1.1 Introduction and Who Guideline applies to

1.1.1 This document provides guidance for Healthcare Professionals on the use of emergency intraosseous (IO) cannulation in adult patients across all University Hospitals of Leicester sites.

1.1.2 Intraosseous cannulation is the insertion of a needle into a bone to allow the delivery of medications in emergency situations. When Intravenous access has failed, is inadequate, unlikely to be achieved or would significantly delay time critical treatment, intraosseous cannulation should be used. IO access has been included in the Resuscitation Council UK (2015) Advanced Life Support guidelines for cases in which intravenous access is difficult or unavailable.

1.1.3 Primary Intraosseous sites for the EZ-IO include the proximal humerus, proximal tibia and distal tibia. Insertion sites should be used only when landmarks can clearly be identified. The EZ-IO may remain in place for up to 24 hours.

1.2 Scope

1.2.1 This guideline is a LOCSSIP for IO cannulation in line with NATSSIP requirements. (UHL Policy on Safety Standards for Invasive Procedures).

1.2.2 This guideline applies to all clinical staff who insert EZ-IO devices and/or care for and maintain intraosseous cannulas for adult patients within UHL. This guideline is for adult patients only and must not be used for paediatrics.

1.2.3 Individual clinical staff who undertake intraosseous insertion, use intraosseous cannula or remove intraosseous cannula must:

- Understand the UHL guideline on EZ-IO insertion. All staff have a responsibility for ensuring that the principles outlined within this document are applied.
- Receive training before practicing and attend a refresher as required.
- Take responsibility for arranging further practice to maintain and increase competency within the workplace.
- Practice in accordance with their own professional duties.
- Practice universal precautions.
- Practice an aseptic non-touch technique.
- Follow the UHL sharps injury procedure.
- Delegate to a more experienced practitioner if they are not competent to insert, use or remove intraosseous cannula.

2. Guideline Standards and Procedures

2.1 Standards for Practice

2.1.1 All staff that undertake intraosseous cannulation must:
• Have knowledge of this policy, the Vascular Access UHL policy and Infection Control policy.
• Understand their legal responsibilities.
• Have a knowledge of the anatomy and physiology of the various intraosseous cannulation sites.
• This procedure is only to be undertaken if trained to do so. Practitioners with current verified ATLS status, are considered as trained.
• If unsure of their competency in this procedure, hand over the responsibility to a more expert practitioner. The practitioner must ensure that the person delegated to perform the task in competent to do so.
• Only attempt intraosseous insertion twice and if unsuccessful ask for a more experienced practitioner to make further attempts.

2.2 Indications

2.2.1 EZ-IO devices should be considered where there is no or inadequate IV access and an immediate need for fluids and/or medication to treat or prevent cardiac arrest, peri-arrest or emergency situations.

2.2.2 Other situations where there is no or inadequate IV access and IV access is difficult or has failed and there is an immediate or urgent need for fluids and/or medication.

2.3 Contraindications

• If a patient with capacity refuses consent.
• If the practitioner is put at risk (e.g lack of patient compliance).
• Fracture in the targeted bone.
• Excessive tissue or absence of adequate anatomical landmarks.
• Infection at area of insertion site.
• Previous, significant orthopaedic procedure at site (e.g prosthetic limb/joint).
• IO access in targeted bone within past 48 hours.

2.4 Caution

• The stylet and catheter are made from tungsten steel and therefore are not MRI compatible- therefore must not go into an MRI scanner.

2.5 Possible Complications

2.5.1 The following are potential complications and the patient should be observed for;

• Extravasation of fluid.
• Compartment syndrome.
• Fracture of target bone.
• Infection.
• Pain on insertion.
• Skin necrosis.
• Embolism.
2.6 Equipment required

2.6.1 An EZ-IO power driver and suitably size EZ-IO needle based on patient size and weight. The weight range on EZ-IO needle sets is a guide only and not an absolute indication that the needle is appropriate for a particular weight. The most important check of correct needle length is once it is inserted through the skin and soft tissue and makes contact with the target bone, there must be at least one black mark on the needle still visible.

2.6.2 All reusable equipment (the EZ-IO power driver) must be reprocessed in line with manufacturers instructions.

2.6.3 The EZ-IO and needle sets are kept in the Critical Care Outreach Teams (CCOT) grab bag at all three sites across UHL. The CCOT are responsible for the maintenance of these.

2.6.3 Needles are;

- Pink: 15mm, 3-39kg (typically used in infants and small children).
- Blue: 25mm, 40kg or over (typically used in children and adults).
- Yellow: 45mm, 40kg or over (typically used in larger adults and for humeral insertion).

2.6.4 Equipment required;

- EZ-Connect (extension set with needle free connector).
- 0.9% Sodium Chloride flush.
- Two empty 10ml syringe (if attempting a sample collection).
- Consider preservative free 2% lidocaine for patients responding to pain.
- Non-sterile non latex gloves.
- 2% Chlorhexidine in 70% Isoprolol wipe. (e.g skin wipe).
- EZ IO stabiliser dressing.
- Cannulation tray.
- Sharpes bin.

2.7 EZ-IO Procedure (Preparation)

- Wear personal protective equipment.
- Obtain suitable assistance as required.

2.7.1 Identify the patient: Check name, date of birth and hospital number.

2.7.2 Ascertain the need for IO cannulation and if possible obtain consent as per UHL policy.

- Choose appropriate sterile needle set and assemble equipment including appropriate receptacle for sharps.
- Draw up 10mls Sodium Chloride 0.9% solution into syringe.
- Connect syringe to the EZ-Connect lumen and prime with normal saline solution- leave the syringe attached to EZ-Connect.

2.8 EZ-IO Procedure (Assessment)

2.8.1 Locate target site on selected limb and assess viability for needle insertion.

2.8.2 EZ-IO- 25mm needle (Blue).
Proximal Tibia- Insertion site is approximately 2cm below the patella and approximately 2cm (depending on patients anatomy) medial to the tibial tuberosity.

Distal Tibia- Insertion site is located approximately 3cm proximal to the most prominent aspect of the medial malleolus. Place one finger directly over the medial malleolus; move approximately 2cm proximal and palpate the anterior and posterior borders of the tibia to assure that your insertion site is on the flat centre aspect of the bone.

Proximal Humerus- Insertion site is located directed on the most prominent aspect of the greater tubercle. Slide thumb up the anterior shaft of the humerus until you feel the greater tubercle, this is the surgical neck. Approximately 1cm (depending on patient anatomy) above the surgical neck is the insertion site. Ensure that the patients hand is resting on the abdomen and that the elbow is adducted (close to the body).

2.8.3 EZ-IO 45mm needle (Yellow).

Is recommended for the proximal humerus in patients with excessive tissue over the insertion site or when a black line is not visible after penetration into the tissue.

2.8.4 EZ-IO 15mm needle (Pink).

Consider tissue density over the landmark desired.

Proximal Tibia- The insertion site is located approximately 2cm medial to the tibial tuberosity along the flat aspect of the tibia. Carefully feel for the ‘give’ or ‘pop’ indicating penetration into the medullary space.

Distal Tibia- Place one finger directly over the medial malleolus; move approximately 2cm (depending on patient anatomy) proximal and palpate the anterior and posterior borders of the tibia to assure that your insertion site is on the flat centre aspect of the bone.

Proximal Humerus- Insertion site is located directed on the most prominent aspect of the greater tubercle. Slide thumb up the anterior shaft of the humerus until you feel the greater tubercle, this is the surgical neck. Approximately 1cm (depending on patient anatomy) above the surgical neck is the insertion site. Ensure that the patients hand is resting on the abdomen and that the elbow is adducted (close to the body).

2.8.5 See appendix one for diagrams of insertion sites.

2.9 Procedure (Insertion)

Clense site using cleaning agent currently being used for IV cannulation.

Stabilise the Limb of the selected target site.

Insert EZ-IO needle into the selected site.

Position the driver at the insertion site with the needle set at a 90 degree angle to the bone surface. Gently pierce the skin with the needle set until the needle set tip touches the bone.

Check to ensure that at least one black line is visible and the needle is touching the bone. If no black line is visible, patient may have excessive soft tissue over selected insertion site and needle set may not reach the medullary space. Consider and alternative site for insertion or a longer needle.

Penetrate the bone cortex by squeezing the driver’s trigger and applying gentle, consistent, steady, downward pressure (allow the drive to do the work).

Release the driver’s trigger and stop the insertion process when the hub is almost flush with the skin or when you feel a decrease in resistance.

Remove EZ-IO power driver from needle set while stabilising the catheter hub.

Remove stylet from catheter by turning counter-clockwise and immediately dispose of stylet in an appropriate sharps container.
• Connect primed EZ-Connect to exposed luer-lock hub on EZ-IO needle.
• Confirm placement by aspirating bone marrow into EZ-Connect.
• Syringe bolus: flush the catheter with the remaining Sodium Chloride 0.9%.
• Assess for post-insertion complications.
• Disconnect 10ml syringe from EZ-Connect extension set and provide therapy.

2.10 EZ-IO Procedure (Aftercare)
• Begin infusion utilising a pressure delivery system- via a pressure bag or syringe.
• Secure needle using an appropriate dressing.
• Continue to monitor extremity for complications on a regular basis, especially pre and post infusions.
• Document time, date rationale and any supporting information for EZ-IO insertion in the medical notes.
• Ensure all multi-disciplinary staff are fully informed of the procedure.
• Insert care pathway into patients notes (see appendix one).

2.11 EZ-IO Procedure (Removal)
• Remove the extension set from the needle hub.
• Attach a sterile syringe (with standard Luer lock) to act as a handle and to cap the open IO port.
• Grasp the syringe and continuously rotate clockwise while gently pulling the catheter out (maintain a 90 degree angle to the bone). Do not rock or bend during removal.
• Dispose of IO needle into an appropriate receptacle for sharps.
• Apply pressure to site as needed; apply adhesive dressing as indicated.
• The catheter should not remain in place for greater than 24 hours.
• Document time and date of removal in medical and nursing notes.

3. Education and Training
3.1.1 Intraosseous cannulation, use and removal require training prior to practice.
3.1.2 Training will be provided on all Resuscitation Council (UK) Advanced Life Support and Modified Immediate Life Support courses. These can be accessed via the clinical skills unit National course lead/Senior Resuscitation Officer.
3.1.3 Training will be targeted at registered healthcare staff that may need to use intraosseous cannula in their clinical duties.
3.1.4 Non medical staff that have been trained in intraosseous cannulation outside of UHL should be assessed locally either by an appropriately experience practitioner or by the Resuscitation Service (see appendix two for assessment form) and this will be recorded.
3.1.5 Refresher training is not mandatory but practitioners must be satisfied that they are meeting their professional requirements and seek training if there is any doubt about their competency.
3.1.6 Use of the IO cannula is similar to the use of an IV cannula and staff that use these cannulas must also undertake an intravenous course.
4. Monitoring Compliance

<table>
<thead>
<tr>
<th>What will be measured to monitor compliance</th>
<th>How will compliance be monitored</th>
<th>Monitoring Lead</th>
<th>Frequency</th>
<th>Reporting arrangements</th>
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</thead>
<tbody>
<tr>
<td>Duration of insertion must be under 24 hours.</td>
<td>IO Care Pathway inserted into patients notes.</td>
<td>Critical Care Outreach Team.</td>
<td>Each Insertion</td>
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5. Supporting References


6. Key Words

Intravenous (IV)- situated within or administrated by entering a vein.

Intraosseous (IO)- situated within or administrated by entering a bone.

Practitioner- One who is legally accountable or responsible for their practice. Including- Doctors, Nurses, Operating Department Practitioners, Radiographers and Midwives.

CONTACT AND REVIEW DETAILS

<table>
<thead>
<tr>
<th>Guideline Lead</th>
<th>Executive Lead</th>
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<tr>
<td>Katrina Short</td>
<td>Critical Care Outreach Nurse</td>
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Details of Changes made during review:

- More information given for the care of IO needles, including a care pathway, information sheet and insertion site diagram.
- Stated that this guideline is a LOCSSIP for IO cannulation.
- Limb monitoring chart for hourly observations.
- Clarified that this procedure is only to be undertaken if trained.
- Clarified that UHL uses the EZ-IO system.
- Reviewed by the Resuscitation Committee, following changes made;
  1. Stated that IO devices are carried by the Critical Care Outreach team
  2. Infusions are delivered via a pressure system.
  3. Using a pink name band and leaving in place for 48hrs post removal.
  4. Clarified training provided.
- Pink band following insertion removed from policy as these did not align with UHL patient ID Band Policy- following discussion with Claire Agnew Van Asch.
Appendix One- Intraosseous Insertion Sites

Ensure adequate training has been taken in the correct land marking techniques for the following sites, prior to using the EZ-IO.

3 Sites, 6 Options

**Proximal Humerus**
- Preferred site for adults
- Optimal site for high flow and quick drug uptake
- Awake, responsive patients
- Less painful

**Proximal Tibia**
- Unresponsive
- Unfamiliarity with other sites
- Unable to landmark other sites

**Distal Tibia**
- Larger patient
- Unable to access other sites
Appendix Two- Intraosseous Care Pathway

Intraosseous Care Pathway
Information sheet for the Care, Maintenance and Removal of IO needles.

How to assess the IO site for patency
- If there are no signs of complications or infection, attempt a flush of 5-10mls 0.9% Normal Saline.
- If there is resistance in the line, perform a rapid syringe flush of 5-10mls 0.9% normal saline. *This helps clear the intraosseous marrow and fibrin allowing for effective infusion rates.*
- Complete flushes minimal of 8 hourly.

What to assess
- Frequent assessment is essential for safe vascular access management.
- Verify placement prior to each infusion.
- Assess for signs of complications- including infiltration/ extravasation.
- Assess flow rates and for any pharmacological effects of infusions.
- Whilst IO needles are in place in the humerus, movement of the affected arm should be minimised- it must not be elevated above the shoulder.
- Patients must not have an MRI whilst the IO needle is in place.

Signs of Infiltration/ extravasation
- Inflammation at or near the insertion site.
- Blanching and coolness of the skin around the insertion site.
- Damp or wet dressing.
- Slowed or stopped infusion.
- Burning/ stinging pain.
- Redness, followed by blistering, tissue necrosis and ulceration.

How to remove IO needle
- Remove any extension set and any dressing insitu.
- Attach a 10ml luer-lock syring to the hub.
- Whilst maintaining axial alignment, twist the syringe and catheter clockwise whilst pulling straight out.
- **Do not rock or bend during removal.**
- Place the needle into a designated sharps container.
- Apply gentle pressure as needed and apply a clean dressing to site.
- There are no activity restrictions after removal.
- Document in medical notes; time and date of removal.

**Intraosseous Monitoring**

Please complete on receiving the patient and every hour following this. Until removal of IO. IO must be removed once IV access is obtained, or within 24 hours.

<table>
<thead>
<tr>
<th>On handover</th>
<th>Is your IO needle still required?</th>
<th>Is the IO needle still patent?</th>
<th>Any signs of infiltration/ extavasation?</th>
<th>Any signs of infection?</th>
<th>Flush?</th>
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24 hours  |  IO needle MUST be removed at 24 hours post insertion

Appendix Two- Assessment of Intraosseous Cannulation

**SUPERVISED PRACTICE RECORD FOR INTRAOSSEOUS CANNULATION USED FOR EMERGENCY INTRAVASCULAR ACCESS**

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<th>ADDRESSOGRAPH</th>
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Consultant:

Ward:

Date:

Site of insertion: …………………………………………………………………………

Adverse events: ……………………………………………………………………………

Action taken: ……………………………………………………………………………….

Intraosseous Care Pathway Inserted into notes………………………………………..

Supervisors name: ………………………………… Designation…………………………

Technique performed correctly : YES / NO

Additional comments: …………………………………………………………………..

……………………………………………………………………………………………..

Supervisors signature: …………………………… Date: ………………………

Supervisee’s comments: ………………………………………………………………..

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