INTRAOSSEOUS (IO) DEVICE – ICU/ED

PURPOSE: To outline the care and maintenance of the patient with an intraosseous (IO) device.

SUPPORTIVE DATA: Vascular access via an IO device may be used for life-threatening conditions when peripheral or central vascular access cannot be readily obtained/achieved. The IO line may be used for IV fluids, blood and blood products, and medications. They are usually inserted at the proximal tibia or humerus. Other sites may include the distal femur, iliac crest, and distal tibia. The proximal metaphysis of the humerus is the preferred site for fast flow rates. For infants, the preferred site is the proximal tibia, 1-3 cm below the tibial tuberosity on the medial aspect of the proximal tibia (being mindful of growth plate).

The IO device must be flushed prior to first use and prior to medication/fluid instillation if the device has been saline locked. 2% lidocaine is usually given into the IO site for patients who are responsive to pain, to decrease pain before initial flush and for continuing pain. Lidocaine may be administered by RNs who have been trained to do so for adult patients with provider order.

IO is used as a bridge until a central or peripheral line can be placed. IO access is discontinued as soon as a suitable IV access can be established. The IO access should not exceed 24 hours.

Contraindications for IO access include:

- Fracture or crush injuries at the target site
- Cellulitis/infection
- Burns at target site

Relative Contraindications include:

- Severe osteoporosis
- Osteogenesis imperfecta
- Local vascular compromise
- Previous surgery of the target site bone
- Previous attempt to establish IO access in the same bone.

The primary complications of the IO device are

- Infiltration/ extravasation of medications and fluids into the soft tissues
- Fractures during insertion
- Osteomyelitis (rare, and associated with poor insertion technique and placement greater than
  24 hours) Compartment syndrome
- Fat, air or bone emboli
- Infection

The device can usually be placed within 10 seconds. Fluids may be infused rapidly but the fluids must be placed under pressure using a pressure bag, rapid infuser, IV pump or manually pushed with a syringe in the pediatric patient. IV pumps may not work effectively due to backflow pressure sensor (alarm trigger).

Some of the devices currently available and FDA approved are:

- EZ-IO Power Driver™ (used for adults and pediatrics at LAC+USC Medical Center)
- Cook Dieckmann (used for pediatrics at LAC+USC Medical Center)
- Big Injection Gun (BIG)
- FAST1 (for sternum use)
- Aspiration needles (e.g. Jamshidi, Illinois)

Administration of medications via IO access is considered preferable in comparison to endotracheal administration, due to a more predictable pharmacologic effect. Dosages of medications or infusions are considered to be equivalent when comparing IO and IV. Chemotherapy and total parenteral nutrition may not be infused via the intraosseous device.

Blood Sampling: IO access is safe and effective for blood sampling for laboratory evaluation. The results of laboratory tests may be slightly different from venous samples because of low flow and stasis in the bone marrow. Blood samples must be labeled "IO".

Physicians and advanced care practitioners insert the IO device. RNs who have been trained in the removal of the IO device may remove it from an adult patient as ordered.

ASSESSMENT:

1. Assess upon insertion
   - Correct placement (needle stands freely and upright without support)
   - Aspiration of bone marrow and blood into the hub of the needle followed by flush as outlined below (Note: blood or bone marrow may not always be aspirated despite correct needle placement)
   - For bleeding or fluid leaking from site
   - For swelling at site or posteriorly
   - For pain
   - Catheter is secure:
     - Stabilize needle, place tape over the flange; place gauze padding on both sides of the needle for support or use IO stabilizer holder from EZ-IO insertion kit if available.
     - Tape IV tubing to the skin to avoid tension on the tubing that might displace the needle
     - Place IV extension tubing connected to the hub with 3-way stopcock to avoid pulling on the needle

2. Assess for the following a minimum of every 2 hours (Peds, every hour):
   - Confirmation of correct placement
     - The catheter is firmly seated and does not move
     - Medications or fluids flow without difficulty (there may be some resistance with first flush)
     - Appropriate response to medications
   - Evidence of IO needle dislodgement
   - Signs of infiltration/ extravasation (swelling particularly to the posterior surface, redness, pain)
   - Signs of infection
   - Pain at site
   - Signs of compartment syndrome (severe pain, tight skin)
   - Dressing is clean, dry and intact

MEDICATION/BLOOD ADMINISTRATION FLUSHING

3. Place wristband which is included in the EZ-IO insertion kit (and indicates when IO device must be removed on patient (EZ-IO only)
4. Administer fluid, medication or blood/blood products per physician's order.
5. **Do not** administer chemotherapy, hypertonic solutions, or total parenteral nutrition via intraosseous device.
6. Flush the catheter as follows with 10 mL normal saline (adults), 5 mL normal saline (Infants/Peds) over 5 seconds.
   - After insertion before medication/fluid/blood administration (must be flushed prior to use or there will be no flow)
   - Before administering fluids/medication into IO device if it is saline locked
   - After medication bolus administration
7. Flush IO device with 2% lidocaine (no preservatives, no epinephrine) as ordered prior to normal saline flush *for patients who are responsive to pain* as follows:
   - Flush lidocaine as ordered, followed by approximately 1 mL NS (to clear lidocaine from extension tubing), slowly, over 120 seconds. Approximate usual dosage:
     Adults:
     - 60 kg: 30 mg (1.5 mL)

- 70 kg: 34 mg (1.7 mL)
- 80 kg and above: 40 mg (2 mL)

- Allow to dwell for 60 seconds
- Administer normal saline flush as above item #6
- Call provider to order additional lidocaine flush if patient is unable to tolerate therapy. (One half of the previous dose may be ordered to be flushed over 60 seconds).
  Note: Lidocaine flush for pediatric patients is performed by the physician

BLOOD SPECIMENS

8. Aspirate 3 mL of blood, re-clamp extension set, and discard this first syringe of blood.
9. Aseptically attach another syringe to the extension set. Withdraw the appropriate amount of blood for laboratory tests and immediately transfer to specimen tubes using transfer device.
10. Flush the IO with 3-10 mL of normal saline.
11. Note on lab request that the specimen is from the IO site.
12. Remove IO device as ordered using the following steps (trained RNs only in adult patients only):
    - Remove saline lock device
    - Attach 5-12 mL luer lock syringe to hub of IO device
    - Grasp syringe, twist clockwise and firmly pull out device (Do not rock or bend during removal)
    - Apply manual pressure to the site for several minutes, then apply bandage or 2x2 gauze

SAFETY

13. Ensure saline lock device is attached to IO device hub.
14. **Do not** send patient to MRI with IO device.
15. Ensure IO device is removed before patient is discharged or transferred to acute care unit.

COLLABORATION

15. Collaborate with physician regarding need for lidocaine administration for patients who are responsive to pain before initial flush, and for continuing pain.

PATIENT/ FAMILY TEACHING:

16. Instruct on the following:
    - Purpose of IO device
    - Not to manipulate device
    - To notify the nurse for increased pain at site or dislodgement of device

PROVIDER NOTIFICATION:

17. Notify the provider immediately for the following
    - Unrelieved pain
    - Site infiltration/ extravasation
    - Site infection
    - Dislodgement of IO device
    - Signs of compartment syndrome
    - Device exceeding 24 hours

ADDITIONAL STANDARDS:

18. Refer to IV Therapy Nursing Clinical Standard as indicated.

DOCUMENTATION:

19. Document in accordance with documentation standards.
20. Document in iView, Lines & Devices, customize view and add dynamic group
    Documentation should include:
    - IO site
    - Gauge
    - Number of insertion attempts (if more than one)
    - Date and time of insertion
    - Assessment of site for signs of infection and/or extravasation
    - Patient and/or family teaching
    - Date and time of discontinuation
    - Assessment of site after IO device is removed

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References:

Day, M. W. (2017) Intraosseous Devices. Procedure Manual for High Acuity, Progressive, and Critical Care. AACN. 7th Edition. 748- 757.

EZ-IO by Vidacare Pocket Guide. Retrieved from Vidacare.com

The Consortium on Intraosseous Vascular Access in Healthcare Practice (2010). Recommendations for the sse of intraosseous vascular access for emergent and nonemergent situations in various healthcare settings: A consensus paper. Retrieved from ins1.org

Pearls of IO access (2014). Retrieved from Vidacare.com

Procedure guidelines for EZ-IO (2014). Retrieved from Vidacare.com

Pediatric Advanced Life Support Provider Manual (2016) American Heart Association (235 -237)

Emergency Nursing Pediatric Course ENPC 4th Edition (2013). Emergency Nurses Association (126-127, 269)