

FEEDBACK TO THE FIELD (FT2F) #7:
*Sternal Intraosseous Intravenous (IO-IV) Infusion:
Assessment by Computed Tomography (CT)**

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** American Registry of Pathology in support of AFMES

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Original Issue

FEEDBACK TO THE FIELD:

Sternal Intraosseous Intravenous (IO-IV)
Infusion: Assessment by Computed
Tomography (CT)

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BACKGROUND

- Intraosseous vascular infusions [IO-IV] are a recognized alternative to peripheral intravenous infusions when access is inadequate.
- Current use of IO-IV device is popular in emergency medicine, with focus on critically ill patients in the out-of-hospital setting.
- The sternum and proximal tibia are the preferred sites.

BACKGROUND

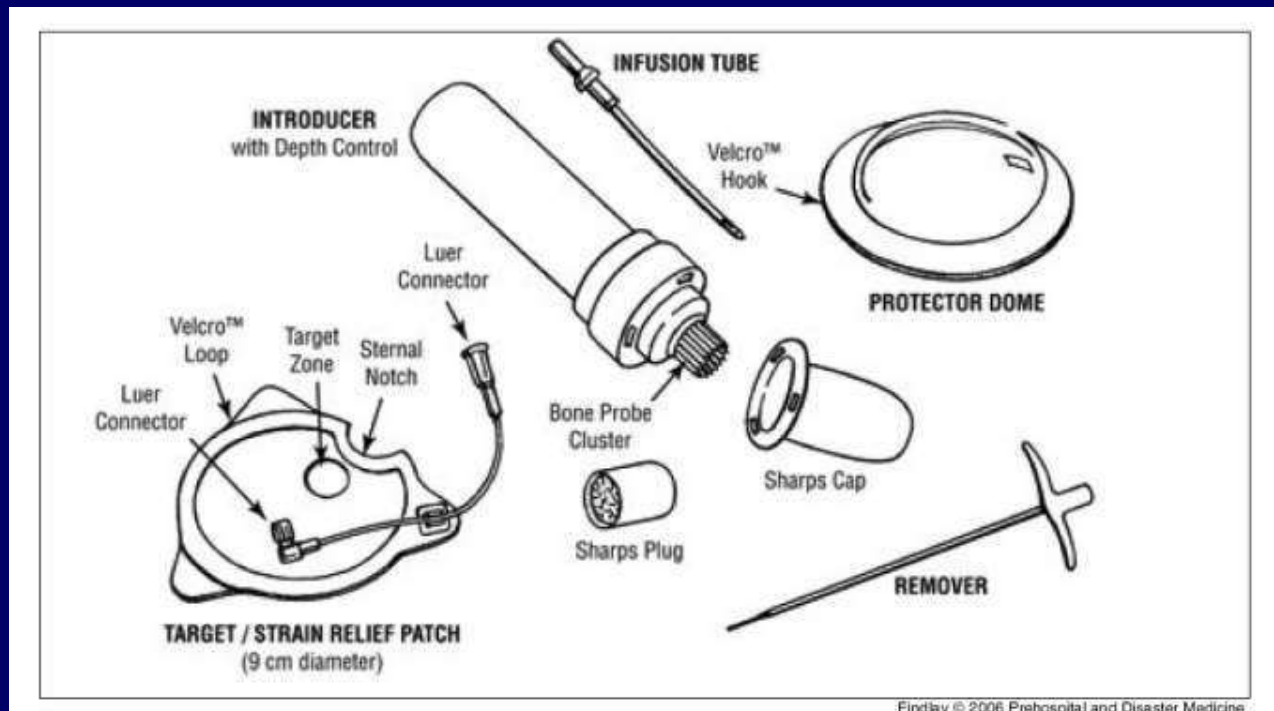
- The principal sternal IO-IV device being taught and distributed by the DOD is the FAST-1 [Pyng Medical] There are three versions of this device.
- Other sternal devices are made and may appear in emergency care facilities within the DOD. One is the EZ-IO [Vidacare] sternal needle which can be inserted manually or with a power driver. This was the topic of a prior “Feedback” communication.



FAST 1

First Version

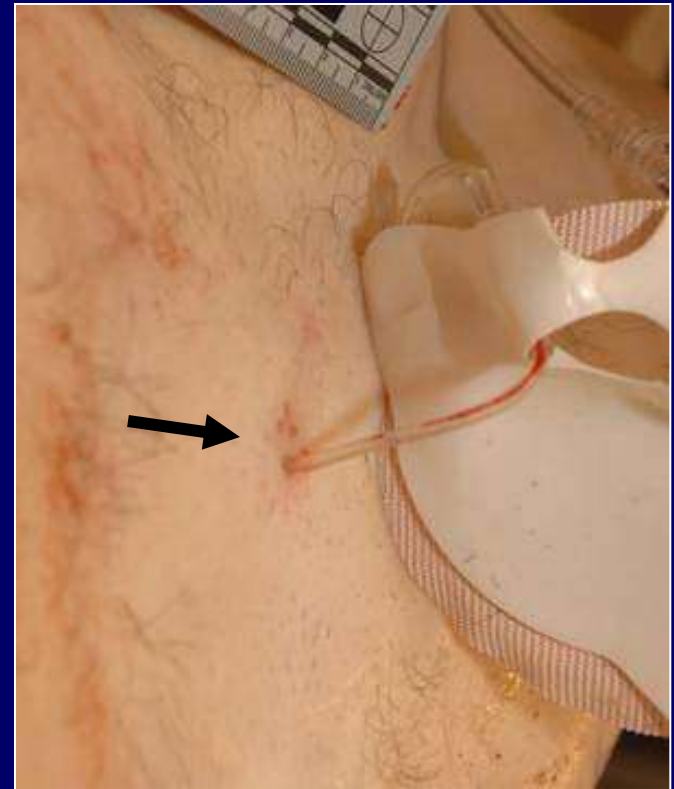
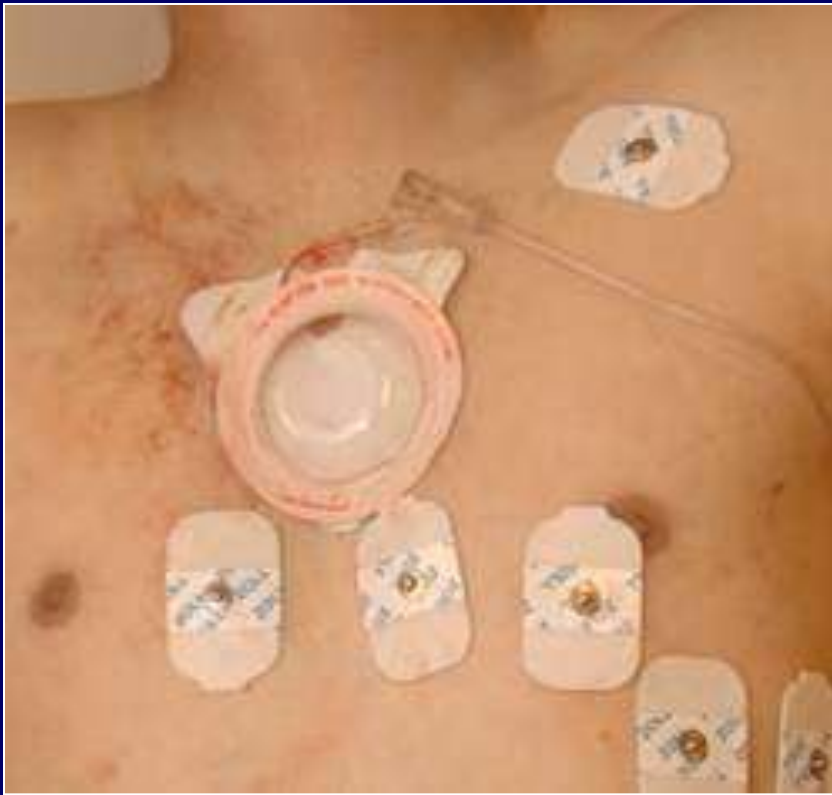
Requires a
Removal Tool



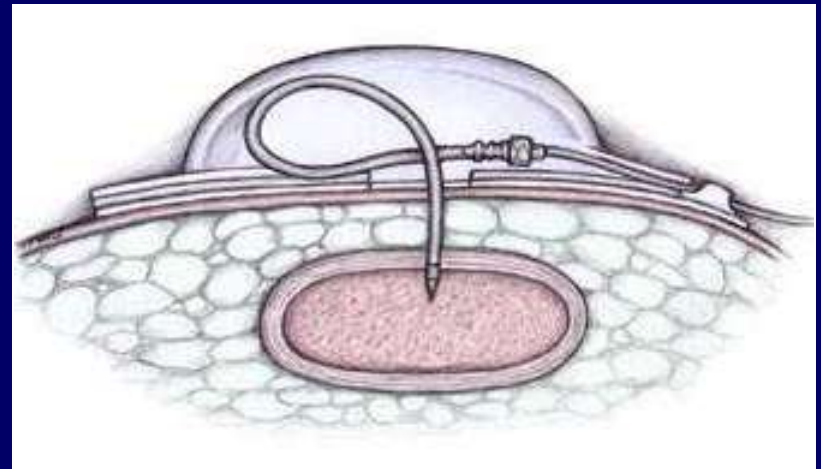


Steps in insertion.

(Source: Fast-1
Instruction Manual)



Fast-1 in place. Note the circle of pin marks around the infusion tube left by the introducer (arrow).

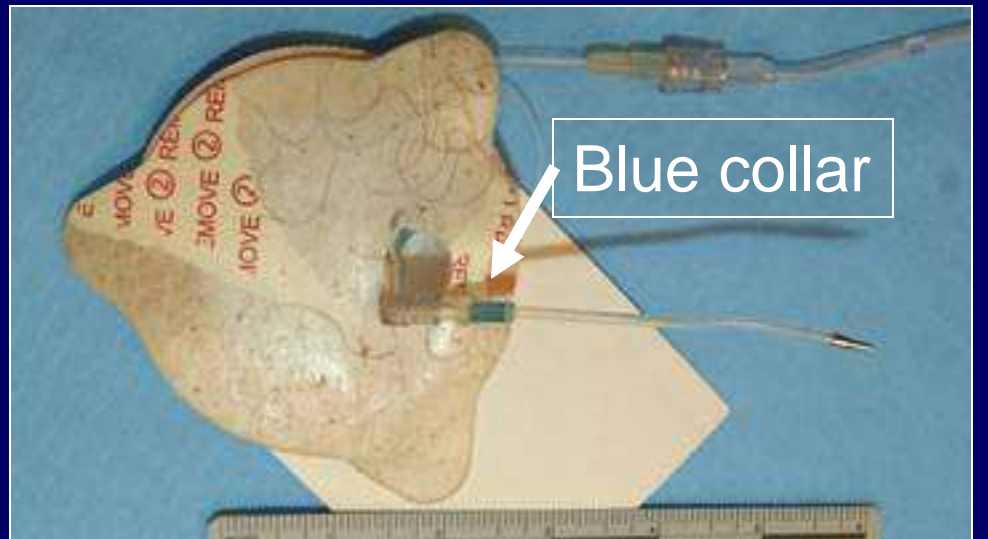


REMOVAL ISSUES

The first version of the FAST 1 required a removal tool, it has a clear collar.

The second version of the FAST 1 now being fielded and not requiring the tool has a blue collar. The tube can be pulled out manually.

Reports of tip retention in the sternum with the second version have been received.

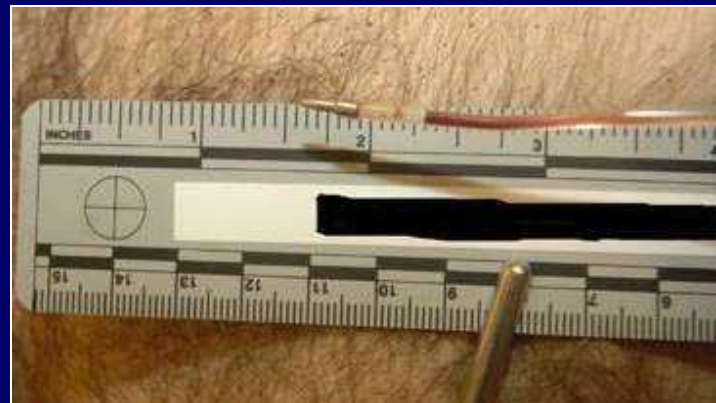


Manufacturer Instructions for removal of the blue collar FAST-1

1. Remove Protector Dome
2. Turn off the source of fluid and medication. Disconnect IV and friction fitting from Infusion Tube.
3. Grasp Infusion Tube with fingers or clamp and pull perpendicular to the manubrium until entire Infusion Tube (including metal tip) emerges from patient's chest.

Note: pull in one continuous motion (do not start/stop) until removed. Use the tube to pull, not the luer connection. It is normal for the tubing to stretch.

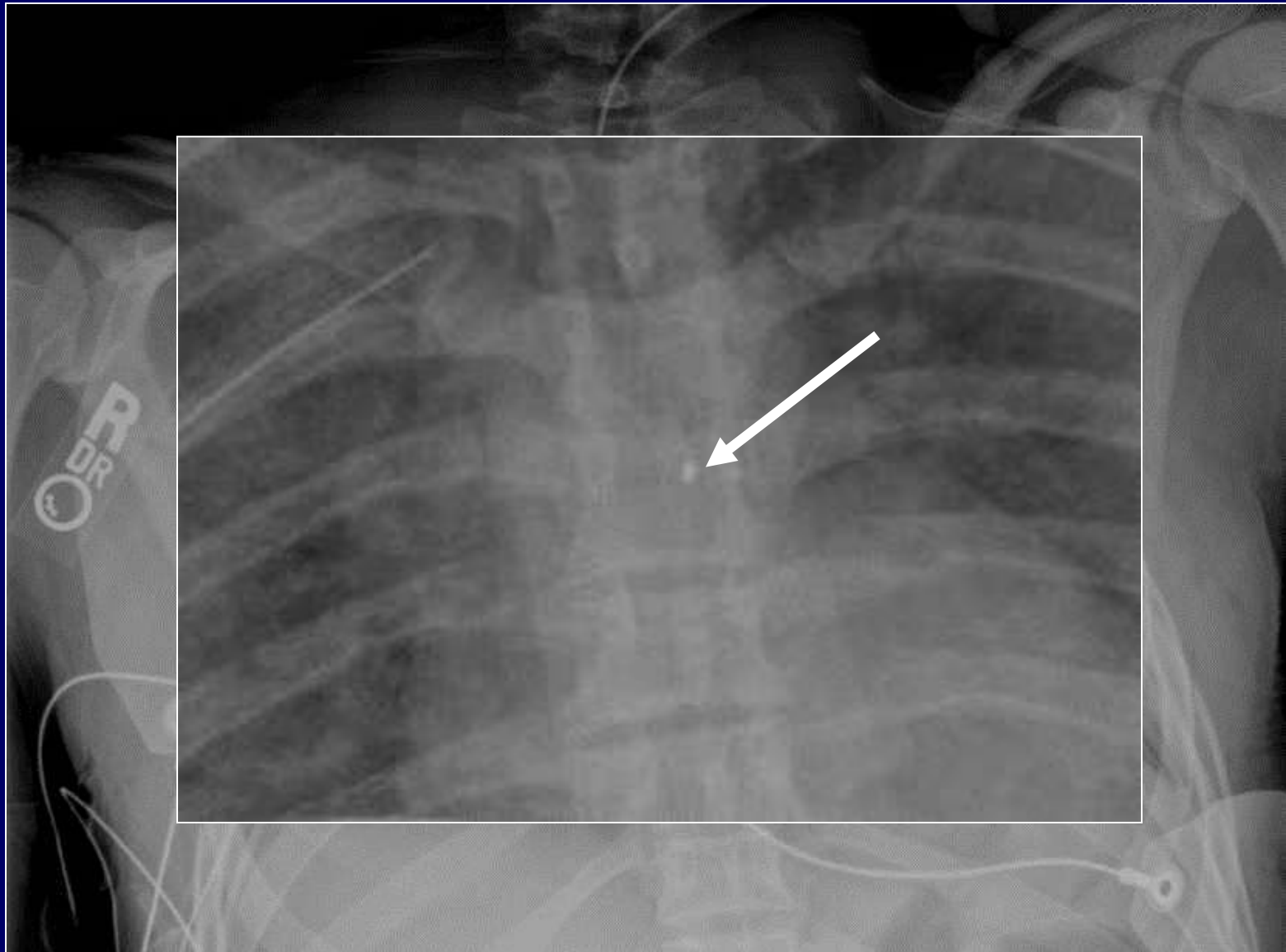
4. Peel off target patch and dress the site as per standard protocol.
5. Discard Infusion Tube and Target Patch following local contaminated sharps protocol.

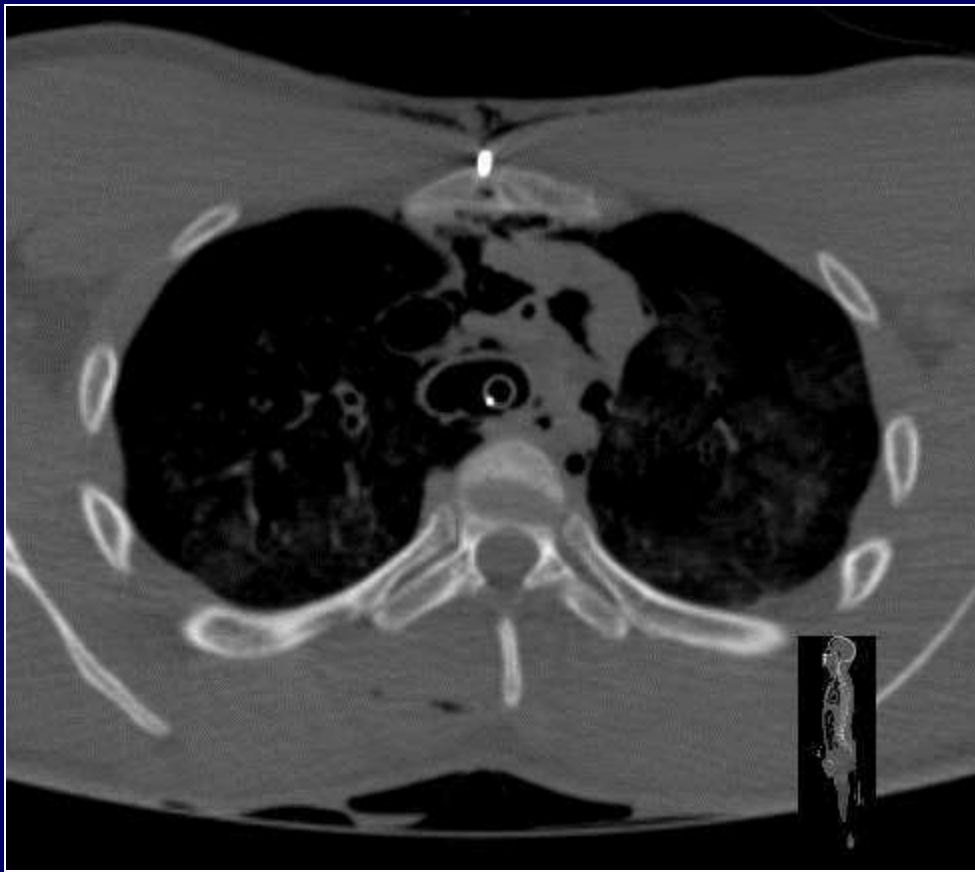


OUR OBSERVATIONS OF FAST 1 USE

- 98 Cases reported as showing evidence of sternal intraosseous infusion at autopsy were identified
- Postmortem digital radiographs and CT images were reviewed
- 81 Sternal intraosseous infusion devices were localized by CT
- 17 Cases with autopsy evidence of a sternal infusion device (pin marking footprint) did not have the device present

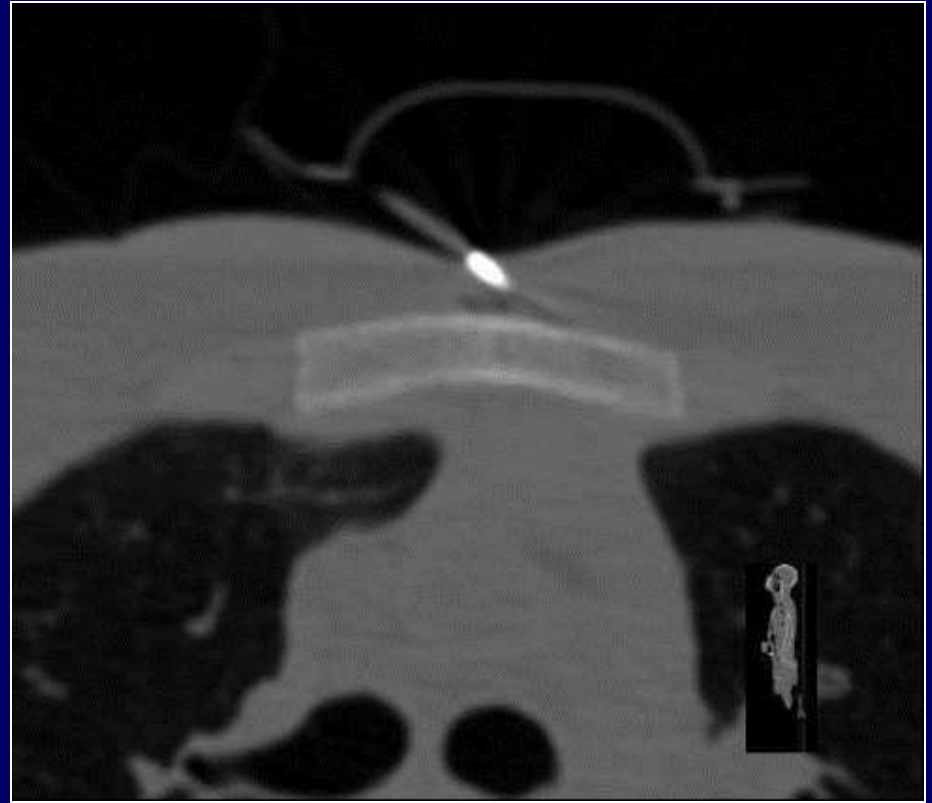
Chest Radiograph showing Sternal IO-IV tip





Axial and sagittal CT shows the metal tip of the infusion catheter in the manubrium of the sternum.





Axial CT shows the sternal infusion device is not in the mabubrium.

PIN MARK CASES

Was the tube in and pulled out intentionally or accidentally in transit?

OR

Was the insertion attempt unsuccessful?

Instructions in theater are to ship human remains without removal of devices used in emergency medical treatment (eg tourniquets, ET tubes, chest tubes, IV devices)



RESULTS- Sternal IO-IV POSITION by computed tomography

98 Cases reviewed

81 Devices present on CT

75 Tip in the manubrium

3 Tip in the body

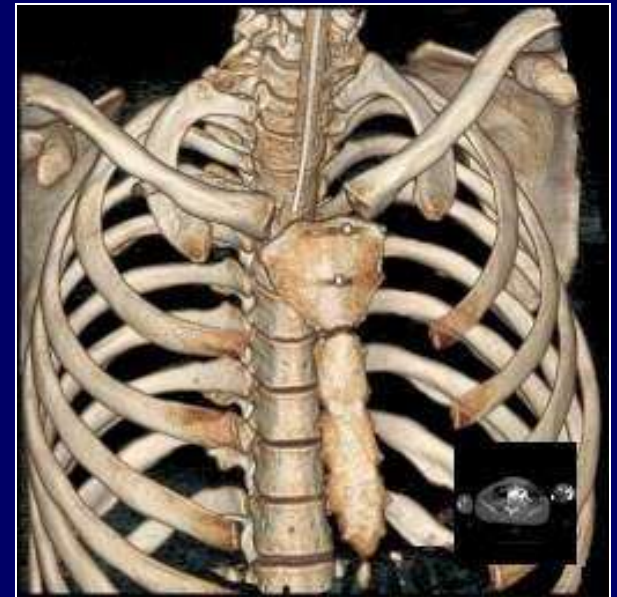
3 Tip not in bone

17 Pin mark with no device

Sternal IO-IV Observations:
At times two attempts are
made.



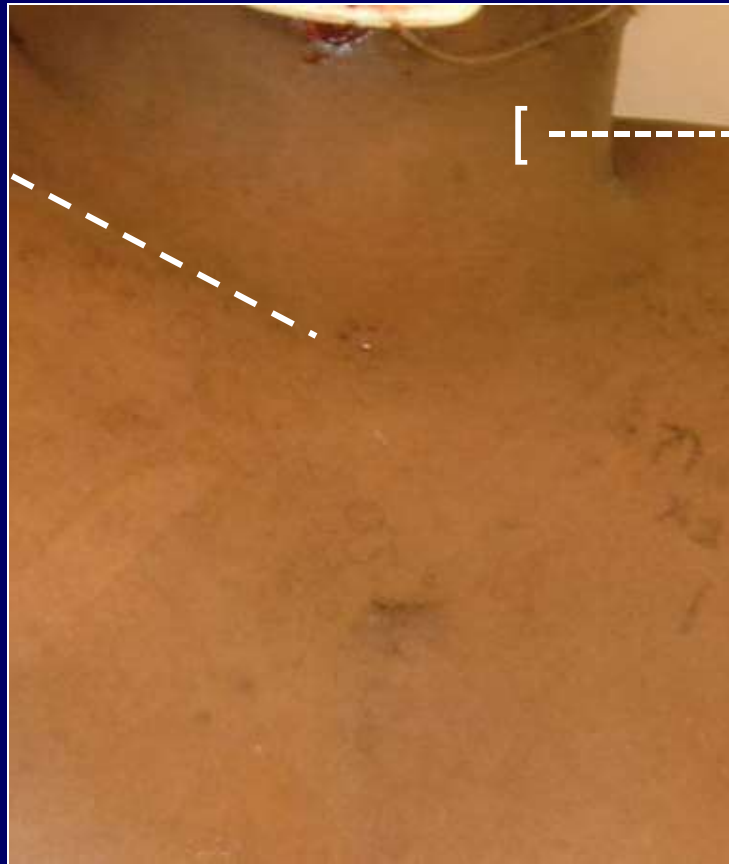
Dual Pin Marks



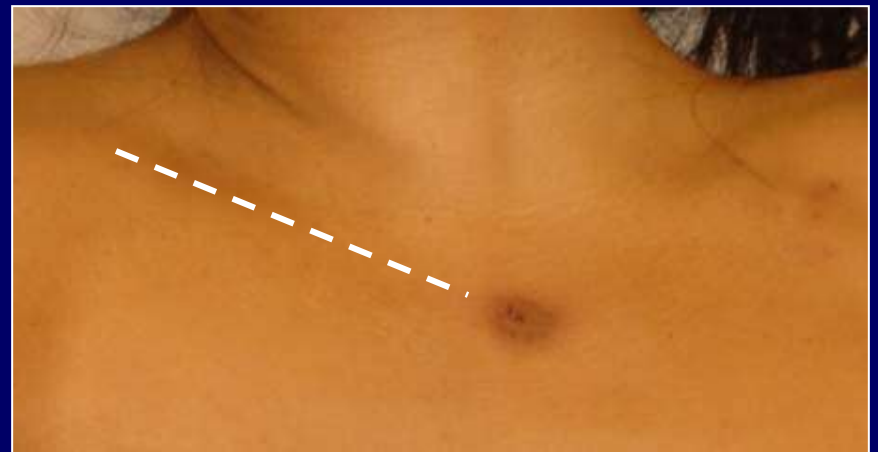
Dual Insertion

Sternal IO-IV Observations

High placement pattern in some cases with pin mark only.



[----- Clavicle Ridge]



Sternal IO-IV Observations

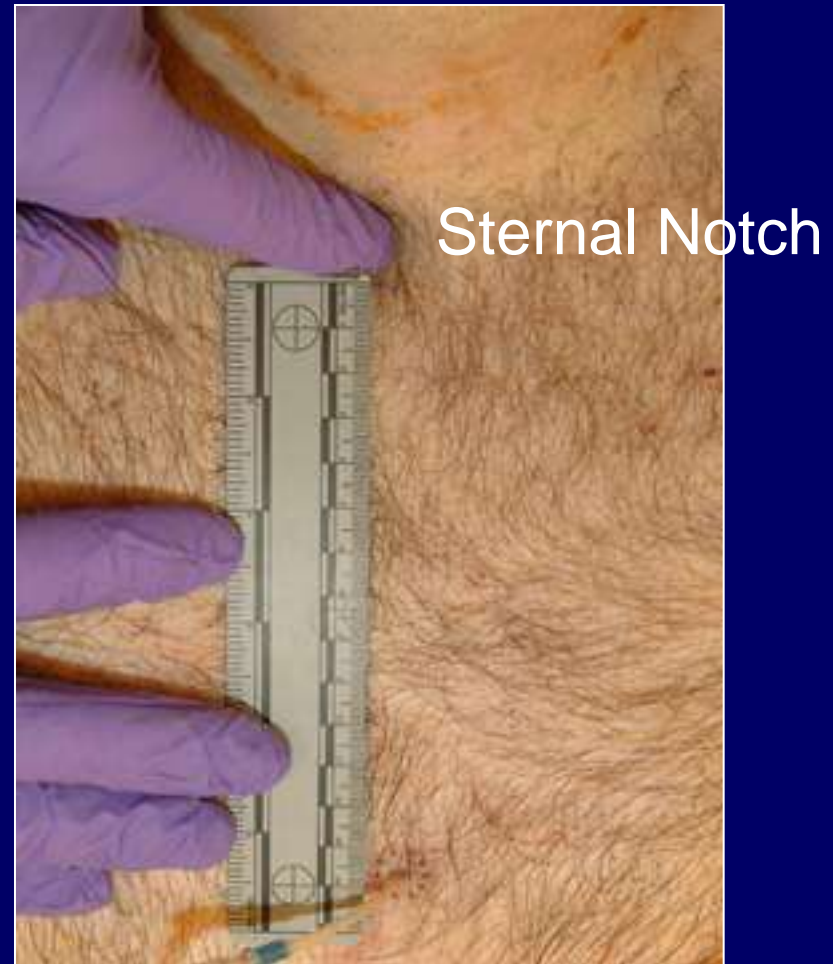
Low Placement- uncertain if placed with or without template

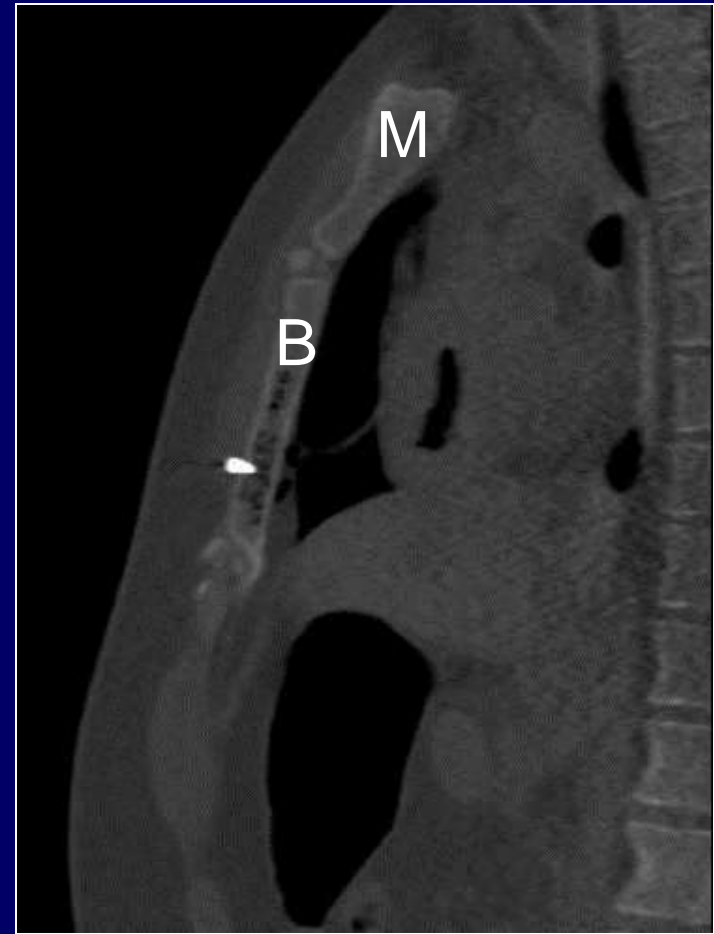
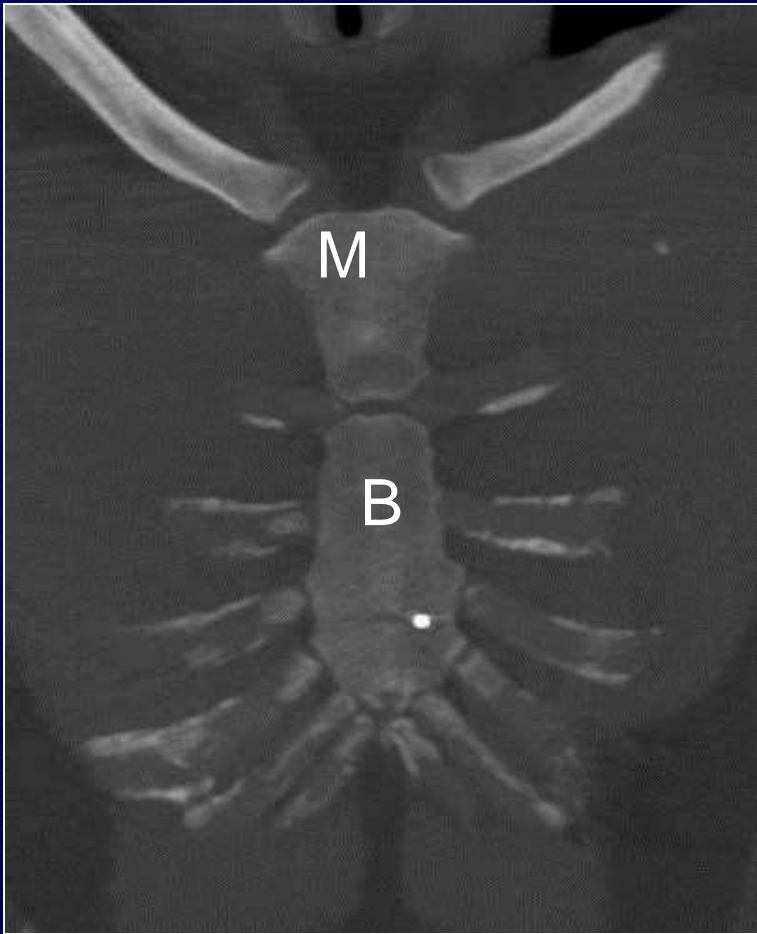
[----- Clavicle Ridge]



Sternal IO-IV Observations

IO-IV device
positioned in the
lower sternal body
as opposed to
manubrium





Coronal and sagittal CT shows a sternal IO-IV
with tip low in the body of the sternum
[M = sternal manubrium, B = sternal body]

RESULTS- Assuming a “worst case” scenario: pin mark and no tip in bone represents an unsuccessful attempt

98 Sternal insertions studied

78 (80%) Tip in the manubrium or body

20 (20%) Tip not in bone (3) or showing pin mark with no device (17)

Caution:

This presentation makes no association between IO-IV position and outcome of treatment. The clinical circumstances and specific details surrounding the delivery of emergency treatment in these cases is unknown.

Sternal IO Device Insertion: Civilian FAST 1 Experience

A NEW SYSTEM FOR STERNAL INTRAOSSEOUS INFUSION IN ADULTS

Andrew Macnab, MD, Jim Christenson, MD, Judy Findlay, PEng, MASC,
Bruce Horwood, MD, David Johnson, PhD, Lanny Jones, Kelly Phillips,
Charles Pollack, Jr., MD, David J. Robinson, MD, Chris Rumball, MD,
Tom Stair, MD, Brian Tiffany, MD, PhD, Max Whelan, MD

ABSTRACT

the line. Further research on flow rates is needed. No complications or complaints were reported at two-month fol-

collected additional data. **Results.** The overall success rate for achieving vascular access with the system was 84%. Success rates were 74% for first-time users, and 95% for experienced users. Failure to achieve vascular access occurred most frequently in patients (5 of 9) described subjectively by the user as "very obese," in whom there was a thick layer of tissue overlying the sternum. Mean time to

Success rates were 74% for first-time users, and 95% for experienced users. Failure to achieve vascular access occurred most frequently in patients (5 of 9) described subjectively by the user as "very obese," in whom there was a thick layer of tissue overlying the sternum. Mean time to achieve vascular access was 77 seconds. Flow rates of up to 80 mL/min were reported for gravity drip, and more than 150 mL/min by syringe bolus. Pressure cuffs were also used successfully, although fluid rate was controlled by clamping

(10–40%),⁶ and the small volumes of fluid that are typically administered.⁷ In the urban setting, the long delays caused by often unsuccessful attempts to initiate IV therapy and stabilize the patient (25 minutes or more) result in higher morbidity and mortality than the "scoop and run" approach.^{5,8} However, other centers have reported much shorter access times and higher success rates, and emphasize the need for physician supervision of paramedic care to ensure appropriate use of the technique.^{1,6,9}

FASTx™



Pyng Medical has a new third version of their sternal IO-IV device which has recently received FDA approval. Use of this device is not included in this series.

PLEASE REMEMBER:

- This presentation makes no association between IO-IV position and outcome of treatment.
- We have no knowledge of the echelon of care, facility and individual(s) involved in device placement.
- Analysis is based on assumption of a “worst case” scenario.

SUMMARY

An intraosseous intravenous infusion device designed for sternal insertion (Fast-1, Pyng Medical) has an 80% rate of successful insertion for cases assessed at Dover.

ISSUE

Can this be improved in the battlefield environment ?

This material is intended for educational and training purposes. If portions are extracted, the following statement must be included:

“Source: Armed Forces Medical Examiner System”

NOTES of CAUTION:

- The clinical circumstances and details surrounding emergency treatment in these cases is unknown
- This presentation makes no association between device placement and outcome of treatment
- This case series is drawn from cases with fatal injuries, which may skew data

For FT2F Comments / Questions / Requests:
Contact the Armed Forces Medical
Examiner System (AFMES)

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