

Intraosseous Vascular Access

An obvious tool for resuscitation that can be used optimally to prevent one...

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History of Intraosseous Access

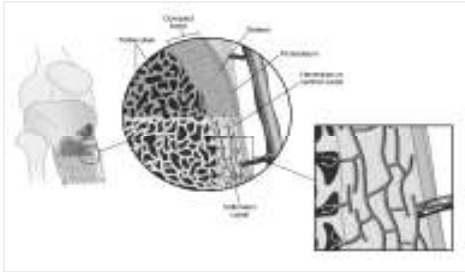
- Over 65 years as a safe effective alternative to IV
- 4,000 adult patients treated during the 1940's and 50's
- IO Access became a lost art for 40 years because no civilian EMS service existed to utilize the technique
- "Re-discovered" in 1985 by James Orłowski MD while on a trip to India
- PALS standards
- New Technology; EZ IO®, B.I.G™, FAST1®

Intraosseous Access Today

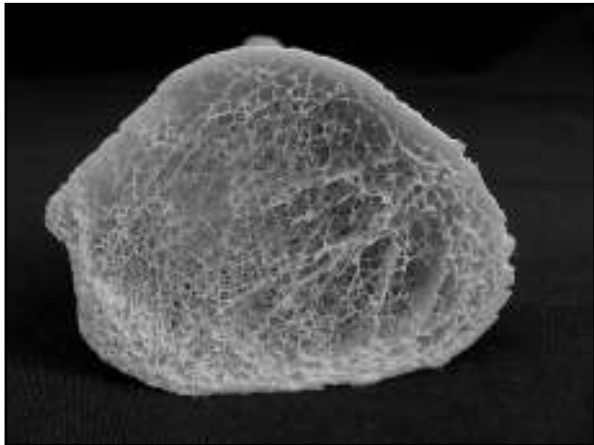
- Established standard of care in Pediatric Advanced Life Support (PALS)
- American Heart Association (AHA) and European Resuscitation Council (ERC) recommendation for all cardiac arrest patients
- Newly released position statement by the INS on IO access
- Nursing manuals and texts have been updated to include additional indications for use and management of IO infusions

IO Impact on the Military and EMS

Anatomy of Intraosseous Access



Thousands of small vessels lead from the medullary space to the central circulation



Who needs an IO?



- Patients with complicated vascular access
- Patients requiring multiple IV sticks to obtain vascular access for medication or fluid infusion
- Patients with limited or no vascular access that are decompensating
- Patients who previously required central venous access for infusion due to difficult vascular access
- Patients requiring rapid intubation or sedation
- Cardiac or respiratory arrest patients

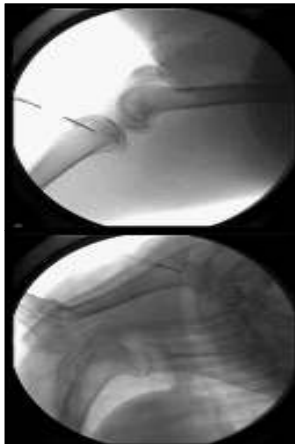
Difficult Vascular Access

- Limited information on frequency of DVA
- Based on data available; At least 8% of Adults and 14% of Children on the medical surgical floors are classified as "hard sticks"
- IVs cannot be started in over 5 million patients
- IVs are extremely difficult to start in over 7 million
 - Veins collapse due to shock
 - The more a patient needs an IV, the harder it is to find

The Average Peripheral IV Insertion takes 10 Minutes

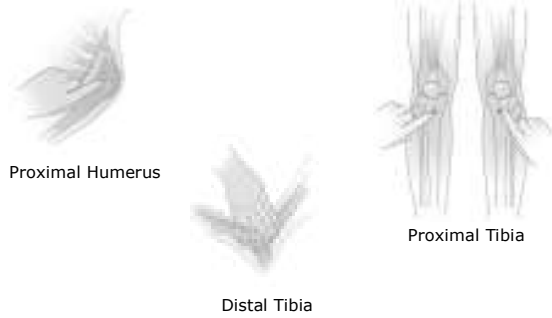
Contraindications for IO Access

- Fracture (targeted bone)
- Previous orthopedic procedures near insertion site
 - * Prosthetic Limb or joint
- IO within past 24 hours (targeted bone)
- Infection at the insertion site
- Inability to locate landmarks or excessive tissue

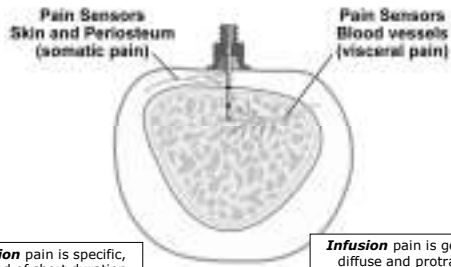


- Any medication approved for IV / central venous injection
- IO and IV doses are the same
- Follow each med administration with 3-5ml fluid push
- Lab Testing:
 - Draw 3-5ml for waste
 - Aspirate IO blood for standardized labs
 - May use heparinized syringe

Intraosseous Access Sites



Intraosseous Usage and Pain



Why Lidocaine? Anesthetic vs. Analgesic

- Lidocaine inhibits stimulation of those sensors and the propagation of signals along the efferent pain fibers
- Pain associated with IO infusion is related to stimulation of pressure sensors (nerve fibers) in the medullary space
- Pain management with analgesic agents can cause systemic effects and may not eliminate local pain
- Analgesics alter the perception of pain while anesthetics block sensation

Lidocaine Considerations

- 2 % (preservative free) Lidocaine - given intraosseously (IO) - has been shown to offer effective local anesthesia in most alert patients
- Adult dosage 20- 100 mg IO
- Pediatric dosage 0.5 mg/kg IO
- Infuse Lidocaine slowly (over 30 seconds)
- Allow 1 minute for anesthetic effect
- Repeat as needed for pain management
- **Only infuse fluids as fast as patient can tolerate**
DO NOT exceed 3 mg/kg in 24 hours



Flush!!!



- The IO space is filled with a thick fibrin mesh
- The medullary space must be pressure flushed to obtain maximum flow rates
- A minimum of 10ml is required for initial bolus
- Flush must overcome initial resistance felt with bolus administration
- More than one flush may be required to achieve maximum flow rate

FLUSH catheter

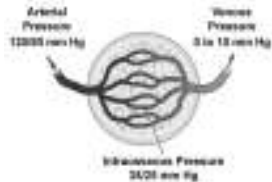


- Reminder: Patients responsive to pain may require 2% preservative free Lidocaine intraosseously PRIOR to flush
- Some patients may require multiple flushes

FLUSH catheter with 10 ml of a sterile solution

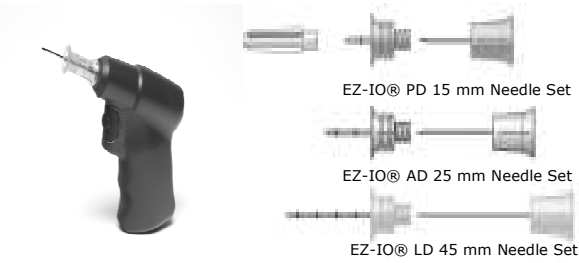
PRESSURE

- The pressure in the medullary space is approximately 1/3 of the patients arterial pressure
- Pressurizing fluids for infusion is required to obtain maximum flow rates
- For aggressive fluid resuscitation a rapid infuser may increase flow rates



EZ IO® Product System by Vidacare

- Adult and pediatric cleared - proximal humerus, proximal and distal tibia
- Three weight based needle set sizes



Bone Injection Gun



- Adult and pediatric versions
- Proximal tibia and proximal humerus cleared

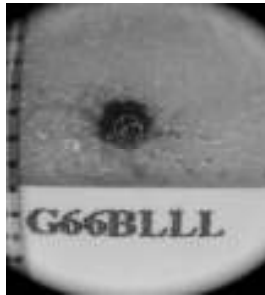
Historic Complications of IO

- Extravasation
- Compartment syndrome
- Dislodgement
- Fracture
- Failure
 - Device or user in origin
- Pain
- Infection



**Precise
insertion and
placement of
the IO device is
imperative for
success**

Drill versus Impact



Insertion Video



What About Infections With IO

- 20 + year history in pediatrics with Cook/Jamshidi needle sets
 - Overall infection rate is 0.6%
 - Cases of osteomyelitis occurred when catheter was left in place for > 72 hours
 - Newer IO devices cause less bone trauma
 - Vidacare reports an estimate of 200,000+ insertions with no reported local infections or osteomyelitis

The Joint Commission 2009 Patient Safety Goals

- **Goal 7 - Reduce the risk of health care-associated infections.**
- **Requirement 7 D**
 - Implement best practices for prevention of catheter-associated bloodstream infections (CABSI)
- **Implementation Expectations for Requirement 7 D**
 8. Avoid using the femoral vein, if possible, for central venous access in adult patients.
 10. Use a standardized protocol for maximum sterile barrier

Insurance and Central Line Infections

- *Major insurance providers have announced that as of October 1, 2008 they will no longer pay the extra costs of treating preventable errors, injuries, infections*
- *Medicare will not pay hospitals for the cost of treating certain "conditions that could have reasonably been prevented"1.*

CDC and Central Line Infections

- *Approximately 80,000 catheter-related bloodstream infections occur in U.S. ICU's each year, at a cost of \$296 million to \$2.3 billion*
- *A total of 250,000 cases of CVC-associated BSIs have been estimated to occur annually if entire hospitals are assessed.*
- *Attributable mortality is an estimated 12%-25% for each infection, and the marginal cost is \$25,000 per episode.*

"Not every patient that gets a central line needs one..."

An Evolved Nursing Standard

- RNs have been placing IO's successfully for over 20 years
- State boards have released advisories on Intraosseous Access
- ACLS and PALS providers should be trained in and knowledgeable about IO recommendations
- National Nursing Societies are updating standards to include IO access
- Peer reviewed Nursing Journals are publishing IO case studies and articles

Getting Started

- Policy and Procedure
- Competencies
- Multi Disciplinary and Department Education
 - Initial Training
 - Ongoing training
- Equipment
 - Where is it going to be kept
 - QA/QI

**Reports from Providers
Nationally:
IO Use Outside of the
Emergency Department**

Case histories Outside the ED

- 60 y/o STEMI pat requiring thrombolytics
- Chronic medical patient
- Difficult vascular access

Case Histories Outside the ED

- 70 y/o pt post cardiac arrest with ROSC x 24 hrs
- Multiple fractured ribs from CPR and resulting hemothorax
- Hypotensive with INR of 9, poor candidate for CVL
- L proximal tibia and proximal humerus IO placed, (practitioner noted contraindication)
- Pt given PLTs and FFP via IO and stabilized

Case Histories outside the ED

- 23 y/o burn pt, 60% 2nd and 3rd degree burns to upper torso and extremities.
- Bilateral tibia IOs placed

Rapid Response Case Study

Case Histories Outside the ED

- 45 y/o pt in severe respiratory distress
- IO placed, RSI-sedated and intubated

Case Histories Outside the ED

- 17 y/o pt, stab wound to abdomen
- Hypotensive
- Unable to gain access (IVDA)
- L humerus IO placed
- Unable to obtain CVL in ED
- Sent to OR with just IO in place

Case Histories Outside the ED

- Dialysis pt arriving from a dialysis clinic with a note that said his K⁺ was 9
- Triage nurse told him this was not compatible with life, but pt was unfazed
- IO inserted because of pt's poor vascular status
- Treatment initiated for pt's hypokalemia

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Questions?

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