# EMC 360 Acute Fluid and Respiratory Disorders

Intraosseous Cannulation

Brady p. 353; 359

## Objectives

- To understand the physiology and principles of fluid intraosseous cannulation
- To review the indications and contraindications of intraosseous cannulation
- To review the procedure for intraosseous cannulation
- To review the complications intraosseous cannulation and how to prevent these

## Priority of ALS Interventions

Stratification

- A / B : oxygenation and ventilation
- C: circulation

## Initial Treatment of Fluid Loss

- COMEBIG
  - 1 LB IV

## I O Vascular Access

- Vascular access for patients in extremis
  - respiratory failure
  - shock
- Peripheral IV access: often difficult or impossible in infants + young children with vascular collapse
- Intraosseous (IO)
  - is as efficient as an IV route
  - can be inserted quickly even in the most poorly perfused patients
  - provides a route for administering: fluids, blood, and medications

## IO Vascular Physiology

The marrow of long bones

- Rich network of vessels
  - which drain into a central venous canal,
  - emissary veins, and
  - ultimately into the central circulation.
- Medications and fluids infused IO
  - gain entry to the central circulation within seconds

## Indications

- Child in extremis
  - no IV after 2 attempts +/or
  - greater than 90 seconds
- Current recommendation
  - Under the age of 6 years
  - Over age 6
    - increased difficulty of insertion
    - smaller marrow cavity
    - increased likelihood of fracture

## Contraindications

- The only absolute contraindication:
  - fracture of tibia or long bones
- Relative contraindications:
  - cellulitis overlying the insertion site
  - inferior vena caval injury

## Risks and Complications

- Risks and complications are rare
- Benefits usually far outweigh the risks in child, in extremis, without IV access
- To decrease the likelihood of complications :
  - ASAP after obtaining alternative IV, then
    - remove of the IO needle
    - goal is to remove the IO needle within 3-4 hours.

## Risks and Complications

- Infection and osteomyelitis
- Bacteremia
- Cellulitis at the insertion site
- Fatty embolism
- Extravasation

## Risks and Complications

- Extravasation
  - most common complication
  - occurs when needle is misplaced (can occur with a properly placed needle)
- Causes:
  - enlargement of the entry site
    - associated with needle movement after insertion
  - needle passed through the opposite cortex
  - repeated attempts

## Risks and Complications

- Consequences:
  - compartment syndrome
    - with potential loss of the limb
  - necrosis of muscle can result from hypertonic or caustic meds:
    - sodium bicarbonate
    - calcium chloride
- Prevention:
  - making only *one* attempt per tibia

## PROCEDURE

- Site
- Insertion
- End point / proper placement
- Rates of infusion

Site : proximal tibia

- landmark : tibial tuberosity
- flat area of bone 2 cm distal ; slightly medial
- sterile technique
- (local anesthesia)

## PROCEDURE

Insertion

- Upon reaching bone, sterilely grasp needle close to entry point
- Constant pressure on the needle
- Use a twisting motion
- Angling perpendicular or even 10° caudally
  - to decrease chances of hitting growth plate
- Popping sensation or drop in resistance felt
  - immediately discontinue further advancement

## Bone Injection Gun

## PROCEDURE

Indications of proper placement

- Needle stands up on its own
- Aspiration of marrow confirms placement
- If marrow is not aspirated, no resistance to flow of 5-10 mL NS
- No evidence of extravasation after 10 ml NS pushed via syringe

Impaled object - immobilization of needle with gauze pads

## PROCEDURE

Rates of Infusion

- IV line is connected with a 3-way adapter
- Gravity rate too slow for resuscitation
- Rapid rate of infusion:
  - by drawing up 30-60 mL aliquots from the IV bag fluid boluses
  - also easier to administer medications

## Alternative Insertion Sites

Alternative sites ( in special situations)

- Sternum
- Distal tibia
  - entered 1-2 cm superior to the medial malleolus.
- Distal femur
  - approx. 3 cm above lateral femoral epicondyles
  - needle directed at a slight angle (10-15° cephalad from the vertical)
    - minimizes risk of trauma to growth plate

## IO Procedure

Bilateral misplaced intraosseous needles

Picture 1.
emedicine.com/ped/topic2557.htm
Ped IO - Gluckman

## IO Procedure

Properly placed intraosseous needle

Picture 2.
emedicine.com/ped/topic2557.htm .
Ped IO - Gluckman

## Summary

We have discussed:

- the physiology and principles of fluid intraosseous cannulation.
- the indications and contraindications of intraosseous cannulation.
- the procedure for intraosseous cannulation.
- the complications of intraosseous cannulation and how to prevent them.