University Hospitals of Derby and Burton
NHS Foundation Trust

Intraosseous Cannulation - Full Clinical Guideline

Reference No: CG-EMD/2023/008

Aim

To provide guidance for the safe insertion of a rapid alternative route for emergency fluids or drugs when other venous access routes are unavailable.

Definition

Intraosseus (IO): Situated within, occurring within or administered by entering a bone.
EZ-IO™: is the bone drill system and the system of choice within the trust for all patients.

Location of EZ-IO Bone drills	
Royal Derby Hospital	**Queens Hospital Burton**
Children's Emergency Department (CED)	Emergency Department (Room 14)
Adult Emergency Department (ED)	ITU
ITU	Main Theatres (in recovery)
Neonatal ICU	Ward 1
Dolphin ward	Ops Room
Hospital Out of Hours team (level 4)	Resuscitation & Simulation Team
Resuscitation & Simulation Team	

Indications for use

Should be considered in:

- Cardiac Arrest where vascular access is urgently required but not immediately available.
- A patient in a peri-arrest condition and no other venous access is available within the 90 -120 seconds advised by the European Resuscitation Council.

Insertion of Intraosseous Cannula

THIS PROCEDURE SHOULD ONLY BE UNDERTAKEN BY MEDICAL STAFF OR NURSING STAFF WHO HAVE RECEIVED TRUST APPROVED TRAINING.

Contact the Resuscitation and Simulation Department at RDH or QHB for further information on this training.

All staff that undertake intraosseous cannulation must:

- Understand their legal and professional responsibilities.
- Have knowledge of the anatomy and physiology of the recommended insertion sites.

Use

This technique is suitable for all ages and weights > 3kg.
There is only limited information regarding use in low birth weight or pre-term babies where umbilical venous access has been unsuccessful. However it has been used in babies >1.5kg.

Contraindications

- Existing proximal fracture of the tibia, femur or humeral head.
- Joint replacement in the same limb.
- Infection at site of access.
- Inability to locate landmarks.
- IO within the previous 24 – 48 hours in the targeted bone.
- If a patient with capacity refuses consent.

Please note that burns to the limb is **not** a contraindication.

Needle Selection

EZ-IO™
3-39kg = 15ga/15mm (Pink) *typically used in infants and very small children*
≥ 3kg = 15ga/25mm (Blue) *typically used in children and adults*
≥ 40kg = 15ga/45mm (Yellow) *typically used in larger adults and for humeral insertions in most adults*

Sites Available

Proximal tibia on the anterior-medial surface, 1-3cms below the tibial tuberosity – *All children and adults.*

Distal tibia on medial surface, 2cm proximal to the medial malleolus – *All children and adults.*

Distal femur, on anterior surface, 3cms above the condyles – *Not to be used in neonates. Can be used in children.*

Proximal Humerus – Site of insertion located directly on the most prominent aspect of the greater tubercle. Approximately 1 cm above the surgical neck is the insertion site. *Only for use in patients over the age of 5 years of age.*

Considerations

Ensure the administration of a rapid **SYRINGE BOLUS (flush) 5-10mls of 0.9% saline** prior to infusion - NO FLUSH = NO FLOW

Conscious Patients

Patients who are acutely unwell / peri-arrest may experience discomfort on insertion of the needle; however the administration of medication and fluids is

significantly more painful. 1% Lignocaine (preservative free) should be considered and prescribed to reduce pain from infusion of drugs or fluids.

Dose - 0.5mg / kg (maximum dose 20 - 40mg). (Appendix 1)

This should be administered very slowly (over 2 minutes) through the Intraosseous cannula so that it remains in the medullary space and prevents it being injected/sent directly into the central circulation.

Uses of the Intraosseous Route

The bone marrow aspirated can be used for bedside glucose testing or haemoglobin testing ONLY
Isotonic fluids, plasma and whole blood may be given.
All resuscitation drugs, antibiotics and fluids can be given safely via this route using a pressure device. Drugs should be flushed with 10 mls sodium chloride 0.9% after administration to ensure entry into the central venous channel.

DO NOT PUT SAMPLE IN THE BLOOD GAS MACHINE

Complications

- Osteomyelitis
- Embolism
- Pain on insertion
- Fracture of the target bone
- Compartment syndrome
- Through and through puncture
- Abscesses and minor skin infections
- Extravasation of fluid and drugs.
- Bone growth disturbance (only in babies & children)

As with any cannula site, the infusion must be stopped and the cannula removed if complications occur.

Care of cannula

- Secure the needle with the EZ-IO dressing.
- Continue to monitor extremity for complications pre and post infusion.
- Apply pink EZ-IO wrist band next to patient ID band (supplied in needle pack).
- Document the time, date, site and rationale in medical notes.
- Communication with staff caring for patient to ensure familiarity with specific care of patient.

Removal of Intraosseus cannula

The cannula should be removed as soon as peripheral or central access has been obtained and secured or within 24 hours of insertion.

- Remove the extension set from the needle hub.
- Attach a 5 -10ml luer-lock syringe to act as a handle and to cap the open port. Hold syringe and rotate clockwise while gently pulling catheter out (maintain a 90- degree angle to the bone) DO NOT ROCK OR BEND during removal.
- Check needle is intact and document in medical records.
- Dispose of sharps.
- Apply pressure and apply adhesive dressing.
- Continue to observe patient and site following removal.

Documentation

The insertion of an intraosseous cannula should be documented in the patient's medical and nursing records. This should include the site and any problems with insertion.

The removal of the intraosseous cannula should be documented in the medical and nursing documentation.

Checking procedure RDH

Equipment to be checked monthly. Local staff will continue to do this in CED, ED and OOH.

Resuscitation and Simulation Educators will check NICU, Dolphin ward and ITU.

Drill to be run and green indicator light checked. (If light is red the drill needs immediate replacement as 10% of battery remaining).

Expiry dates of consumables checked.

All to be documented and signed on appropriate checklist. (Appendix 2)

Checking procedure QHB

Equipment to be checked monthly. Local staff to do this in all areas with device.

Drill to be run and green indicator light checked. (If light is red the drill needs immediate replacement as 10% battery remaining).

Expiry dates of consumables checked.

References

European Resuscitation Council Guidelines (2021)
Resuscitation Council Resuscitation Guidelines (2021)

~~2015~~
Advanced Paediatric Life Support The Practical Approach 6th Edition 2011
Advanced Life Support 8th Edition Resuscitation Council 2021
Neonatal Life Support 5th Edition Resuscitation Council 2021

https://www.teleflex.com/usa/en/clinical-resources/ez-io/documents/EZ-IO_Science_Fundamentals_MC-003266-Rev1-1.pdf

Documentation controls:

Development of Guideline:	Resuscitation and Simulation Educator
Consultation with:	Paediatric Consultants, Paediatric Emergency Consultants, Neonatologist, Emergency Consultant, Consultant Intensivist, Clinical Practice Group and Trust Resuscitation Group
Approved by:	ED - Dec 2023 Medicine Division - Dec 2023
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Version / Amendment History	**Version**	**Date**	**Author**	**Reason**
	1	August 2000	Y Sant	Original guideline
	2	July 2007	Helen Rollé	Review Due
	3	September 2010	Helen Rollé	Review Due Addition of EZ-IO™
	4	November 2013	Caroline Cocking	Review due to updated ALS/NLS RC(UK)guidance
	5	August 2017	Caroline Cocking	Review Due
	5.1.0	22nd Nov 2019		Addition of lignocaine infusion appendix
	5.2.0	December 2019	Caroline Cocking	Minor update following NPSA 05.11.19
	5.3.0	March 2020	Caroline Cocking	Review as now UHDB
	6	December 2023	Victoria Baker	Review due

Intended Recipients:
All Medical and Nursing staff within Children's Emergency Department (CED), Emergency Department (ED), Anaesthetics, Neonatal Intensive Care Unit (NICU), Paediatrics, Intensive Therapy Unit (ITU).

Training and Dissemination: Guideline published on the Intranet. Trust approved training of EZ-IO™ insertion and competency assessment by Resuscitation and Simulation Educators
Distribution and Location of Guideline: Publication on Trust Intranet
To be read in conjunction with: Treatment guidelines from Resuscitation Council (UK).

Intraosseous administration of preservative-free lignocaine in the conscious patient

Read this guideline fully before use
– if in doubt seek senior medical advice

Appendix 1

Patient with intraosseous (IO) needle in situ *and* responsive to pain.

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Aspirate marrow for laboratory analysis, cross-match and culture if required.

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Exclude contra-indications to lignocaine: → Sino-atrial disorders, all grades of AV block, severe myocardial depression, acute porphyria.

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Consider cautions to lignocaine: → Epilepsy, respiratory impairment, impaired cardiac function, bradycardia, severe shock, myasthenia gravis, hepatic and renal impairment, congestive cardiac failure, hypertension, elderly, post-op cardiac surgical patients, reduce dose in debilitated patients.

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Monitor patient clinically.
ECG, SpO_2, BP as minimum

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Administer initial (higher) dose of IO lignocaine over 1 to 2 minutes. 0.5mg/Kg (max 40mg)*

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Flush the IO needle with *up to* 10 ml sodium chloride 0.9% over 5 seconds. *

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Administer subsequent (lower) dose of IO lignocaine over 30 seconds. *

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Inject or infuse fluids and medication *under pressure* as required. *

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If discomfort re-occurs, consider repeating subsequent (lower) dose of IO lignocaine at a maximum frequency of once every 45 minutes 0.25mg/Kg (max 20mg). *

*** Observe for extravasation, hypersensitivity and other side-effects with every IO lignocaine injection:**

Dizziness, parasthesia, nystagmus, rash, drowsiness, confusion, convulsions, respiratory depression, bradycardia, hypotension, methaemaglobinaemia.

If extravasation occurs, site a new IO needle. If side effects occur immediately stop administration and treat as appropriate.

*** The internal volume of the IO needle and extension set must be considered when calculating administration speed. Ensure the IO needle and other 'dead-space' (1ml) has been totally cleared of lignocaine before flush, medication or fluids are commenced.**

Volume of 1% preservative-free lignocaine			
Age	Weight (kg)	Volume of 1% (ml) 1 ml of 1% = 10 mg	
		Initial	**Subsequent**
Neonate	3	0.15	0.07
Neonate	4	0.2	0.1
2 months	5	0.25	.012
4 months	5.5	0.3	0.15
6 months	7	0.35	0.17
8 months	8	0.4	0.2
1 year	10	0.45	0.22
18 months	11	0.5	0.25
2 years	12	0.6	0.3
3 years	14	0.7	0.35
4 years	16	0.8	0.4
5 years	18	0.9	0.45
6 years	25	1	0.5
7 years	28	1.1	0.57
8 years	31	1.3	0.65
9 years	34	1.4	0.72
10 years	37	1.6	0.8
11 years	40	1.7	0.87
12 years	43	1.9	0.97
13 years	44	2.2	1.1
14 years	50	2.5	1.2
15 years	54	2.6	1.3
16 years	58	2.8	1.4
Adult	60	3	1.5
	70	3.4	1.7
	80+	4	2

Appendix 2

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ROYAL DERBY HOSPITAL MONTHLY RECORD TO CHECK INTRA-OSSEOUS ACCESS EQUIPMENT

The equipment in the locations identified below must be checked by a Resuscitation & Simulation Trainer and documented below.

Monthly - Check the DRILL (Green light evident on pressing the trigger) and contents of the bag against the contents list. Expiry dates must also be checked and equipment cleaned if required.

Initial the relevant box and print name and sign.

Month	Level 1 NICU	Level 2 ITU	Level 2 DOLPHIN Ward	RESUSCITATION & SIMULATION DEPT	Print Name: Sign:
January Date:					
February Date:					
March Date:					
April Date:					
May Date:					
June Date:					
July Date:					
August Date:					
September Date:					
October Date:					
November Date:					
December Date:					

Appendix 2

EQUIPMENT	**QUANTITY**
EZ-IO Drill with battery indicator light	1
Sterile Dressing Pack	1
ChloraPrep	1
I-O needle set 15mm (Pink)	1
I-O needle set 25mm (Blue)	1
I-O Needle set 45mm (Yellow)	1
1000 ml pressure bag (single use)	1
Posiflush 10ml	2