

Use of Intraosseous access in Neonatal and Paediatric Retrieval

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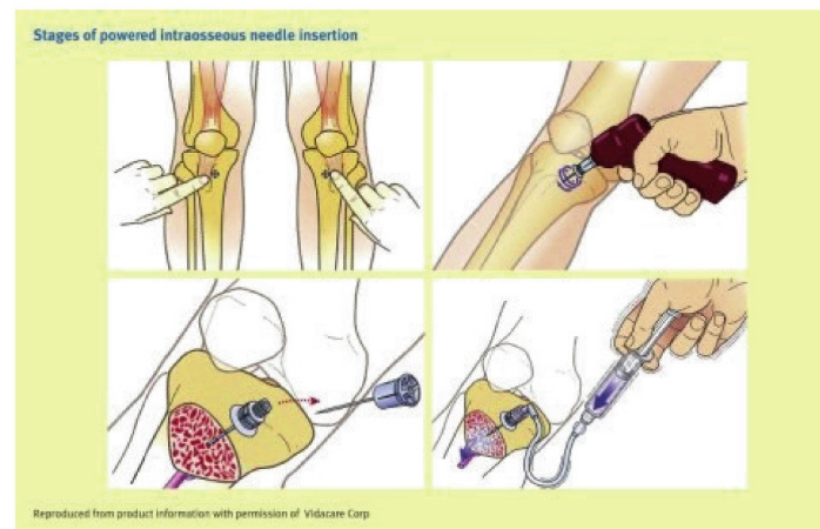
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Introduction

Rapid access for critically unwell neonatal and paediatric patients can be difficult and the intraosseous (IO) route allows quick access to central circulation via the bone marrow¹.

Guidelines for paediatric life support recommend early utilisation of an IO to obtain vascular access for rapid administration of resuscitation medications, fluids and antibiotics^{2,3}.

In comparison to adults, children have increased superficial tissue and compressible vasculature, posing a challenge during a presentation of severe septic shock or cardiac arrest. Placement of an IO by a skilled clinician provides a non-collapsible primary route for administration of life saving medications into the central venous circulation⁴.



Aim

To review the frequency, complications, and efficacy of IO insertion in neonatal and paediatric patients requiring retrieval by a neonatal and paediatric retrieval service.

Methods

This was a retrospective review of prospectively collected data obtained from the Newborn and Paediatric Emergency Transport Service (NETS NSW) database. Inclusion criteria were any child that had documentation of an attempted IO access in retrieval during the epoch 2006-2020.

Sydney Children's Hospital Network Human Research Ethics Committee approval 2020/ETH02818.

Results

IO access was documented in 467 patients (102 neonatal, 365 paediatric).

The most common presenting issue was sepsis; followed by respiratory distress, cardiac arrest and encephalopathy (seizures and meningitis).

Results

Descriptive	Neonatal 102 (21.8%)	Paediatric 365 (78.2%)
Mean age	PMA 39+3weeks (range: 24 – 44 weeks)	22.7 months
Median weight	3.25kg (IQR 3.78kg – 2.71kg)	10kg (IQR 12.88kg – 7.13kg)
Gender		
Male	63 (61.8%)	218 (59.7%)
Female	39 (38.2)	147 (40.3%)
Ventilated	70 (68.6%)	227 (62.2%)
IO injury rate	11 (10.8%)	52 (14.2%)
Mortality	19 (18.6%)	70 (19.2%)
Presenting issue at time of initial NETS call		
Sepsis	27 (26.5%)	53 (14.5%)
Respiratory distress	26 (25.5%)	56 (15.3%)
Cardiac Arrest	14 (13.7%)	62 (17.0%)
Encephalopathy	14 (13.7%)	98 (26.8%)
Cardiac failure	10 (9.8%)	19 (5.2%)
Metabolic/Endocrine disease	4 (3.9%)	15 (4.1%)
Gastrointestinal disease	3 (2.9%)	20 (5.4%)
Prematurity (≤ 30 weeks)	2 (2.0%)	
Renal disease	1 (1.0%)	3 (0.8%)
Trauma/Drowning/Burns		35 (9.6%)
Other	1 (1.0%)	4 (1.1%)

Table 1: Demographics and presenting conditions

Treatment	Neonatal	Paediatric
Fluid bolus	54 (28.3%)	169 (28.6%)
Antibiotics	33 (17.3%)	103 (17.5%)
Maintenance fluids	21 (11.0%)	67 (11.4%)
Resuscitation drugs (eg: Adrenaline)	19 (9.9%)	49 (8.3%)
Inotropes	16 (8.4%)	41 (6.9%)
10% glucose	14 (7.3%)	16 (2.7%)
Prostaglandin E ₁	7 (3.7%)	1 (0.2%)
Sedation	6 (3.1%)	31 (5.3%)
Blood products	4 (2.1%)	2 (0.3%)
Anticonvulsants	3 (1.6%)	50 (8.5%)
Induction drugs	3 (1.6%)	18 (3.1%)
Insulin	2 (1.0%)	8 (1.4%)
Analgesia	1 (0.5%)	8 (1.4%)
Unknown (not documented)	8 (4.2%)	27 (4.6%)

Table 2: Treatments delivered via IO catheter to neonatal and paediatric patients

PGE₁ was given to eight patients but did not result in reopening the ductus arteriosus.

Complications and associated IO related injuries occurred in 52 (14.2%) paediatric and 11 (10.8%) neonatal patients.

Complications and IO related injury included extravasation/sub-periosteal infusion, dislodgement, compartment syndrome, pain, complete bone penetration, and fractured right tibia.

Neonatal and paediatric mortality occurred in 18.6% and 19.2% respectively.



Example of injuries from extravasation of tibial IOs in a 29-day old term neonate with left heart obstruction

Discussion

Survival in retrieved neonatal and paediatric patients who required IO is higher than previously described in paediatric and adult cohorts⁵. The most common presenting diagnosis requiring IO was respiratory distress, sepsis, and encephalitis (seizures and meningitis).

When interpreting the efficacy of treatments ROSC occurred in 52.9% of patients receiving resuscitation drugs, perfusion improved in 73.1% of patients given a fluid bolus, blood pressure improved in 63.2% of patients after receiving inotropes and seizures terminated in 88.7% of patients after anticonvulsants. Additionally, 136 patients received timely antibiotics for early recognition of sepsis.

Recommendations

Early insertion of an IO facilitates early volume expansion and delivery of critical drugs. This allows time for retrieval teams to gain more definitive venous access to administer volume expansion, resuscitation medications, antibiotics and anticonvulsants.

In this study, PGE₁ delivered via a distal limb IO had no success in reopening the ductus arteriosus.

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