

Intraosseous flow rates may vary, depending on age and anatomy of the patient, insertion site, and use of a pressure bag. Flow rates are commonly slower than most peripheral catheters due to the anatomy of the intraosseous space. A pressure bag or stopcock syringe may need to be utilized.

Complication rates are reported to be low. The most common complication is extravasation. This is evidenced by local swelling of surrounding tissue, increased circumference of the affected extremity, or increased infusion resistance. If extravasation is detected, the intraosseous device should be removed, and the patient should be closely monitored for the development of compartment syndrome.

Other complications may include infection, compartment syndrome, bone fractures, and osteomyelitis. Conditions which may be associated with a greater risk for osteomyelitis include prolonged IO use, bacteremia, and the administration of hypertonic fluids.

The EZ-IO is made of 304 stainless steel; MRI procedures are contraindicated while in place.

Ambulation should be discouraged with a tibial EZ-IO catheter in place. For humerus IO, movement in the arm should be minimized and the arm should not be elevated above shoulder level. There are no activity restrictions after EZ-IO removal.

Intraosseous access is safe and effective for fluid resuscitation, medication administration, and blood product administration.

Blood sampling for laboratory testing from the IO is acceptable on a limited basis. Acceptable testing includes cultures and chemistry (except CO<sub>2</sub> Total). Sampling from the IO is not acceptable for hematology, coagulation, or blood bank testing. All samples obtained from an IO should be labeled with this information. Individual questions or concerns regarding sampling from the IO for a specific patient should be directed to the Clinical Laboratory (Attn: Director on-Call for the specific laboratory service).

If blood sampling is necessary, the following procedure may be utilized:

1. Aspirate 3 ml of blood. You may attach a syringe directly to the hub, but use caution when doing so.
2. Aseptically attach another syringe. Withdraw the appropriate amount of blood for laboratory tests.
3. Flush the IO with 3-10 cc of 0.9% normal saline
4. Note on lab request that the specimen is from the IO site

#### Discontinuation of Intraosseous Catheter:

1. Stabilize patient's extremity
2. Connect sterile Luer Lock syringe to hub of catheter
3. Maintain a 90 degree angle during removal
4. Rotate catheter clockwise – while gently pulling. **DO NOT ROCK** the catheter while removing. Rocking or bending the catheter with a syringe may cause the catheter to separate from the hub.

*Note: If the catheter and hub separate or break simply grasp the exposed catheter*

- tip with a hemostat. Maintain the catheter at a 90 degree angle, then rotate the catheter (clockwise/ counter clockwise) while gently pulling*
5. When the catheter has been removed, place in a sharps container
  6. Cover the site (small bandage should be sufficient) and continue to monitor
  7. If the patient bleeds from the site, apply direct pressure

### **Intraosseous Reference List**

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