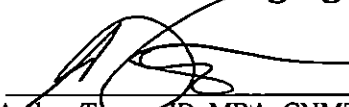



**Zuckerberg San Francisco General Hospital and Trauma Center  
Imaging Services Department Policy PC - 137**

  
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**TITLE: Use of Intraosseous Lines for Intravascular Administration of Contrast  
Media in Computed Tomography**

Intraosseous (IO) lines provide an alternative means of vascular access in critically ill or injured patients. Some centers have successfully used IO lines for iodinated contrast injection for CT examinations (1–5). Currently at ZSFG we are not using IO lines for iodinated contrast administration, but this is a service that may be of benefit to our patients. Please note: we are not aware of any IO lines that are currently rated MRI safe or MRI conditional, and so these devices must be removed from a patient prior to any MRI examination.

The IO line in use at ZSFG is the Arrow EZ-IO, which is a 15 Gauge device that is manufactured by Teleflex. Teleflex does not provide guidance about administration of iodinated contrast, whether by hand or power injection via the EZ-IO device.

However, there are multiple reports in the literature of administration of iodinated contrast via 15 Gauge IO devices in the humerus, tibia, and sternum. The initial studies from the late 1990s involved IO administration in pediatric patients, and employed hand injection (1,2). More recently in a review in the American Journal of Roentgenology in 2016, Baadh *et al* describe their experience using hand injection of iodinated contrast in adult patients (3). Meanwhile, others have reported successful power injection of iodinated contrast with flow rates of up to 5 mL per second and maximum pressure of 300 psi (4,5).

Given the reports of uneventful administration of iodinated contrast via power injection, and the logistical benefits of using power injection over hand injection, we recommend power injection. Initially, we plan to use a modest maximum flow rate of 2 mL per second with 300 PSI maximum. As we gain experience and confidence, we will slowly increase the maximum flow rate, with a goal of eventually maxing out at 5 mL per second. Studies have demonstrated that a 15 Gauge IO line can sustain similar flow rates to a 20 Gauge peripheral IV (6), and so we are hopeful that the IO lines will ultimately support injection rates compatible with CT angiography.

Regardless of contrast injection rate, image quality and contrast opacification for angiography examinations performed with IO lines will be inferior to that obtained with injection of a peripheral IV or central line. A peripheral IV, power injectable central line, power injectable PICC, or power injectable port are always preferable to using an IO line for contrast administration. Using a 2 mL per second flow rate, we anticipate the following image quality for the most common types of contrast CT examinations:

- Trauma protocol CTA of the chest, abdomen, and pelvis: will be limited to detect arterial injury and active extravasation. Performance may be partially decreased, but should still be sufficient, for detection of solid organ injury or hematoma.
- Dissection protocol CTA of the chest: may be partially limited for detection of dissection flaps.
- PE protocol CTA of the chest: will likely be diagnostic only for central emboli. Segmental and sub-segmental clot will likely not be identifiable.
- Stroke CTA: We hope that M1 vessel clot will be identifiable, but will likely be very limited for seeing M2 or more distal clot.
- CT abdomen/pelvis: image quality will likely be adequate for evaluation of diverticulitis, appendicitis, right upper quadrant pathology, and bowel obstruction. Evaluation for vascular pathology may be partially limited.

Please be aware that when an IO line is used for CT scans of multiple body parts, image quality will be further impaired.

## Protocol

1. Referring provider places order for CT, and places order for intraosseous analgesia per analgesia protocol listed below.
2. Patient's nurse administers intraosseous analgesia. This can be done prior to or following patient arrival in the radiology department, but will be performed by the patient's nurse. If patient is responsive to pain, 2% epinephrine free lidocaine (20mg/mL) should be administered prior to contrast as per the protocol below. If patient is unconscious and unresponsive to pain, then pretreatment can be omitted. Pretreatment may be performed up to 60 minutes prior to contrast injection.

### ADULT:

- Prime connection tubing with 2% epinephrine free lidocaine.
- Infuse 2 mL of 2% epinephrine free lidocaine IO over 2 minutes.
- Wait 1 minute.
- Flush IO with 10 mL of normal saline.
- Administer an additional 1 mL of 2% epinephrine free lidocaine IO over 1 minute.

### PEDIATRIC:

- Prime connection tubing with lidocaine.
- Over 2 minutes infuse 0.5 mg/kg of 2% epinephrine free lidocaine IO, not to exceed 40 mg (2 mL of 2% lidocaine).
- Wait 1 minute
- Flush IO with 2-5 mL of normal saline.
- Administer 0.25 mg/kg of 2% epinephrine free lidocaine IO over 1 minute, not to exceed 20 mg (1 mL of 2% lidocaine).

3. CT Technologist flushes IO line with 20 mL normal saline. If IO line does not flush easily, do not use.
4. Perform limited low-radiation-dose CT of IO site. Images reviewed by radiologist (trainee or attending) to confirm intramedullary placement of line. IO lines may be placed in the humerus, tibia, distal femur or sternum.
5. Connect contrast tubing to IO line and prepare for power injection.
6. Perform power injection.
  - Same volume of contrast as with protocols for power injection of peripheral IV lines.
  - **For humeral IO lines, arm should remain at patient's side (to prevent dislodging of IO when patient's arms are lifted above the head)**
  - A technologist must remain in the CT scanner room during duration of contrast power injection.

### ADULT:

- Max flow rate of 2 mL/sec, maximum pressure 300 PSI

### PEDIATRIC:

- Child under 3 years of age: injection rate of 0.2 mL/sec – 1.0 mL/sec, depending upon size of child. Maximum pressure 300 PSI.
- Child 4 – 12 years of age: injection rate of 1.0 mL/sec, maximum pressure 300 PSI
- Child 13 years of age or older: 2.0 mL/sec, maximum pressure 300 PSI

7. Flush line with 20mL of normal saline.

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