FAST 1 – First Access for Shock and Trauma Intraosseous (IO) Infusion System

Introduction

Intraosseous (IO) infusion provides an alternative route for the administration of fluids and medications when difficulty with peripheral or central lines is encountered during resuscitation of the critically ill and injured patient.

About FAST 1

FAST 1 system is a flexible infusion tube. Its tip – a stainless steel bone portal – is placed through the patient's skin and anterior cortical bone, into the marrow space of the sternal manubrium. The stainless steel tip of the infusion tube is firmly embedded to a precise depth in the bone, allowing fluids to flow into the patient's marrow. The flexible tubing allows the skin and tissue to move without disturbing the needle tip. A low, hard dome protects the infusion site. The adhesive patch provides strain relief. This protects the infusion tube from stresses on the IV line, which would otherwise loosen or dislodge the infusion tube.

Fluids and medications can be given or administered within 90 seconds of the insertion of the procedure. IO access is achieved within 60-90 seconds. FAST 1 is inserted under 60 lbs. force and can remain in place up to 24 hours.

The device is single-use – the introducer mechanism is not easily re-settable. IO dosages and compatibility are the same as for peripheral IV access.

CPR can be performed while FAST 1 is in place, as the protective dome that covers the infusion site isolates it from CPR. CPR can be performed while fluids are being infused.

Tracheotomy can be performed while FAST 1 is in place, and FAST 1 is also compatible with the use of C-spine collars.

FAST 1 Site – the single recommended site for insertion is the adult manubrium on the midline and 1.5 cm (5/8") below the sternal notch.

Fluids infused into the sternum rapidly reach the central circulatory system.

Blood samples drawn from IO sites can be used for type and cross match blood, serum electrolytes, creatinine, glucose, and calcium levels.

Drugs and fluids used are blood products, fluids, 5%, 10% dextrose, saline, lactated ringer's solution, plasma, whole blood, packed red blood cells, parenteral nutrition, colloids, crystalloids, antibiotics, anticonvulsants, analgesics, anesthetics, catecholamines, mannitol, atropine, lidocaine, sodium bicarbonate, digitalis, heparin, insulin, calcium, muscle relaxants (succinylcholine chloride, atrocarium besylate and thiopental sodium).

Flow rate – 30 cc/min (gravity drip) to 125 cc/min (pressure cuff or syringe / stopcock pump) to 250 cc min (single syringe).

When medications are given in a push method, give medication and flush with 10 cc N/S, then continue with the next med.

Indications

- The adult patient who is in cardiac arrest, and in whom it is difficult to obtain peripheral venous access or central line.
- Circulatory shock due to heart failure, drug overdose, severe hemorrhage
- Where peripheral veins are collapsed due to above conditions.

Contraindications

- Fractured sternum
- Recent steronotomy (may have compromised the integrity of the manubrium or is revascularization)
- Severe osteoporosis or bone softening conditions
- Burns to the sternal area
- Abnormally small individuals (i.e., midget)

Potential Complications

- Subperiosteal infusion due to improper placement
- Osteomyelitis
- Sepsis
- Fat embolism
- Marrow damage
- Subcutaneous and occasionally subperiosteal infiltration of fluids leakage from the puncture site (extravasation)
- Localized cellulitis
- Subcutaneous abscesses
- Pain in conscious patient with insertion and with rapid fluid infusion

- Bone marrow necrosis following administration of sodium bicarbonate, 50% dextrose, epinephrine & Lidocaine
- Mediastinitis
- Hydrothorax
- Bone fragment embolism
- Periostitis

Nursing Responsibilities Prior to and Following IO Insertion

Prior to Insertion of IO

- With conscious patient, obtain consent; teach patient and/or family about the purpose of IO.
- Position the patient flat and as close to the head of the bed as possible.
- Expose the chest – if excess hair, shave sternal bone area approximately 10 cm in diameter.
- Perform nursing assessment and interventions related to IV or central line insertion.
- Assist RRT's or physicians by providing needed material for insertion.
- Prepare & prime IV tubing.

Post Insertion

- Immediately following insertion, assess for pain if patient is awake; administer pain medication according to physician orders.
- Assist in connecting the infusion tube to the tubing on the patch and then connect the infusion tube to the IV infusion with the requested fluids.
- Assess for leakage of fluid around the site, stretching, bleeding.
- Assess flow rate and adjust IV rate accordingly.
- Ensure the patch is securely attached to the patient's skin.
- Ensure the protective dome is pressed down firmly over the target patch.
- Administer medications and fluids as per orders and as per hospital protocols (treat IO as peripheral IV access).
- Assess tubing for patency, kinks.

- Ensure the removal kit is attached to the patient's gown or bed. Label the removal kit with the patient's name.

- Reposition the patient to a comfortable position. Monitor tubing position to prevent pulling.

- Assess system function & flow, and troubleshoot as necessary.

- Use aseptic technique when providing care. Monitor for signs of complications. Refer to your medical & nursing references or review complications and nursing interventions.

- Ensure the device does not remain in place for more than 24 hours.

Resources Required Pre- & Post-Insertion

- Non-sterile gloves
- Clipper
- Alc straps (10)
- Iodine prep pad (3)
- 1 cc luer-lock SC syringe
- 10 cc luer-lock syringe
- 60 cc luer-lock syringe
- 1% or 2% xylocaine for local anaesthesia
- 20 g needle (2)
- IV tray, IV pump
- IV tubing, primed, and requested fluids
- Safety pin
- 4 x 4 gauze (6)
- Label with patient's name, for removal kit
- 10 cc NS (5)

Professional Accountability and Responsibility

- Keep open the lines of communication with the physician and RRT's responsible for the patient, and notify him/her of anything relevant to the FAST 1.

- RN and/or RRT may draw blood from IO system, e.g., for cross match, electrolytes, creatinine. Laboratory assistants and technologists are *not* certified to take blood from IO.

- Turn off the IV when withdrawing blood.

Patient Teaching

- It is important to teach the conscious patient/ family about IO.

- Explain the need for IO insertion and that it will not remain in place for more than 24 hours.
- Explain the importance of preventing pulling on the device and/or IV tubing.
- Explain the importance of reporting pain at the insertion site.
- Patient to remain supine, with head of bed at maximum of 30^{o} & head supported with pillow.

Documentation

Charting about FAST 1 needs to be comprehensive and accurate. The FAST 1 site and system must be assessed every hour. Document IO procedures, and patient's tolerance of procedures, in the Nurses Notes. Write date and time of insertion on the tubing, and label the IV and tubing.

IO complications can have life-threatening consequences and must be documented comprehensively. Document the name of the physician notified, the time, and the nursing interventions carried out.

References

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Macnab, A., Christenson, J., et al. (2000). A new system for Sternal Intraosseous Infusion in Adults. Prehospital Emergency Care. Volume 4, No. 2. (April/June). 173-177.

Troubleshooting FAST 1

Description of Problem	Probable Cause	Recommended Action
The sternal notch cannot be located	Extreme obesity or abnormal sternal anatomy	Abort the procedure; proper targeting requires accurate location of the sternal notch. Employ an alternative method of vascular access
The patch has been incorrectly placed	Operator error during application, movement of the skin over the manubrium during application, or patient movement after placement	If the patient was moved after the patch placement, return the patient to the original position. If the patch is still incorrectly placed, remove and place another patch. During insertion, ensure that the skin over the sternum is not stretched away from its normal position.
The patch will not adhere to the skin.	Wet skin or thick body hair	Shave or dry skin, clean with iodine prep pad followed by alcohol pad. Apply new patch; the patch can also be taped down using the three extended tabs. If the patch became detached during use, it should be taped to the skin to ensure strain relief.
The introducer does not release, and the bore probe cluster is fully inserted into the tissue.	Extreme bone hardness or technique error	Without pulling back on the introducer, check that the introducer is perpendicular to the manubrium surface, and that force is being applied directly along the introducer axis. Some patients may have a very hard bone; if the operator cannot maintain control of the introducer, use an alternative method of vascular access.
The introducer releases but the infuser tube falls out of the patient	The infusion tube did not adequately penetrate the anterior cortical bone of the manubrium due to excessive tissue thickness or very hard bone	Action: RRT or Physician ONLY may re-attempt with open FAST 1 device.
No marrow can be withdrawn to verify placement of the infusion tube	The bone portal is blocked by trubecular bone, or the tip of the infusion tube did not reach the manubrial marrow space	Connect FAST 1 system to fluid source, check flow rate, and infuse 10 cc of saline with a syringe to clear the tip of the portal. If no flow is established, see next troubleshooting tip.

Description of Problem	Probable Cause	Recommended Action
The tubing has been kinked	The tubing has been twisted during application	A small amount of kinking may not be a significant barrier to the administration of fluids. Assess the flow rate; if the kink is stopping flow, remove the dome and manipulate the connector tube to remove the kink, ensure the connection is secure, and replace the dome.
Low or no flow through infusion tube	There is a severe kink in the tubing, there is a line blockage, or the bone portal failed to penetrate the manubrium	Check for kinked tubing. If no kink can be found, attempt to clear the line by flushing 10 cc of NS. If this fails to improve the flow rate to an acceptable level, use an alternative method of vascular access.
Extravasation (leakage) at the insertion site	Infused fluids are leaking from inside the manubrium past the tip of the infusion tube	A small amount of leakage sometimes occurs and is commonly acceptable in IO infusion. If leakage is excessive, an alternate method of vascular access should be used.
Tubing comes away, leaving portal embedded in patient	The infusion tube was pulled on directly and the tubing separated from the stainless steel portal, leaving it embedded in the patient's bone.	Attempt removal (by RRT or Physician only) by inserting remover into the tissue. Engage portal thread in remover and pull out. If portal cannot be located by this method, make a small (1 cm) incision through the skin and remove the portal.