	Policies & Procedures  Title: <b>INTRAOSSIOUS ACCESS &amp; REMOVAL BY NON-PHYSICIAN HEALTHCARE PROVIDERS</b>  I.D. Number: <b>1185</b>
Authorization:  <input checked="" type="checkbox"/> SHR Nursing Practice Committee <input checked="" type="checkbox"/> Patient Services Committee	Source: Nursing Date Revised: November 2012 Date Effective: November 2010 Scope: <b>PICU Transport Team</b> <b>SPH Emergency Department</b> <b>Saskatchewan Air Ambulance</b> <b>PICU Charge Nurse / Code Blue Nurse</b>

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## 1. PURPOSE

- 1.1 Intraosseous (IO) access can be utilized in infants, children and adults when rapid vascular access is required for emergent administration of essential medications/intravenous fluids where other methods of vascular access (peripheral or central) are not feasible. Intraosseous access provides access to the non-collapsible, high vascular marrow of long bones.

## 2. POLICY

- 2.1 Pediatric Transport Teams, Saskatchewan Air Ambulance and St. Paul's Hospital Emergency Department and PICU Charge Nurse/Code Blue Registered Nurses as identified by their Manager will initiate IO vascular access in situations where rapid administration of medications and fluids are essential to the resuscitative effort (ex: cardiopulmonary arrest, cardiovascular collapse) and no vascular access can be established within 60 to 90 seconds via alternative routes.
- 2.2 All medications and fluids given by IV may be giving via IO, including blood products, as ordered by the physician/protocols/standing orders. Guidelines for peripheral administration of specific medications should be followed.
- 2.2.1 Pediatrics: administration of IV fluids are by an IV infusion pump or direct IV push to ensure volume administered is controlled and accurately measured.
- 2.3 Contraindications to IO include:
- recently fractured bone or crush injury to selected long bone
  - previous puncture of same bone by unsuccessful IO attempt
  - overlying skin or soft tissue infection (ex: cellulitis, infected burn)
  - recent orthopedic procedures near insertion site
  - bone disorders affecting bone integrity or proper land marking (ex: osteoporosis, osteogenesis imperfecta or osteogenesis petrosus, Osgood-Schlatter disease).
- 2.4 Aseptic technique and use of personal protection equipment is required.

- 2.5 Availability of manual IOs as back-up is recommended when using automated or electric IO devices.
- 2.6 Intraosseous access is to be used as a temporary measure in emergent circumstance. Vascular access by peripheral or central venous access should be obtained as soon as feasible, ideally within 12 to 24 hours.
- 2.7 RNs educated in care of IO sites/infusions and administration of medications via IO route may provide ongoing care to patient with IO.
- 2.8 RNs educated in removal of IO devices may do so with physicians order or with site complications, such as extravasations, are identified.
- 2.9 Disposal of IO devices should be in appropriate medical biohazard waste receptacle.

### 3. PROCEDURE

#### 3.1 Equipment

- Intraosseous needle appropriate for patient size/age and insertion device (see Appendices for specifics on each IO device )
- Personal protective equipment
- Chlorohexadine antiseptic solution/swabs (alcohol for infants under 2 months of age)
- 0.9% saline – 10 mL syringe with leur lock
- 3-way stop cock
- Microbore extension tubing or IO specific IV adaptor
- IV solution as ordered
- Peds: IV pump and/or 60 mL syringes
- Adult: IV pump and/or pressure bag
- Appropriate IV tubing
- Dressings – 2 x 2 gauze and tape, tegaderm and tape.

#### 3.2 Insertion site selection and Landmarking (See Appendix A)

- 3.2.1 Insertion sites must be away from large vessels, nerves and organs.

*Note: Fractures crush injury or previous IO attempts in same bone disrupt the vascular network in bone cortex, and contraindicate use of that long bone site.*

- 3.2.1.1 Proximal medolateral tibia (preferred site)
- 3.2.1.2 Distal tibia
- 3.2.1.3 Distal femur (younger children and infants)
- 3.2.1.4 Anterior head of humerus (older children and adults)

#### 3.3 Insertion Method

- 3.3.1 Assemble equipment
- 3.3.2 Don sterile gloves
- 3.3.3 Stabilize site with non-dominant hand. (Avoid placing your hand under limb to prevent hand injury should IO miss or puncture through patient bone)

- 3.3.4 Landmark carefully
- 3.3.5 Cleanse site with appropriate antiseptic
- 3.3.6 In conscious patient, infiltrate site with 2% Lidocaine, per physicians order.
  - Adult- Lidocaine 2%: 20 to 40 mg
  - Pediatric -Lidocaine 2%: 0.5 mg/kg mg/kg to max of 40 mg
- 3.3.7 Insert IO needle per manual method or as outlined in manufactures instructions, away from joint space and epiphyseal plates.
  - 3.3.7.1 **Manual Method – see Appendix B**
  - 3.3.7.2 **Power Drill Method – see Appendix C**
  - 3.3.7.3 **Single Use BIG IO – see Appendix D**
- 3.3.8 Following insertion of IO and removal of sylette, attach 10 mL syringe and aspirate site for bone marrow (pale pink fluid) or blood, indicating proper placement.

*Note: Aspirated bone marrow/blood can be used for diagnostic analysis, such as random glucose level, chemistry, cross match.*
- 3.3.9 Attach appropriate connection tubing and/or stopcock flushed with saline. Instill 10 mLs saline, observing limb for swelling and signs of extravasations. Inability to flush site indicates improper placement and IO needs to be removed.

#### 3.4 Care and Monitoring of Site

- 3.4.1 Apply sterile dressing to site and secure with tape.
- 3.4.2 Administer medications/fluids as ordered. IO sites have higher resistance to flow.
  - Adults: Pressure bag may be required to aid flow of IV fluids especially during aero medical transport.
  - Pediatrics and infants: must use IV infusion pump device or measured volume in syringe via direct push.
- 3.4.3 Monitor limb circulation distal to insertion site and site/limb for other complications:
  - Extravasations – improper placement, dislodgement or leakage around IO puncture site results in IV fluids/medications escaping into surrounding tissue resulting in firm swelling near or under insertion site.
  - Compartment Syndrome – extravasations of large volumes of fluid may result in impaired blood flow and tissue necrosis to limb.
  - Infection – osteomyelitis, cellulites, abscesses and septicemia can result from improper aseptic technique and extended timeframe of IO use
  - Bone Injury – IO insertion may produce bone injury X-ray of IO site or IO puncture attempt site is recommended only if clinical indications of fracture. (ex: decreased movement, limb instability)
  - Pain – IO insertion produces pain similar to insertion of IV cathalon. Localized use of lidocaine at insertion site and for high pressured infusions in conscious patients is recommended.

### 3.5 Intraosseous Removal

- 3.5.1 IO should be removed once an alternate vascular access has been obtained, per Physicians order, or with signs of extravasations.
- 3.5.2 Remove IV extension set from IO and attach empty 6 or 12 mL syringe which will act as handle or per manufacturer's instructions.
- 3.5.3 Maintain a 90 degree angle to site, rotate IO needle with syringe and gently pull IO out.
- 3.5.4 Hold direct pressure on site until hemostatis achieved. Cover site with bandaid.
- 3.5.5 Monitor site for bleeding and signs of infection.

### 3.6 Documentation

- 3.6.1 Document date, time, IO site, needle size, name of person performing procedure and complications encountered in Nursing Notes or appropriate record.
- 3.6.2 Document medications, including lidocaine, on MAR or other designated record.
- 3.6.3 Document IV fluids given on appropriate record.
- 3.6.4 Document removal date, time, person performing and any complications on appropriate record or Nursing Notes.

## 4. REFERENCES

American Heart Association. (2011). *Pediatric Advanced Life Support: Provider Manual*

American Heart Association (2011). *Vascular Access. Pediatric Advanced Life Support: PALS Course DVD*. Communicore.

Hawkins, H. S. (2008). Intraosseous infusion. In *Procedure manual for pediatric acute and critical care*, American Association of Critical Care Nurses, pp. 1082-1088. Saunders: St. Louis MI.

PerSysMedical. 2012. *BIG (Bone Injection Gun) Instructions for Use*. Houston. Tx.

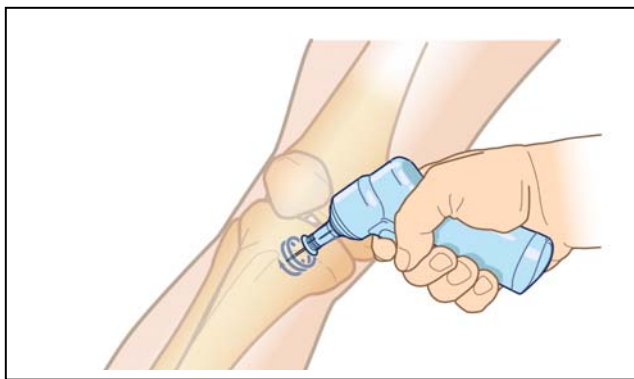
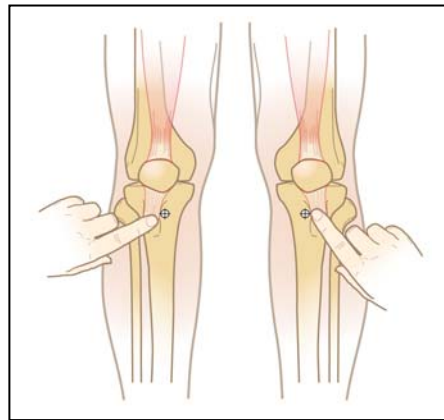
Vidacare. (2007). *Immediate vascular access: When you need it most*. EZ-IO Training Program Disc.

## Appendix A

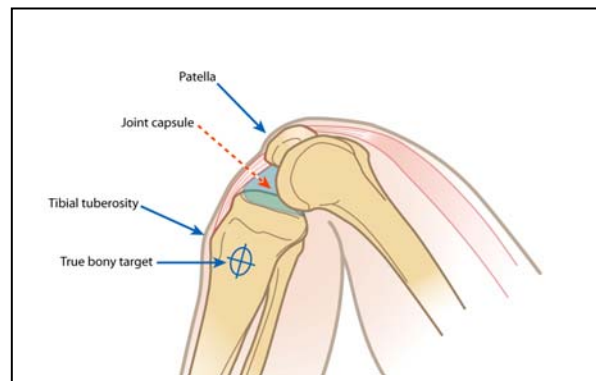
### LANDMARKING FOR INTRAOSSEOUS VASCULAR ACCESS

#### 1. Anteromedial Tibia:

- a. First choice site for all ages
- b. Landmarking :
  - i. Less than 12 years of age: locate tibial tuberosity, and move medial and 1 to 3 cm (approximately one fingerbreadth) **below** the tibial tuberosity, away from joint and epiphyseal plates.
    - Over 12 years of age: locate tibial tuberosity, move medial and 1-2 cm **above**, ensuring away from joint space
    - Hyperextension of knee may distort landmarks. Slight flexion of knee with support under joint by rolled towel is recommended.
  - ii. To avoid user injury, when stabilizing this site hold the anterior aspect of patient's leg with non-dominant hand. Do not hold posterior part of patient's leg.
  - iii. if puncture unsuccessful at this site, attempt at the same location on the other leg.



Correct Positioning



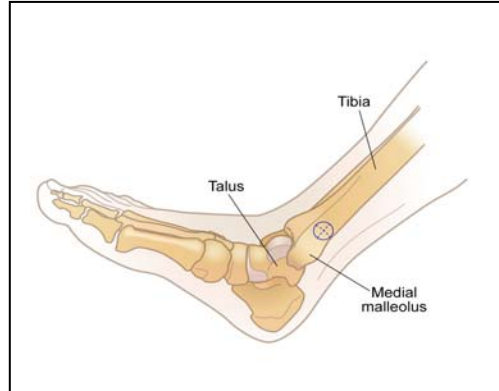
Incorrect Positioning

Hyperflexion of the extremity can lead to improper assessment

Graphics from: EZ-IO Learning Disc – Vidacaire (2007)

**2. Distal Tibia (for older children and adults)**

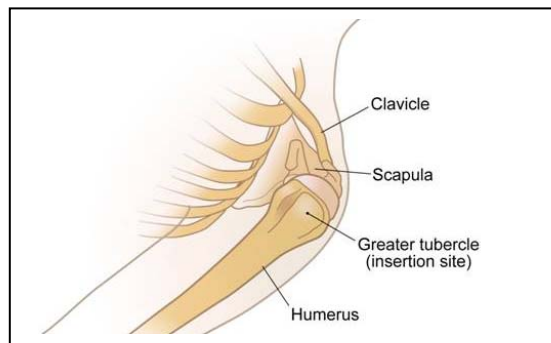
- a. Landmark: one fingerbreadth above the medial malleolus.
- b. if puncture unsuccessful at this site, attempt at the same location on the other ankle.
- c. Do not use this site on same limb that attempted anteromedial tibial IO



Graphics from: EZ-IO Learning Disc – Vidacaire (2007)

**3. Proximal humerus (for older children and adults) .**

- a. Landmarking: adduct elbow at 90 degrees by placing patient’s hand over umbilicus.
- b. Hold the humeral head with non-dominant hand and palpate for greater tubercle of proximal humerus which is on the lateral midline of shoulder
- c. if puncture unsuccessful at this site, attempt at the same location on the other shoulder.



Graphics from: EZ-IO Learning Disc – Vidacaire (2007)

**4. Distal femur (for young children and infants)**

- a. Landmarking: two fingerbreadths above the superior border of the patella at midline  
Note: needle length may need to be increased to account for more subcutaneous tissue above bone surface
- b. if puncture unsuccessful at this site, attempt at the same location on the other femur

## Appendix B

### MANUAL INTRAOSSEOUS NEEDLE INSERTION METHOD

#### Size Selection:

- Infant and young child: #18 gauge 2.5 cm. or smaller
- Older child to adult: #18 gauge 4 cm. or larger

#### Insertion Technique:

- Cleanse and landmark site
- Stabilize limb from medial and lateral aspects, avoiding hand behind insertion site
- Insert the needle, pointed slightly away from the epiphysis, through the skin until the bone is reached
- Use a gentle firm but twisting motion until the needle “pops” through the bone cortex. A decrease in resistance felt
- Stop advancing needle when feel the “pop”
- Unscrew and remove stylet from needle
- Attach syringe and attempt aspiration of blood/bone marrow
- Attach saline flushed IV extension device
- Secure with dressing and tape

## Appendix C

### POWER DRILL INTRAOSSEOUS DEVICE METHOD

- **Needle Size Selection**
  - Pediatrics/infants 3 to 39 kg: 15 gauge 15mm (pink) needle
  - Adults and over 40 kg: 15 gauge 25 mm (blue) needle
  
- **Insertion Technique**
  - Attach a drill to compatible needle of an appropriate size. Line up needle with site at a 90 degree angle to the bone. Depress “on” button to activate drill. Using gentle pressure, push the needle through the skin until you feel the needle contact bone.
  
  - At this point with the needle tip touching the bone verify you can see the 5 mm markings on the needle. The 5 mm marking is the one closest to the IO hub.
  
  - If the 5 mm marking is visible, continue with insertion. If the 5 mm marking is not visible, do not continue with the procedure as the needle may not reach the IO space. Procedure may be restarted then with a longer needle.
  
  - Using mild pressure on the drill, press trigger until needle “pops” through the bone cortex at which time a decrease in resistance will be felt.
  
  - Gently remove drill from needle device. Unscrew stylette from inner cannula, leaving cannula in place.
  
  - Attach 10 mL syringe and aspirate for blood/bone marrow to confirm placement.
  
  - Attach saline flushed IV connection device.
  
  - Secure with dressing and tape.
  
  - Observe site for extravasation of fluid into the tissue.



**Appendix D**

**BIG (Bone Injection Gun) Intraosseous Device**

<b>Age</b>	<b>Needle Size</b>	<b>Proximal Tibia Insertion Depth</b>
Infants 0 to 3 years	18 g (Red)	0.5 – 0.7 cm (0.2 – 0.3 in)
Children 3 to 6 years	18 g (Red)	1 – 1.5 cm (0.4 – 0.6 cm)
Children 6 to 12 years	18 g (Red)	1.5 cm (0.5 in)
Adult	15 g (Blue)	Prox Tibial or Humerous 2.5 cm (1 inch)

1. Select Appropriate BIG device based on chart.
  - a. **Under 12 years of Age:** (Red Barreled Device) dial the red barrel to the patient's age in years to set predetermined needle depth.
  - b. **Over 12 years of Age:** (Blue Barreled Device)-preset needle depth of 1.5 cm
2. Landmark insertion site and cleanse, utilizing sterile technique.
3. Working away from growth plate, hold barrel of device with non-dominant hand, at 90 degrees to insertion site. While maintaining patient contact, squeeze and pull the red safety latch out with dominant hand. Retain safety device for IO stabilization later.
4. Holding barrel with non-dominant hand and 90 degree contact with site, position dominant hand in a syringe-like fashion with heel of hand covering top of device.
5. Trigger device with dominant hand by pushing down with the heel of the hand. Do not attempt to use thumb or strike to top of device to trigger device.
6. Ensuring the IO needle portion of device remains intact in bone; remove the insertion portion of the device by carefully pulling upward with a slight side-to-side movement to clear needle hub.
7. Slide the red safety latch around the base of the needle. Tape red safety latch to skin to stabilize.
8. Remove the sylette from the center of the needle by pulling and rotating upward. The IO cannula should remain in the bone.
9. Confirm placement by aspirating for blood/bone marrow.
10. Connect to saline flushed IV extension set or stopcock for infusion.
11. Secure with dressing and tape.
12. Removal of BIG Intraosseous Device
  - a. Remove dressing and tape from site.
  - b. Remove red safety latch from around IO needle. Place square portion of latch around the square portion of the needle hub and pull upwards while twisting.