



# IO Placement

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# What is an IO?

- ▶ Intraosseous (IO) vascular access refers to the placement of a specialized hollow bore needle through the cortex of a bone into the medullary space for infusion of medical therapy and laboratory tests. The IO route is an option when standard venous access would delay therapy or is not easily obtained in the hospital or pre-hospital setting.

# Why choose an IO?

- ▶ IO success rates are twice as high as intravenous line placement in critical trauma patients without a blood pressure and should have priority over IV placement. IO needle insertion has been shown by multiple studies to have high success rates by physicians, nurses, and paramedics in adults and pediatrics patients.
- ▶ Although IO access is superior in many clinical situations, it is highly underutilized. Studies show that IO access can be acquired within 20 seconds, allowing rapid access in emergent patients who would otherwise be challenging to access intravenously.
- ▶ IO can be used to administer any substance that is infusible intravenously, but IO use should not be for longer than 24 hours due to an increased risk of complications.

# Indications for IO Placement

- Unable to obtain venous access or delayed venous access
- Immediate vascular access is required
- Blood for laboratory analysis or point of care testing
- Access needed for contrast injection for radiologic evaluation

# Contraindications for IO

- ▶ Adequate venous access
- ▶ Fracture of the boney site
- ▶ Burn site
- ▶ Cellulitis or infection at the site
- ▶ Osteogenesis imperfecta (a genetic disorder that prevents the body from building strong bones)
- ▶ Osteoporosis (relative)
- ▶ Previous IO attempted site
- ▶ Previous IO site less than 48 hours
- ▶ Recent orthopedic surgery

# IO Placement Sites

- ▶ Sternum, clavicle, humeral head, iliac crest, distal femur, proximal tibia, distal tibia, and calcaneus are all potential sites for intraosseous access. The proximal tibia, humeral head, and sternum are the preferred sites in adults. The distal femur, proximal tibia, and distal tibia are preferred sites for infants and neonates. Always palpate both margins of the bony site to ensure penetration of the bone centrally. Note that each site is always one to two fingerbreadths in measurement to locate the correct location.

# Humerus Placement

- ▶ The humerus should be internally rotated and the hand placed on the abdomen with the elbow flexed to 90 degrees, ensuring that the bicep tendon is medially located and not penetrated. The surgical neck is palpated, and the needle is placed 2 cm above the surgical neck into the greater tubercle at about 45 degrees to the anterior plane. A longer IO needle is necessary, such as the 45 mm needle, to access the intramedullary space.
- ▶ <https://youtu.be/3ojdhEgw1zM>

# Proximal Tibia

- ▶ 1 cm to 2 cm inferior and medial to the tibial tuberosity in the flat portion of the tibia.
- ▶ <https://youtu.be/99DVtJSKi6k>



# Distal Femur

- ▶ With the leg straightened and centered in the anterior plane, 1 cm proximal to the patella, and 1 to 2 cm medially.
- ▶ <https://youtu.be/1i46M1LnYWY>

# Distal Tibia

- ▶ 2 cm proximal to the medial malleolus in the flat portion of the tibia.
- ▶ <https://youtu.be/R4wZNC77kn8>

# Lidocaine Administration

- ▶ 2 % (preservative free) Lidocaine given IO has been shown to provide effective local anesthesia in most awake patients
- ▶ Prime the EZ-Connect with 2% Lidocaine
- ▶ Adult Dose 40 MG IO (Titrate to Effect)
- ▶ Pediatric Dosage 0.5 MG/KG IO (Titrate to Effect)
- ▶ Infuse Lidocaine Slowly 0.2 CC Increments
- ▶ Allow 15 seconds for anesthetic effect
- ▶ Flush Hard to get flow ( May cause brief Pain)
- ▶ Repeat 20 MG after the Flush
- ▶ Do not exceed 3 MG/KG

# Flow Rates

## IO Infusion Rates Under Pressure (300mmHg): Cadaver Study

Outcome	Sternum	Humerus	Proximal Tibia
Mean Flow Rate	93.7 mL/min	57.1 mL/min	30.7 mL/min
1st Attempt Success Rate	100%	100%	81%

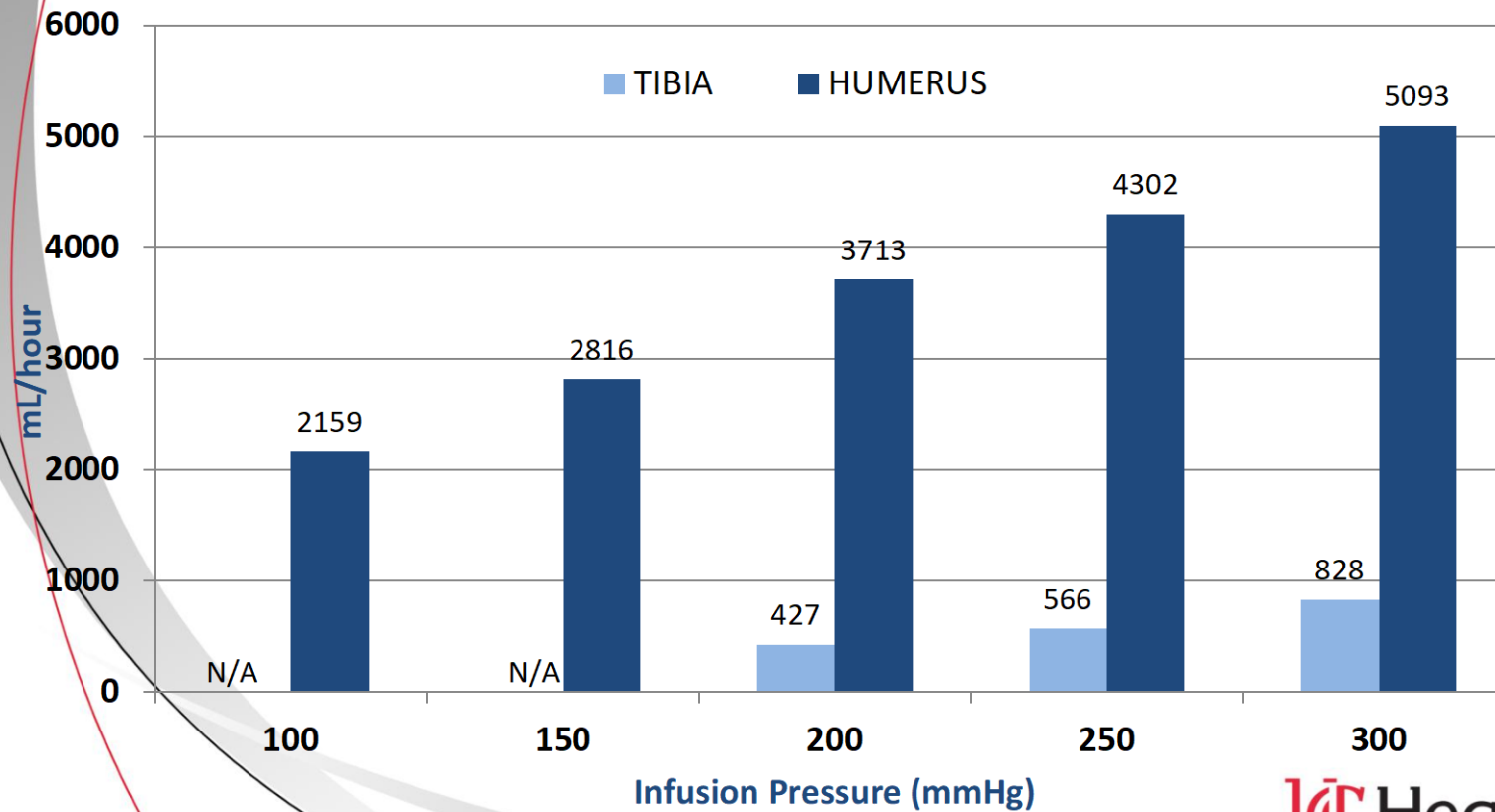
**BOTTOM LINE:** The IO site with the highest 1<sup>st</sup> attempt success rate and infusion rate was the sternum > humerus > proximal tibia.



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# Infusion Flow Rates – Humans (mL/hr)

## At Different Infusion Pressures (mmHg)



Note: For tibial IO, not enough cases at 100 and 150mmHg to calculate means.

Questions?