Clinical Practice Policy:	Neonatal Intraosseous (IO) Access
Effective Date:	APRIL 2019

I. Purpose

- To provide access to the neonatal intraosseous (IO) space thereby allowing venous circulation of medications and fluids. Access to the IO space is indicated when intravenous (IV) access cannot be obtained or cannot be obtained in a timely manner.
- To define who may insert neonatal IO devices
- To outline procedure for insertion, care and removal of neonatal IO devices

II. Special Information/Guiding Principles

IO infusion refers to the infusion of fluids, medications, and/or blood products through the bone marrow. The marrow cavity, also known as the intramedullary space is a highly vascular component of the bone and has a direct connection to the venous system. The intramedullary space is a non-collapsible vein and can be accessed in such situations as cardiopulmonary arrest as a bridge to intravenous access. IO access is meant to be temporary venous access. IO devices should be removed as soon as other venous access is established or within 24 hours after insertion.

III. Policy Statement

- The intraosseous needle will **only** be placed by an MD, LIP or PICC RN who has completed required training for insertion of the IO devices.
- IO needles will only be placed in one of the following three sites:
  - Proximal tibia: most preferred
  - Distal tibia
  - Distal femur
- Special considerations impacting site placement include:
  - Bone fracture at the selected site
  - Infection or cellulitis at the selected site
  - Prior IO access in the past 24 hours in the same site
- Prematurity is NOT a contraindication
- IO devices MUST be removed after 24 hours of insertion
- All fluids, medications, and blood products that can be infused through an umbilical venous catheter (UVC) can be infused through a neonatal IO.

- All fluids, medications, and blood products must be infused through an infusion pump with the exception of a code situation where emergent medications are pushed at the discretion of the MD/LIP
- Insertion site must be monitored for potential extravasation damage as seen with IV infiltration
- Bone marrow can be aspirated and sent for laboratory studies such as complete blood count, blood cultures, and chemistries. The absence of bone marrow upon aspiration does not necessarily indicate improper placement of the IO device
- MRI is prohibited for the patient with an IO device in place, CT scan is permissible
- IO device will only removed by trained MD, LIP or PICC RN

IV. Complications

- Extravasation of fluid
- Osteomyelitis infection
- Compartment syndrome
- Fat embolism
- Air embolism
- Bone fractures
    - Osteogenesis Imperfecta
    - Osteoporosis
- Insertion and infusion pain

V. Equipment

EZ-IO needle 15mm/15g (pink)
EZ-IO power driver
EZ-Stabilizer dressing
EZ-Connect extension tubing
Non-sterile gloves
Chlorhexidine (CHG) swabsticks
Povidine Iodine (PVP) swabsticks
Sterile 2X2s
IV infusion pump
IV administration tubing
Pre-filled 10 ml 0.9% normal saline syringes
Syringes needed for blood sampling
Needless connector

Personal protective equipment, including eye protection

VII. Insertion Procedure

1. Perform hand hygiene
2. Perform a pre-procedure verification and time out
3. Palpate the appropriate landmark for the needle set placement and estimate soft tissue depth overlying the site
    a. Proximal tibia: two finger widths (15-20mm) distal to the patella and then medially along the flat aspect of the tibia
    b. Distal tibia: two finger widths proximal to the medial malleolus and then along the medial, flat aspect of the tibia
    c. Distal femur: proximal to the patella (max 1cm) and then 1-2cm medial to midline
4. Cleanse the site using CHG or PVP per patient gestational age guidelines
5. Attach 10 ml syringe to EZ-Connect extension tubing and prime with 0.9% normal saline
6. Attach appropriate sized EZ-IO needle based on patient weight and anatomy to the power driver allowing the magnetic pull to hold it in place
7. Extend the leg and secure the area manually to minimize motion during the insertion
    a. A LIP hand should never be used to stabilize a limb during placement in the event of inadvertent movement. A small towel should be used instead under the limb of the insertion site.
8. Aim the needle towards the center of the bone at a 90 degree angle. Push the needle into the skin to the surface of the bone
9. Using the power driver, press the power trigger while holding gentle downward pressure and advance the needle through the bone cortex into the marrow space. There is a distinct change in resistance when the needle enters the marrow space.
10. Hold the EZ-IO hub in place and pull the driver straight off
11. Continue to hold the hub while twisting the inner stylet off the hub with counter clockwise rotations
12. Place the stylet in the sharps container
13. Place the EZ-stabilizer dressing over the hub
    a. It is crucial to hold the IO device until properly stabilized as neonates do not have a hard bony cortex
14. Attach the primed EZ-connect extension set to the hub, firmly securing by twisting clockwise
15. Gently aspirate a small amount of blood to confirm placement

   a. The inability to aspirate blood does not mean the insertion was unsuccessful. Consider flushing the EZ-IO after aspiration. Placement can be confirmed if the EZ-IO can be flushed.
16. Pull the tabs off of the EZ-stabilizer dressing to expose the adhesive and apply to skin
17. Label patient's bedside that intraosseous device is in use
18. Assess the patient for pain using an appropriate pain assessment tool and treat as necessary.
19. In a code situation, treatment for pain can be delayed until the infant is more stable
20. Connect IV fluids and medications as ordered
    a. IO devices can be saline locked with a 2-5ml flush given every 4-6 hours
    b. IV fluids and medications may require more pressure for infusion. If infusion pump alarms occlusion, flush with 2-5 ml of 0.9 % saline before removal
21. Medications should be followed with a saline flush to ensure the delivery of the medication into the marrow cavity and blood vessels
22. Stabilize and monitor the site and limb for extravasation and/or other complications listed above
23. Document the location, date, and time of IO placement in the patient's electronic medical record

VIII. Intraosseous Blood Sampling

1. Bone marrow can be aspirated and sent for laboratory studies such as complete blood count, blood cultures, and chemistries
2. Blood sampling must only be done by a MD, LIP and/or PICC RN with required IO training.
3. Confirm the patient's name, DOB, medical record number, and LIP order
4. Turn off IV medications and fluids
5. Disconnect IV tubing and place a sterile female cap on the IV tubing's distal end to maintain sterility
6. Scrub the needleless connector on the EZ-IO with CHG for 15 seconds and allow to dry for 30 seconds
7. Attach a 10 ml syringe and draw back 3ml of blood and discard
8. Attach another 10 ml syringe and draw back blood sample
9. Flush EZ-IO with 2-5 ml of normal saline
10. Reattach IV tubing and resume infusion
11. Label blood sample as IO sample
    a. Specimen samples from bone marrow have a lower correlation to serum levels after 30 minutes of resuscitation

IX. EZ-IO Removal

1. Remove the EZ-IO connector extension and dressing being careful not to "rock" the needle
2. Stabilize the catheter hub and attach a 10 ml luer-lock syringe to the hub of the EZ-IO device
3. Stabilize the limb
4. Grasping the needle hub and syringe, rotate the EZ-IO device clockwise and pull straight up at a 90 degree angle from the insertion site, continuing turning clockwise until the device is fully out
5. Dispose of the needle and syringe in the sharps container
6. Apply pressure to the IO insertion site to minimize bleeding and apply an occlusive dressing
7. Observe the IO insertion site for any signs and symptoms of infection
8. Notify MD if
    a. patient indicates symptoms of pain after the IO device has been removed for 24 hours
    b. redness, swelling, bleeding, or drainage at IO insertion site
    c. patient develops a fever

X. References

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