Queensland Paediatric Emergency Care

Skill Sheets

Intraosseous (IO) Device Insertion & Management

The insertion of an intraosseous (IO) device is a life-saving intervention in clinical situations where intravenous access is unable to be immediately obtained. IO access should only be utilised until more definitive access is obtained. The IO should only be used for up to 24 hours, unless clinically indicated. Most children will have IO access obtained using the Arrow® EZ-IO® system. In neonates and infants under 6 months, a manual insertion technique can be considered. The Arrow® EZ-IO ® system can be manually inserted (without using the drill). Other brands of IO devices may also be available. Always refer to specific manufacturer instructions.

Contraindications

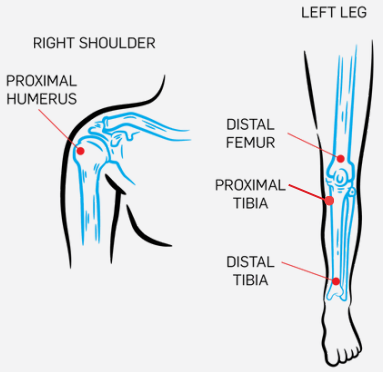
- Open injury or burn to limb
- Known bone pathology at site eg. fracture, bone cancer, osteoporosis
- Infection at the site
- Previous attempt at IO insertion on limb in previous 48 hours
- Prosthesis
- Inability to adequately identify landmarks

Insertion Site Selection

Inspect the anticipated site of insertion to ensure there are no contraindications to insertion in the selected limb.

Humerus
Location: Proximal, 1-2cm above the surgical neck
Used in adolescents and adults

Femur
Location: Distal, midline, 2-3cm above the external condyle



Proximal Tibia
Location: Anteromedial surface, 2-3cm below tibial tuberosity
Preferred in paediatrics

Distal Tibia
Location: Proximal to the medial malleolus

Refer to the Arrow® EZ-IO® Landmarking Guide and for brand specific details of landmarking insertion sites.

Needle Size Selection

Consideration to the body habitus of the patient and the specific location of the insertion site is required to select the appropriate sized device. To select the appropriate size device, first check the patient's weight. If there are two suitable sized options, then consider the insertion site, body habitus and soft tissue deposit of the patient to determine if a longer or shorter needle is required.

COLOUR	NEEDLE LENGTH		WEIGHT
PINK	EZ-IO® 15mm		3-39KG
BLUE	EZ-IO® 25mm		≥3kg
YELLOW	EZ-IO® 45mm		≥40kg

Insertion

1 GATHER

Antiseptic swab

EZ-IO® Power Driver

Correctly sized IO Kit

Drawing up needle

10mL Syringe

0.9% Sodium Chloride

ALERT

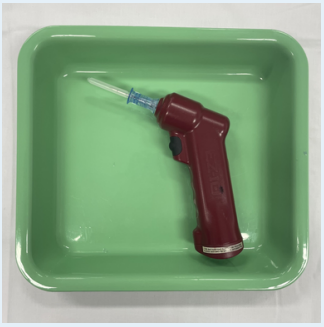
In neonates up to two weeks, the Umbilical Vein (UV) is the preferred access site.
IO access is more likely to result in complications and catheter failure in this age group.

2 PREPARE

Open the appropriately sized IO kit and prime the extension set with 0.9% Sodium Chloride. Leave syringe attached.

3

Open needle kit packaging and attach the EZ-IO® needle to the compatible EZ-IO® driver. Leave the safety cap on until ready to insert.



4

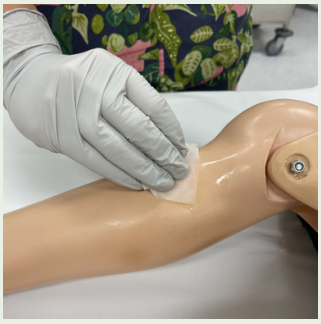
Perform hand hygiene and don gloves. An aseptic clinical handwash of 30 seconds is sufficient.

ALERT

If the child is conscious and time permits, consider infiltration of 1% lidocaine (0.4mL/kg) to the subcutaneous tissue prior to IO device insertion.

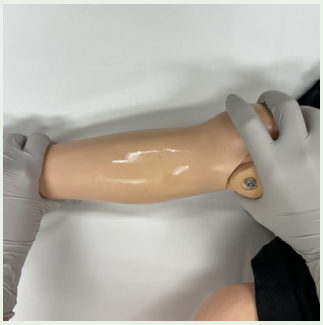
5 PROCEDURE

Using aseptic non-touch technique, clean skin at the selected insertion site with 2% Chlorhexidine Gluconate and 70% alcohol.



6

Stabilise the limb. You may need an assistant to help you with this. Do NOT place your hand behind the insertion site.



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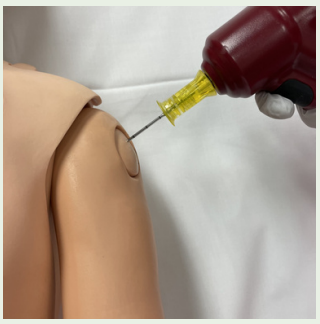
Humerus OR All other sites

Remove safety cap. Position tip of needle at insertion site.

Position needle set at a 45° angle to the bone.



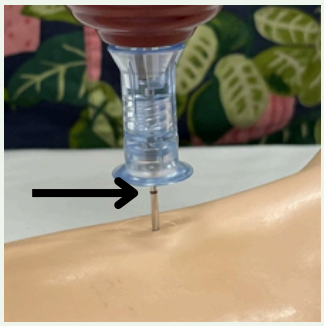
Position needle set at a 90° angle to the bone.

8

Push the needle set tip through the skin until the tip rests against the bone.

9

Ensure that one black line is visible. If no black line is visible, a longer needle must be considered prior to proceeding to the next step.



10

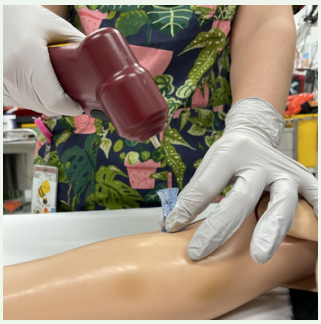
With a steady, consistent downward pressure, gently squeeze the driver's trigger, guiding the needle until it penetrates bone.

11

Release driver's trigger and stop advancing when a sudden "give" or "loss of resistance" is felt on entry to the medullary space.

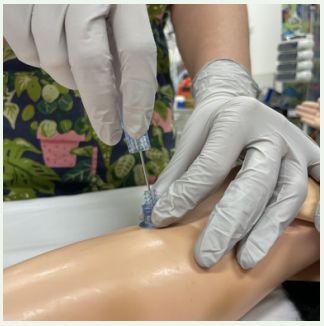
12

Stabilise the hub and detach the needle from the power driver.



13

Stabilise the hub and remove the inner stylet from the device in a counter clockwise motion. Discard stylet in sharps container.

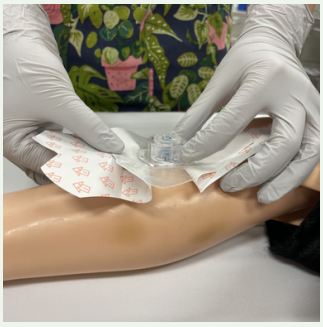


14

Confirm position by aspirating marrow directly from hub. Marrow aspiration may not always be successful.

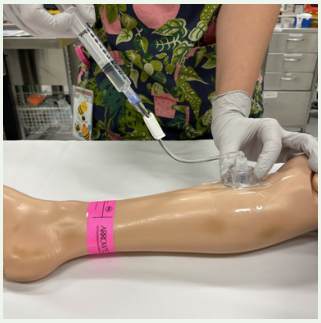
15

Remove the plastic backing from the dressing, place over hub and apply to skin.



16

Attach primed extension set to catheter hub. Flush the line and lock with clamp. Attach pink identification band to the limb.



Tips

If aspiration was unsuccessful, reattempt after flushing device with 0.9% Sodium Chloride.

When administering any medication or fluid via an IO device, manually stabilise the hub of the device to prevent device migration out of the medullary space (as seen in Step 16). Observe closely for signs of extravasation.

Blood Sampling Considerations

There are circumstances that point-of-care testing (via iSTAT) of IO samples will be useful to help guide care decisions for the patient. There is some variation between values obtained by IO sample when compared to venous or arterial samples.

- NOT to be tested: FBCs, Coagulation Studies, Transfusion Assay, Blood Gas Analysis
- Potassium (K+) samples will be significantly different
- AST, ALT and ALP may be increased
- Other biochemistry sample difference should be clinically insignificant

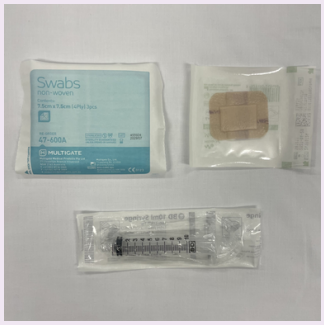
Management of the IO Device

- The insertion site and limb should be monitored for signs of extravasation at least hourly and immediately prior to use. Hourly neurovascular observations of the IO accessed limb must be completed.
- All fluids and medications that are administered via a central line can be safely infused through an IO.
- It is preferred for fluid and medication to be pushed manually. Medications may be administered via a pump if clinically required, however note that high pressure alarms may result due to the closed compartment nature of the medullary space. Close observation of the infusion and pump is required. Consider moving infusions from the IO device to a more definitive access point (central line, peripheral intravenous cannula) as soon as practicable.
- If the patient is conscious, use of the IO device will be painful. Consider an intraosseous lignocaine flush as per CREDD.

Removal

1 GATHER

Gather equipment required for device removal; gauze, adhesive dressing and a 5mL or 10mL leur lock syringe.

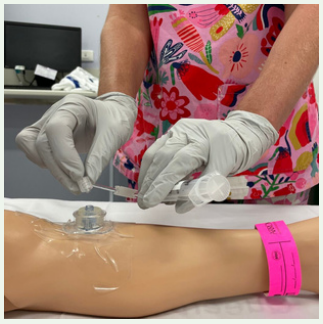


2 PREPARE

Perform hand hygiene and don gloves. An aseptic clinical handwash of 60 seconds is sufficient.

3 PROCEDURE

Stabilise the catheter hub and unscrew the extension set from the needle hub



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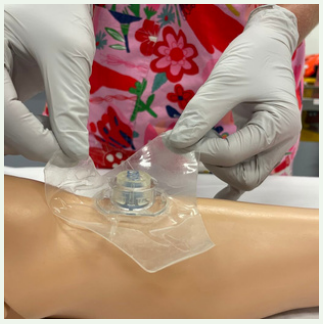
Remove the securement dressing with caution.



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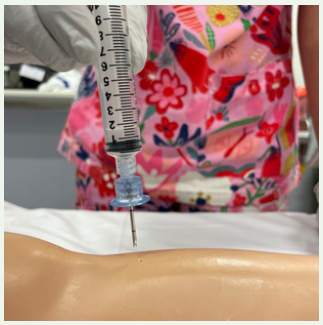
Attach a 5 or 10mL sterile leur lock syringe to act as a handle and to cap the open intraosseous port.

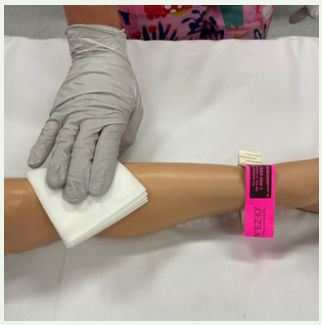
6

Grasp syringe and continuously rotate clockwise while removing the needle. Maintain a 90° angle to the bone.



7

Dispose of catheter in sharps container. Apply pressure to site and replace with an adhesive dressing.



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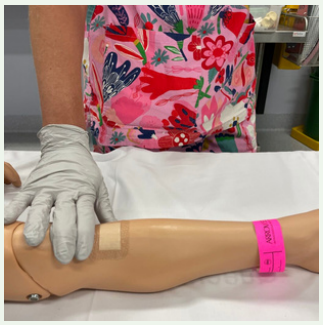
The pink identification band must remain on the limb and neurovascular observations must be completed for 48 hours post removal.



Complications

IO insertion is a life saving procedure, however it is not risk-free. Possible complications of IO device insertion and use include: extravasation, dislodgement (younger children are at highest risk, manual stabilisation in addition to dressing application is required), compartment syndrome, infection or fracture of the bone and air embolus.

For further information:

Video: Intraosseous Device Insertion
Arrow® EZ-IO® Paediatric Clinical Resource
Arrow® EZ-IO® Proximal Humerus Landmarking Guide
CHQ Procedure: Insertion, Management and Removal of Intraosseous Devices

References:

This Queensland Paediatric Skill Sheet was developed by the Emergency Care of Children working group (funded by the Queensland Emergency Department Strategic Advisory Panel) with the help of the following resources:

Australian and New Zealand Committee on Resuscitation (ANZCOR). (2024). Paediatric Advanced Life Support (PALS): Intraosseous injection and infusion. Retrieved 16 April 2025 from https://www.anzcor.org/home/paediatric-advanced-life-support/guideline-12-2-paediatric-advanced-life-support-pals/

Children's Health Queensland. (2024). Procedure: Insertion, Management and Removal of Intraosseous Devices. Retrieved 16 April 2025 from https://qheps.health.qld.gov.au/__data/assets/pdf_file/0030/2552691/Proc-80003.pdf/_nocache

Joerck, C. , Wilkinson, R. , Angiti, R. , Lutz, T. , Scerri, L. & Carmo, K. (2023). Use of Intraosseous Access in Neonatal and Pediatric Retrieval—Neonatal and Pediatric Emergency Transfer Service, New South Wales. Pediatric Emergency Care, 39 (11), 853-857. doi: 10.1097/PEC.0000000000003005.

Pathology Queensland, Chemical Pathology Briefing Note, 28/5/2020.

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Skill Sheet Disclaimer