



Northern Inter-tribal Health Authority

**DIRECTIVE FOR A CLIENT POPULATION
REGISTERED NURSE SPECIALTY PRACTICE**

**INTRAOSSSEOUS INSERTION, MANAGEMENT & REMOVAL
ADULT & PEDIATRIC**

Updated August 9, 2023

INTRAOSSUEOUS INSERTION, MANAGEMENT & REMOVAL (ADULT & PEDIATRICS)

DIRECTIVE FOR CLIENT POPULATION

This RN Specialty Practice Clinical Protocol provides the authority and direction for RNs to perform the skill of Adult and Pediatric Intraosseous (IO) Insertion, management and removal of IO needle in a medical emergency situation. IO access is used when IV access is difficult and emergency medication administration and/or fluids are required immediately via vascular access. IO access will be implemented in situations where immediate fluids and/or medications are required to increase resuscitative efforts.

- This directive applies only to the 13 Communities within the NITHA Partnership that have Primary Care Centres (Identified Nursing Station status) where the access of care to an acute care hospital setting is 45 minutes or further away.
- This directive is consistent with the NITHA OVERARCHING POLICY FOR SPECIALTY PRACTICE BY REGISTERED NURSES EMPLOYED WITHIN THE NITHA PARTNERSHIP (June 2023)

Updated per Carrie Gardipy, NITHA Nursing Program Advisor

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INTRASOSEOUS INSERTION, MANAGEMENT & REMOVAL (ADULT & PEDIATRICS)

RN COMPETENCIES FOR INTEROSSEOUS INSERTION, MANAGEMENT & REMOVAL

- Current ITLS (International Trauma Life Support)
- Current PALS (Pediatric Advanced Life Support)
- Current ACLS (Advanced Cardiac life Support)
- Current BLS-CPR Healthcare Provider Course

RNs are required to review this protocol annually and to adhere to the procedures relating to Intraosseous Insertion as outlined within this protocol and the attached guidelines (see Appendix A)

BACKGROUND:

- The indication for performing intraosseous (IO) insertion is in the presence of a life-threatening condition where peripheral intravenous access cannot be obtained.
- This directive applies to the infant, pediatric and adult populations.
- This is to be initiated when rapid response is required to increase resuscitative efforts. Intraosseous insertion can be done immediately upon recognition of a life-threatening emergency without a client specific order.
Emergency Physician should be contacted as soon as possible after emergency interventions are initiated.

CONTRAINDICATIONS:

Intraosseous access (IO) is contraindicated in the presence of:

- Infection, trauma or burns around the insertion site.
- Osteoporosis
- Fracture or crush injury on same limb
- Recently fractured bones at insertion site
- Previous IO attempts in the same bone

OTHER CONSIDERATIONS:

- May be difficult to insert and landmark where there is absence of anatomical landmarks (for example: due to excessive adipose tissue or swelling) or underdeveloped humerus in an infant or small child.

OBJECTIVE

- 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 or have been unsuccessful.

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NURSING CONSIDERATIONS:

- RNs working within the NITHA Partnership may initiate IO vascular access in emergency situations where rapid administration of medications and fluids are essential to the resuscitative effort and no vascular access can be established within 60-90 seconds via alternative routes.
- All medications and fluids given by IV may be given by IO as per Specialty Practice documents (i.e. ACLS emergency medications)
- Best practice for the pediatric population recommends all medications and fluids should be given via an IV pump or direct IV push to ensure volume administration is controlled and accurately measured
- Availability of manual IOs as back-up is recommended when using automated or electric IO devices
- IO 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. In the majority of cases, clients would be triaged prior to this timeframe.
- RNs educated in care of IO sites/infusions and administration of medications via IO route may provide ongoing care to patient with IO.
- RNs educated in removal of IO devices may do so with physician's order or with site complications, such as extravasations, are identified
- Disposal of IO devices should be in appropriate medical biohazard waste receptacle.

PROCEDURE

Equipment and supplies for Intraosseous Infusion

- IO needle appropriate for patient size/age and insertion device (see Appendices for specifics on each IO device)
- Personal protective equipment
- Chlorohexidine 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

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Needle Selection based on size:

EZ-IO 15mm (3kg and greater)
Generally used for pediatric or individuals with lean body mass

EZ-IO 25mm (3kg and greater)

EZ-IO 45mm (40kg and greater)
Generally used for adults with larger body mass
Needle length of choice for proximal humerus insertions for patients over 40kg.



The 3 lengths of EZ-IO needles each have 5 mm interval black markers on the shaft. At least one black marker line must be visible once the needle is inserted through the tissue and resting against the bone (refer to picture below). The presence of at least one visible black marker line ensures there is enough remaining needle length to penetrate adequately into the bone. Selection of the appropriate needle length can be estimated by first assessing the depth of tissue over the insertion site.

Insertion site selection and Landmarking (See Appendix A)

- Insertion sites must be away from large vessels, nerves and organs. Note that fractures crush injuries or previous IO attempts in same bone disrupt the vascular network in bone cortex, and contraindicate use of that long bone site.
- Proximal medolateral tibia (preferred site)
- Distal tibia
- Distal femur (younger children and infants)
- Anterior head of humerus (older children and adults)

***Lidocaine should be preservative and epinephrine free.**

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Insertion Steps

- 1) Assemble equipment
- 2) Don sterile gloves
- 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)
- 4) Landmark carefully as per guidelines
- 5) Cleanse site with appropriate antiseptic
- 6) In conscious patient, infiltrate site with Lidocaine

Adult- Lidocaine 2% without epinephrine: 20 to 40 mg/kg body weight

Pediatric -Lidocaine 2% without epinephrine: 0.5 mg/kg mg/kg to max of 40 mg

- 7) Insert IO needle per manual method or as outlined in manufactures instructions, away from joint space and epiphyseal plates.
- 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.
- 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

Care and Monitoring of Site

- Apply sterile dressing to site and secure with tape.
- Administer medications/fluids as per ACLS Guidelines or physician/NP orders. 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.
- Monitor limb circulation distal to insertion site and site/limb for other complications:
 - Extravasation: This may result from the improper placement of the intraosseous needle into the surrounding soft tissue which is indicated by swelling and hardness near the site.
 - Compartment Syndrome: The power drill method decreases the possibility of extravasation which could cause compartment syndrome or tissue necrosis which can be avoided by frequent reassessment of the site.
 - Epiphyseal Plate Injury: There is a danger of epiphyseal plate injury in infants and children. Careful landmarking of the site and proper placement will circumvent this problem. This can be avoided by inserting the needle at a 10-20 degree angle caudal to the epiphysis.
 - Fat Embolism: Fat embolism related to IO insertion is a rare and extremely infrequent occurrence.

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- Infection: Osteomyelitis, cellulitis, subcutaneous abscesses and septicemia are examples of types of infections related to poor aseptic technique at time of insertion and length of time the intraosseous is left in place.
- Bone Injury: Will occur with IO insertion. A bony defect may be noticed on x-ray which will usually heal in 30 to 40 days and is not of any clinical significance. It is recommended that x-rays be carried out as soon as possible on any bone where an IO puncture has occurred.
- Extreme Pain: Although IO insertion looks painful, when inserted with a drill device, it is reported to be no more painful than an insertion of an 18g IV cathlon. There have been reports of increased pain with high-pressure infusions in conscious patients related to stimulation of pressure sensors within the bone. Pain on insertion and infusion can be minimized by injecting a preservative-free lidocaine prior to insertion or high pressure infusion.

Intraosseous Removal

- Once reliable alternate venous access is established the intraosseous can be removed.
- Remove the IV extension set from the IO needle. Attach an empty 6 or 12 ml syringe which will act as a handle to facilitate removal.
- Maintain a 90 degree angle to the site from this point on.
- While rotating the syringe and catheter clockwise slowly, gently pull the catheter out.
- Dispose of the IO needle in the sharps container.
- Hold direct pressure on the site if bleeding; otherwise cover the site with a Band-Aid.

Communication and Documentation

- Insertion: Document date, time, site, type and size of needle, dose of lidocaine if used, name of person performing procedure and any complications encountered on code blue record, nursing transport record or nursing notes as applicable.
- Removal: It is also required to document the date, time, site condition and any complications related to the removal of the intraosseous device.

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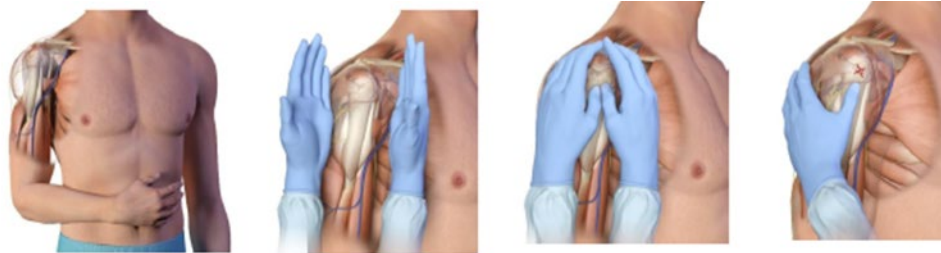
APPENDIX A: INSERTION SITE LANDMARKS

ADULTS SITES FOR IO INSERTION:

- right and left proximal humerus
- right and left proximal tibia (preferred pediatric site)
- right and left distal tibia

Proximal Humerus: The insertion site is 1 to 2 cm above the surgical neck, on the most prominent aspect of the greater tubercle.

- There are 2 options for positioning the patient:
 - A) Place the patient's arm close by their side with their hand resting on their abdomen (see picture below).
 - B) Extend the patient's arm, keeping it close to their side, and touch/tuck their thumb to their buttock "thumb to bum".
- Slide thumbs up the anterior shaft of the humerus until you feel the greater tubercle, this is the surgical neck. Approximately 1 to 2 cm above the surgical neck is the insertion site.



Proximal Tibia

If using the tibial tuberosity to landmark, the insertion site is approximately 2cm medial to the tibial tuberosity, along the flat aspect of the tibia. If using the patella to landmark, the insertion site is approximately 3cm below the patella and then approximately 2cm medial along the flat aspect of the tibia.



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Distal Tibia

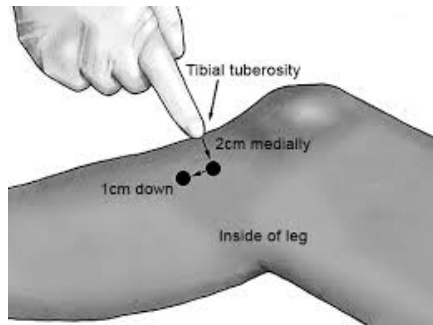
The insertion point is 3cm proximal to the medial malleolus (medial ankle bone) and midline on the tibia.



CHILDREN:

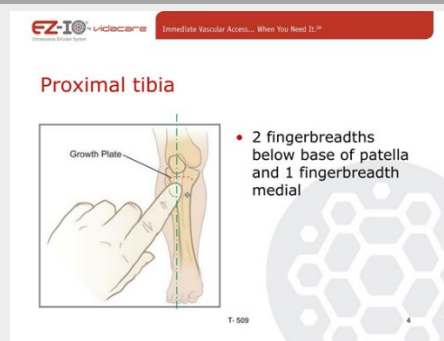
The insertion site of choice in children and infants is the proximal tibia; the distal tibia and distal femur are alternatives.

Preferred Pediatric IO Site



INFANTS:

Proximal tibia preferred site for infants:



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REFERENCES

International Trauma Life Support for Emergency Care Providers, 9th Edition. Published September, 2020

Pediatric Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.

Saskatchewan College of Paramedics (2023). Paramedic Clinical Practice Protocols <https://collegeofparamedics.sk.ca/wp-content/uploads/2020/08/Protocol-Manual-July-2020-v6.1.2.pdf> Retrieved August 9, 2023.

Saskatoon Health Region (2018). Policies & Procedures Advanced Cardiovascular Life Support (ACLS) –Initiation and Management of Interosseous Access. POLICIES & PROCEDURES (saskatoonhealthregion.ca)

CRNS 2023. Registered Nurse Specialty Practices Guidelines. <https://www.crns.ca/wp-content/uploads/2020/06/RNSP-Guidelines-2020.pdf> Retrieved August 9, 2023.