



A COLLABORATION BETWEEN
HUS & UNIVERSITY OF HELSINKI

HUS  Leading
healthcare.

THORACIC WALL TRAUMA

NORDTER Oslo 2025

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NORDICFORUM www.nordictraumarad.com
TRAUMA & EMERGENCY RADIOLOGY

Disclosures

- None

Objectives

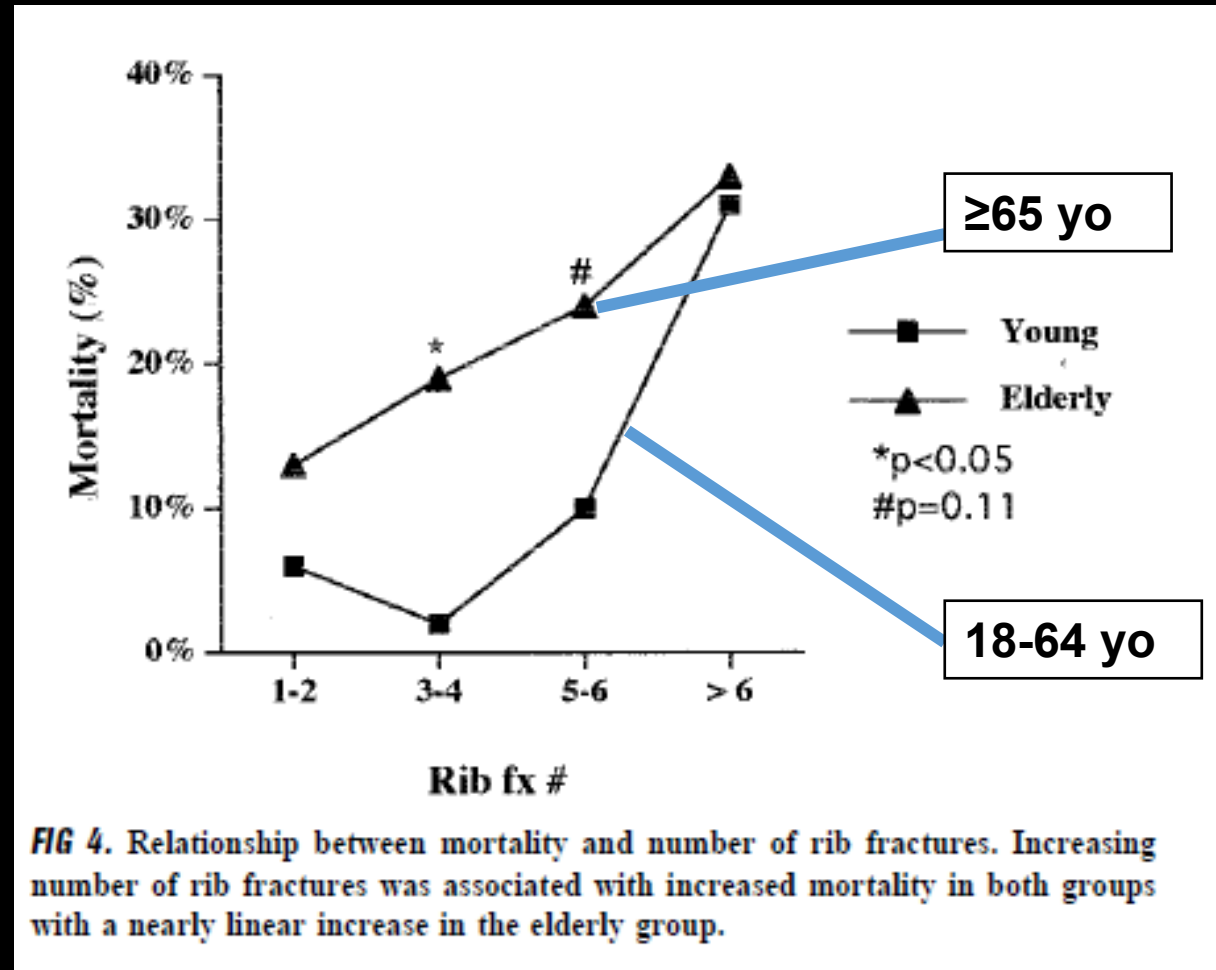
To describe the severity of rib cage injuries

To detect costal cartilage fractures

To understand the difference flail chest and flail segment

To know the main indications for SSRF – surgical stabilization for rib fractures

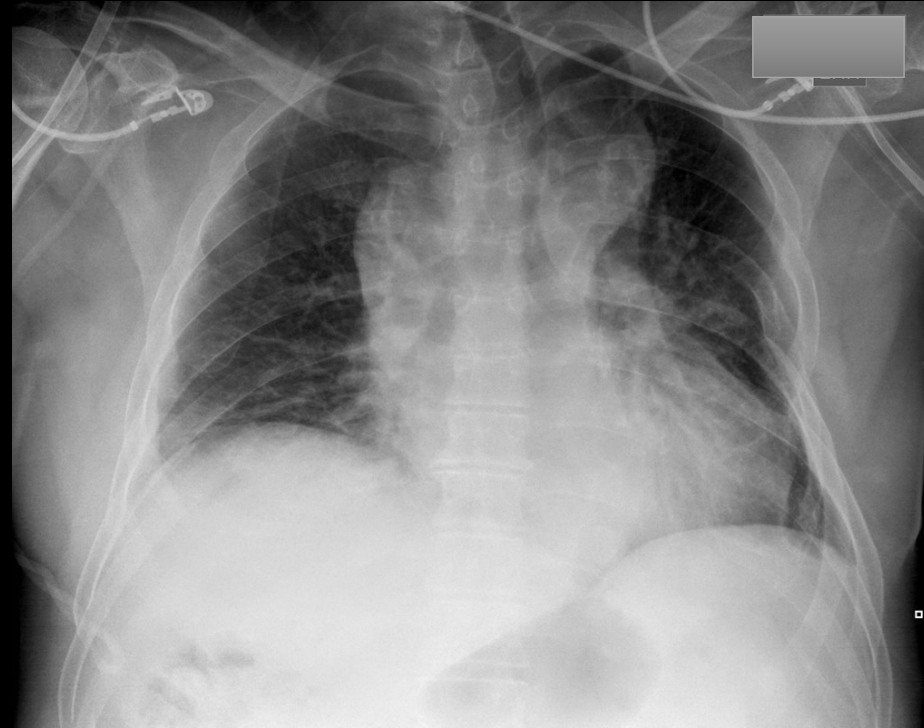
Mortality - how many ribs does it take ?



Bulger et al. JTrauma 2000: Rib fractures in the elderly

CT vs CXR

61M, MVA.



Trupka et al. J Trauma. 1997 Sep;43(3):405-11
Murphy et al. Ann Emerg Med. 2017
Nummela et al. Radiology 2017

50-75% of rib fxs remain
undetected in CXRs

Examples of typical cartilage fractures



COR

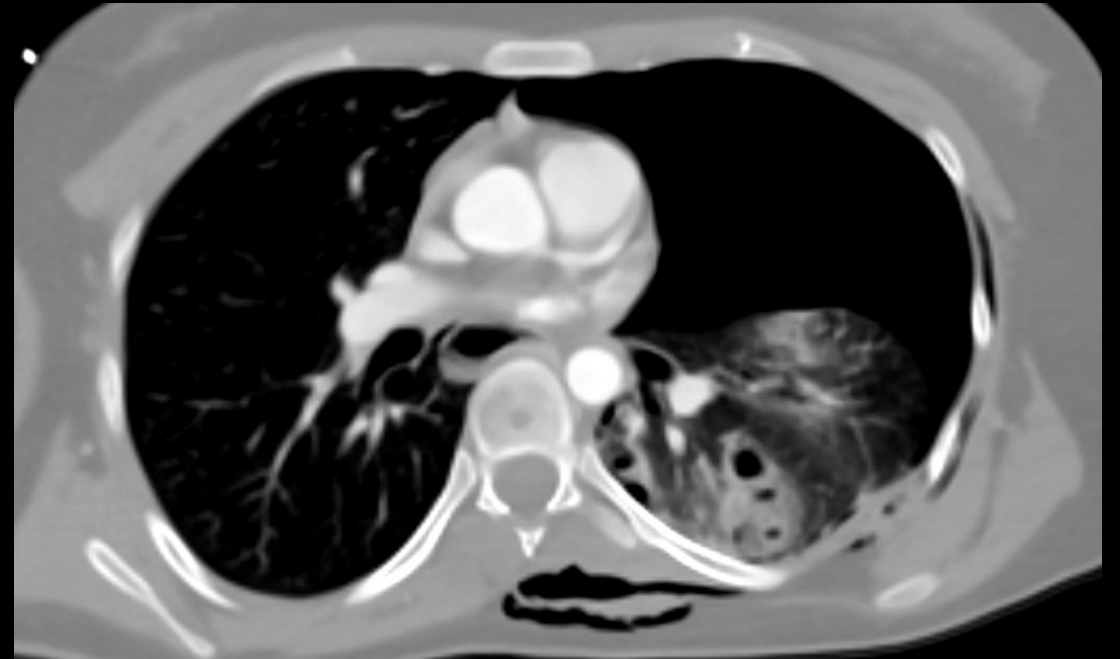
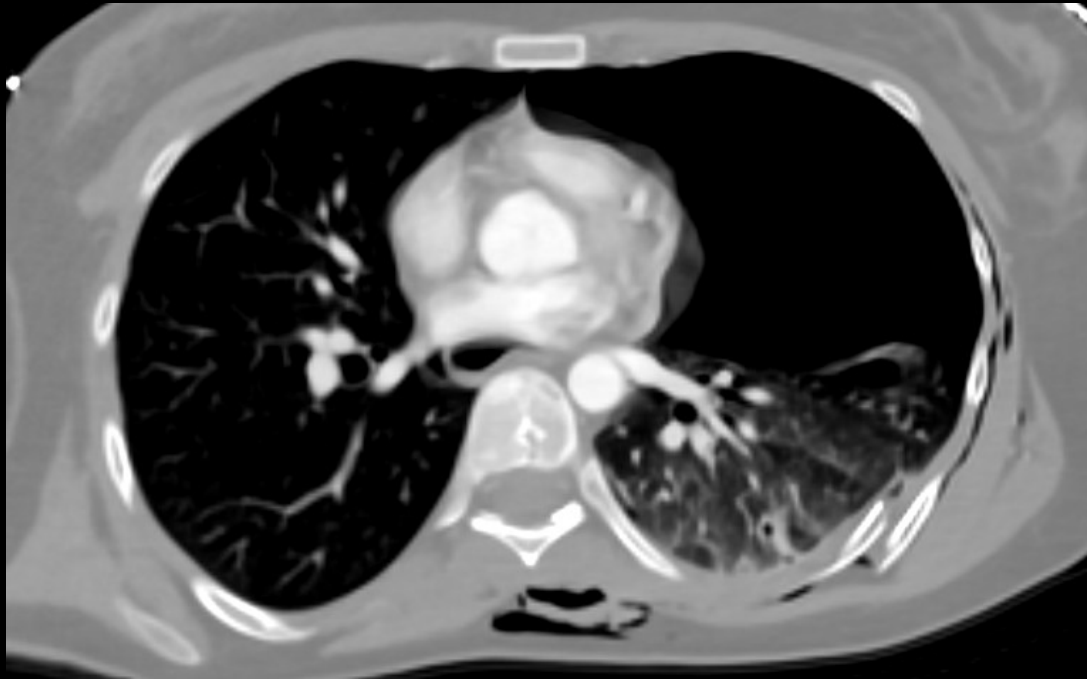
39M, fall
CC fx's of ribs 6 and 7 on the left



AX

27F, MVC
Dislocated CC fx of the right 1st rib

Ribs, PTX, lacerations, contusions, active bleeding?



Chest wall injury - reporting

Rib fractures

which rib, lateral/posterior/anterior

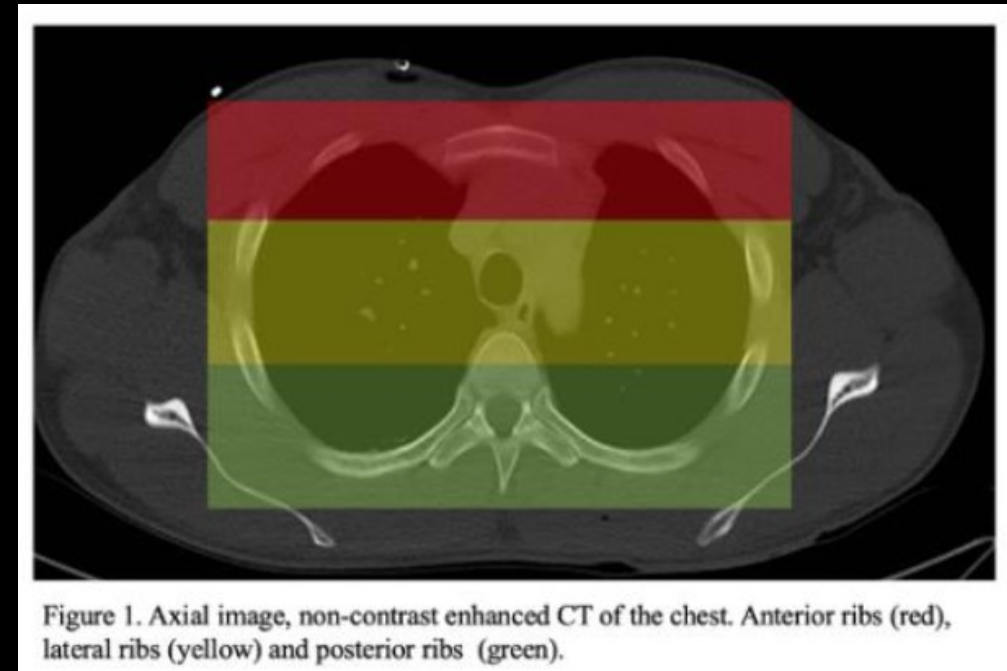
nr of fractures

level of dislocation

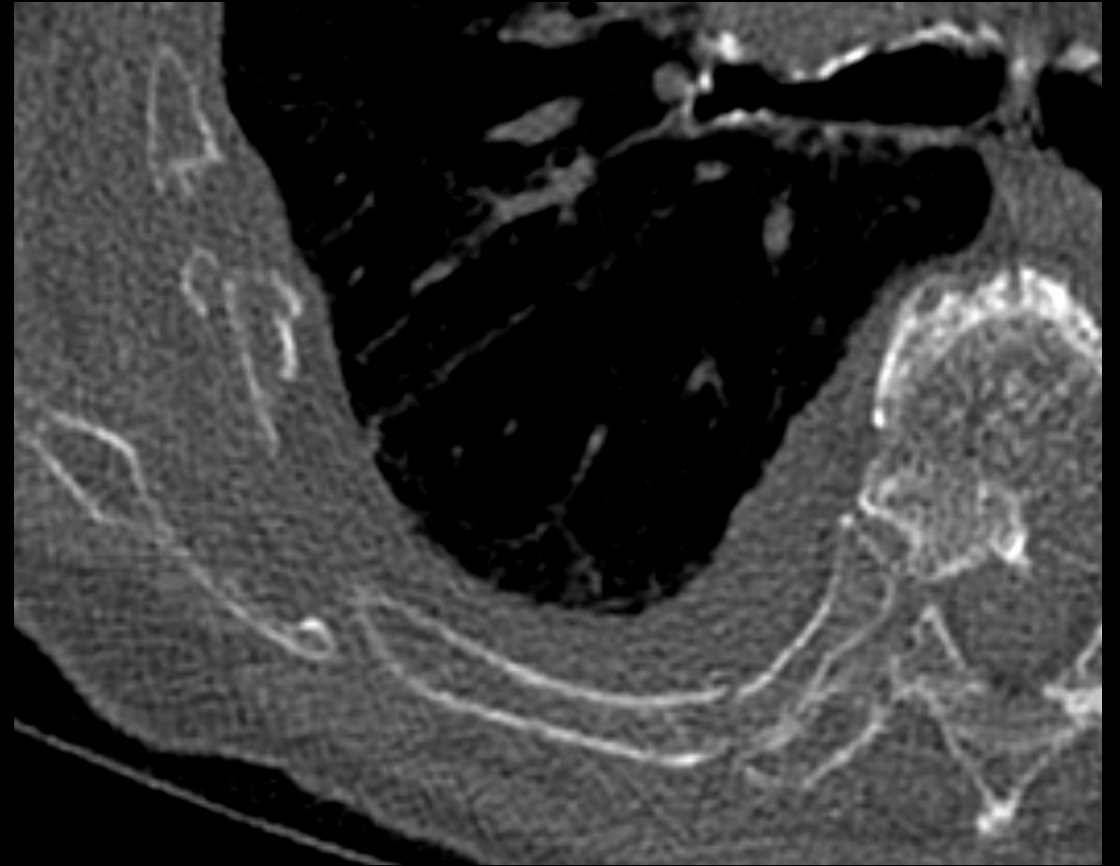
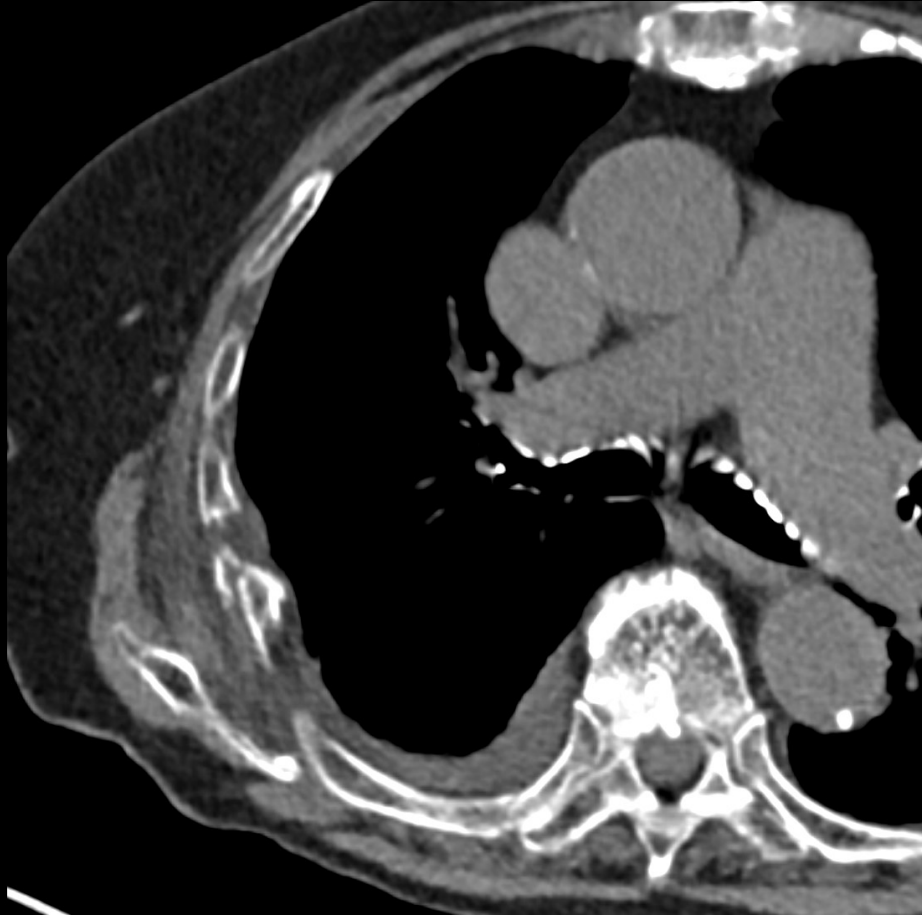
consecutive, single or segmental

Costochondral fractures

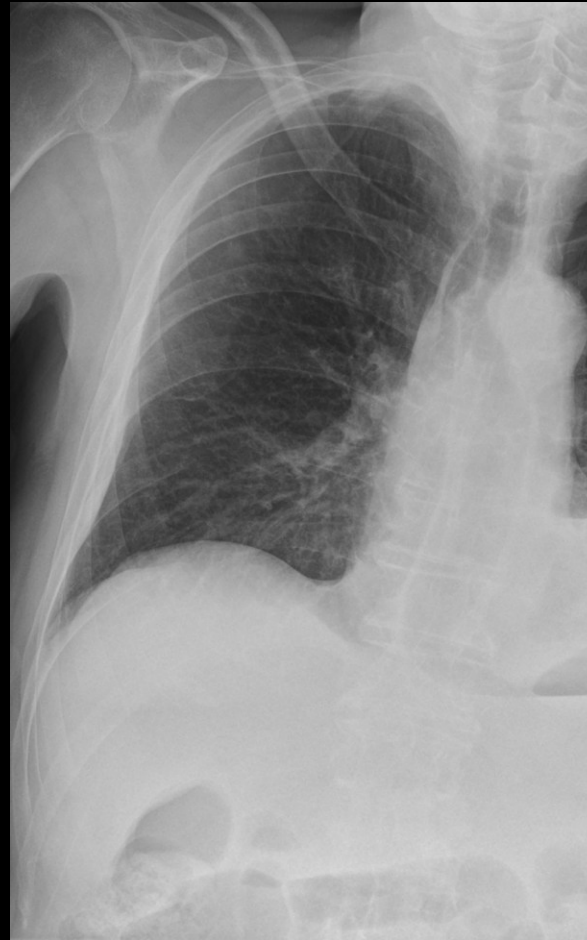
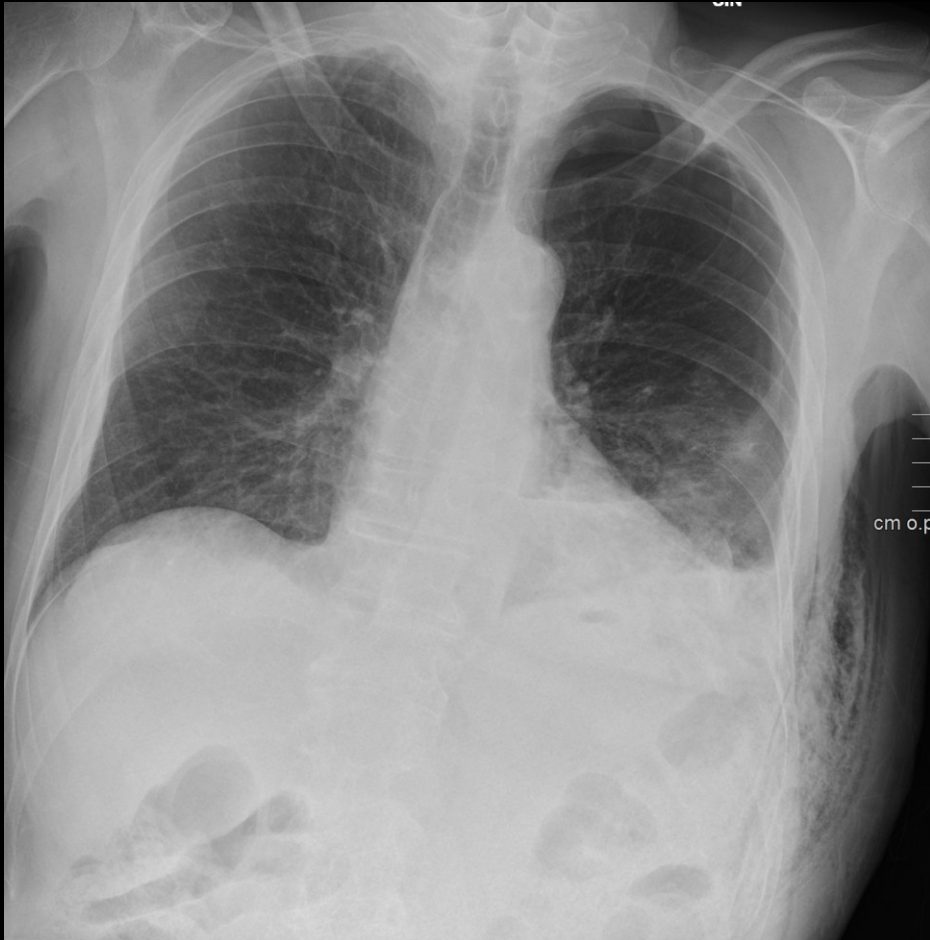
Flail segment / Flail chest/ Chest wall deformity



Chest CT without contrast/ 90F, fall



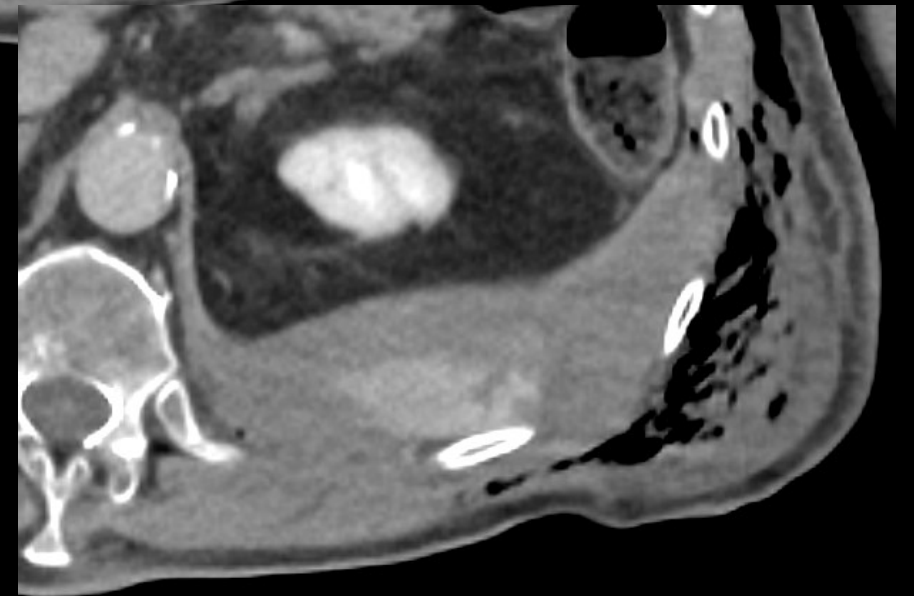
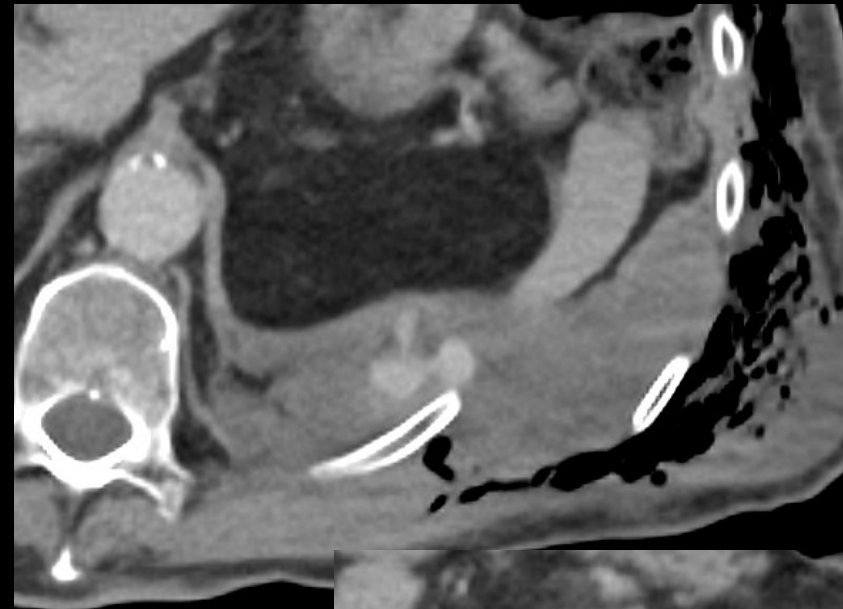
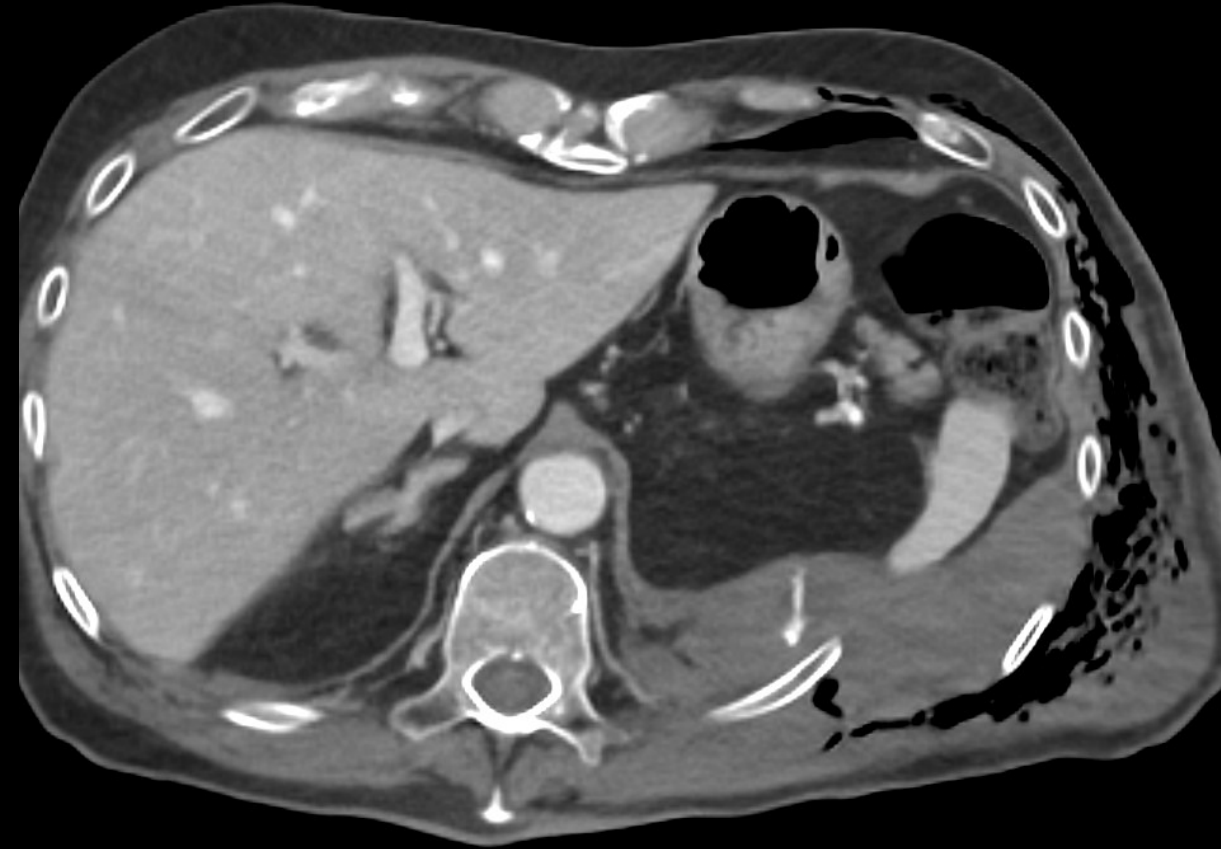
Case 1. 78M. Fell at home, left flank pain

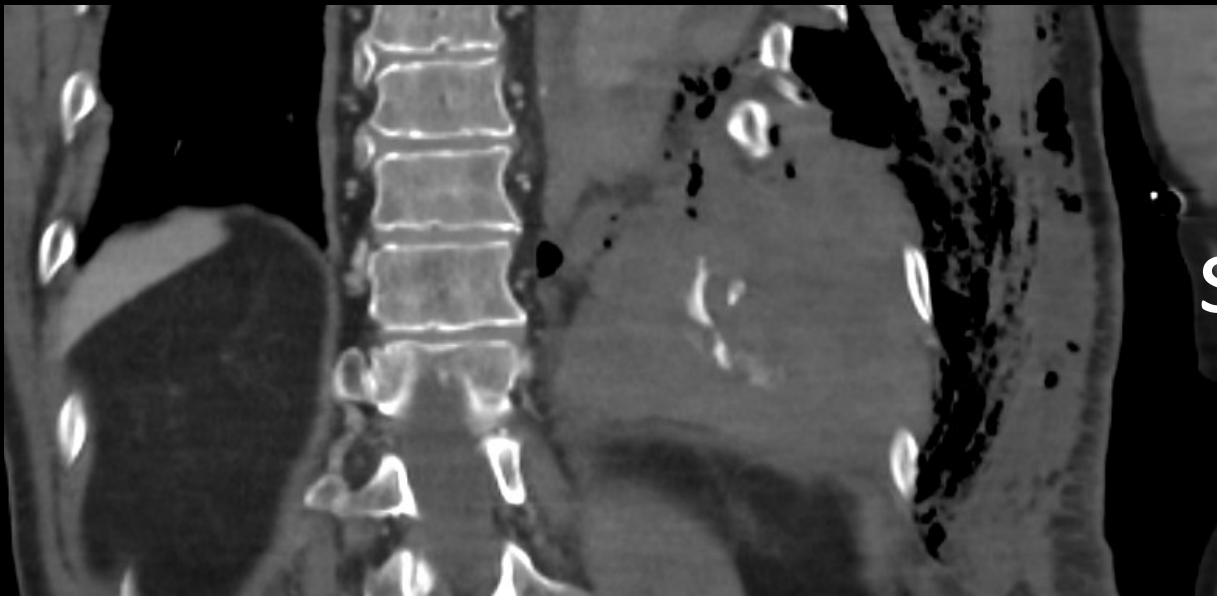


Case 1. 78M. Blood from the chest tube

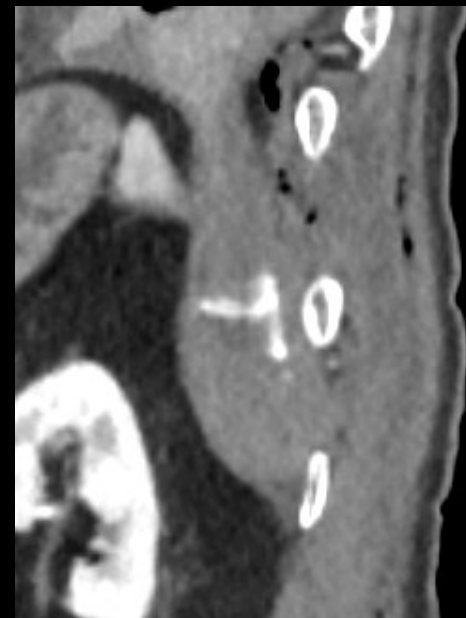
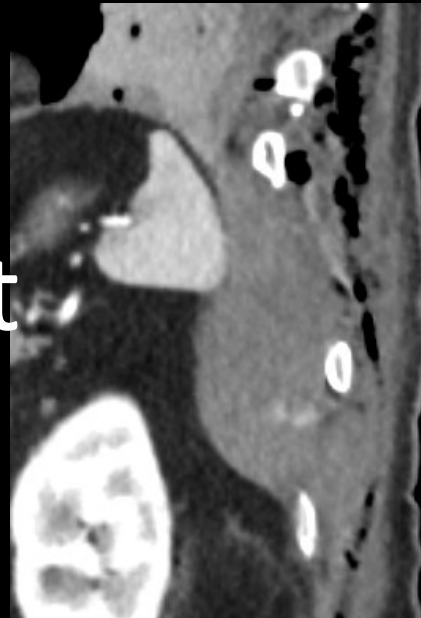


Case 1. 78M. 10/11th intercostal artery





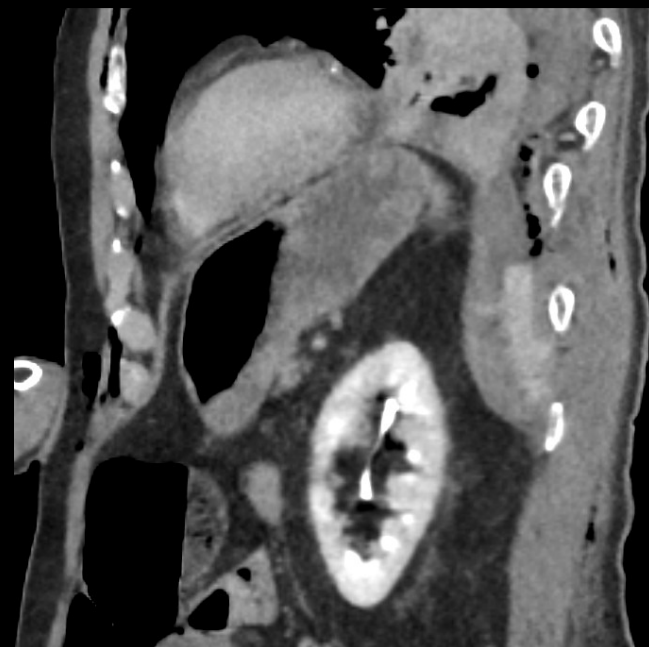
split



cor

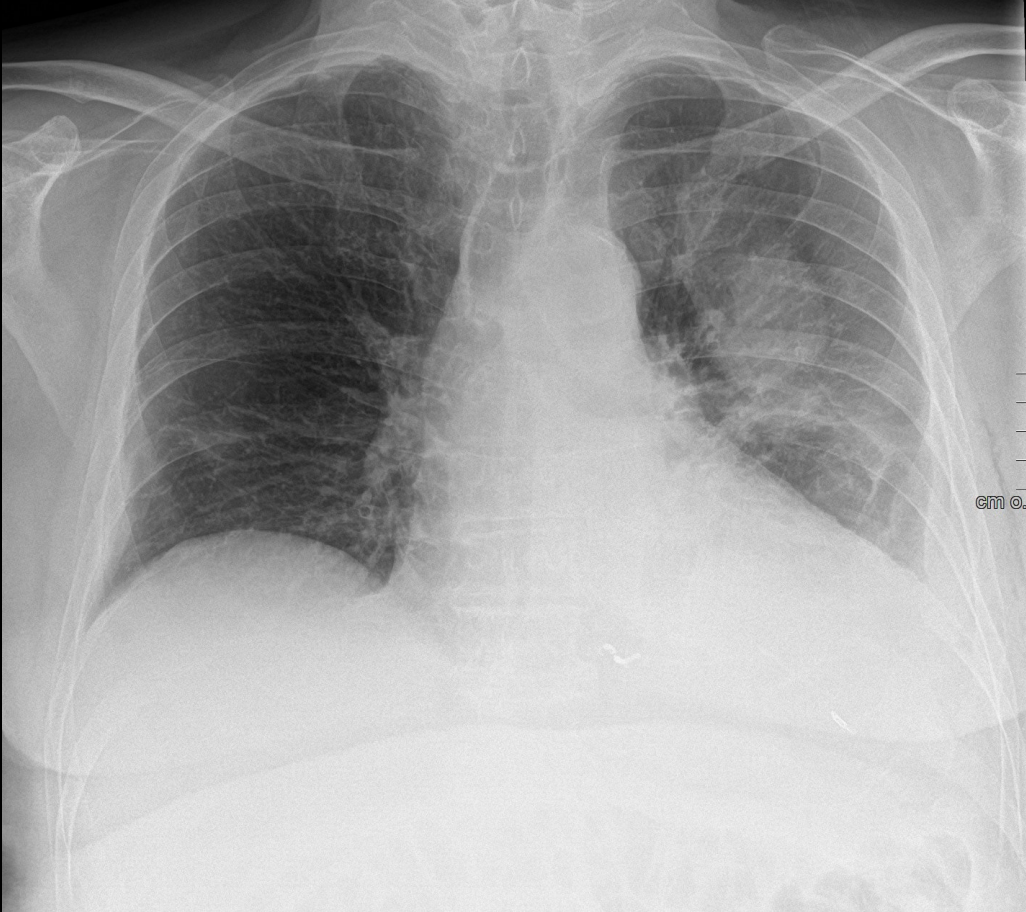


delayed



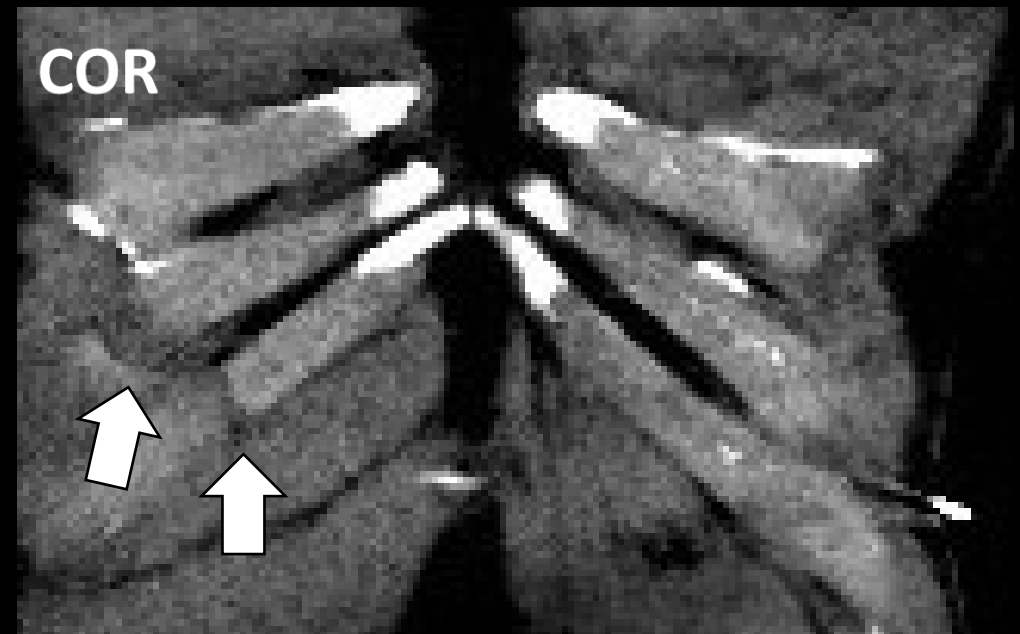
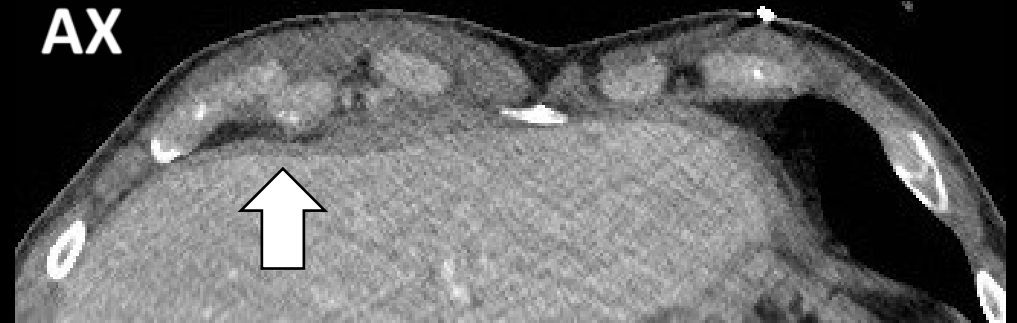
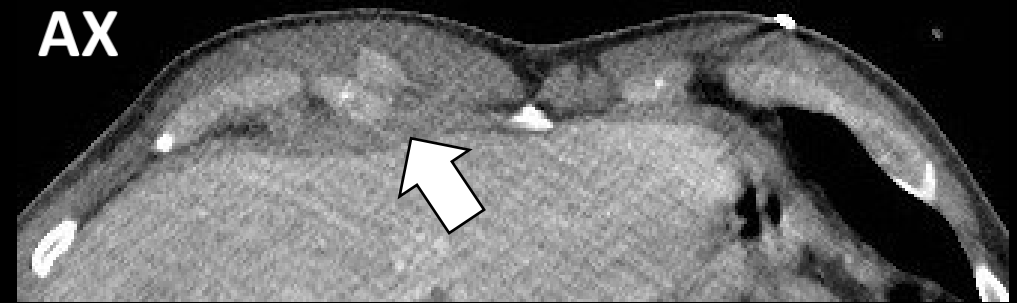
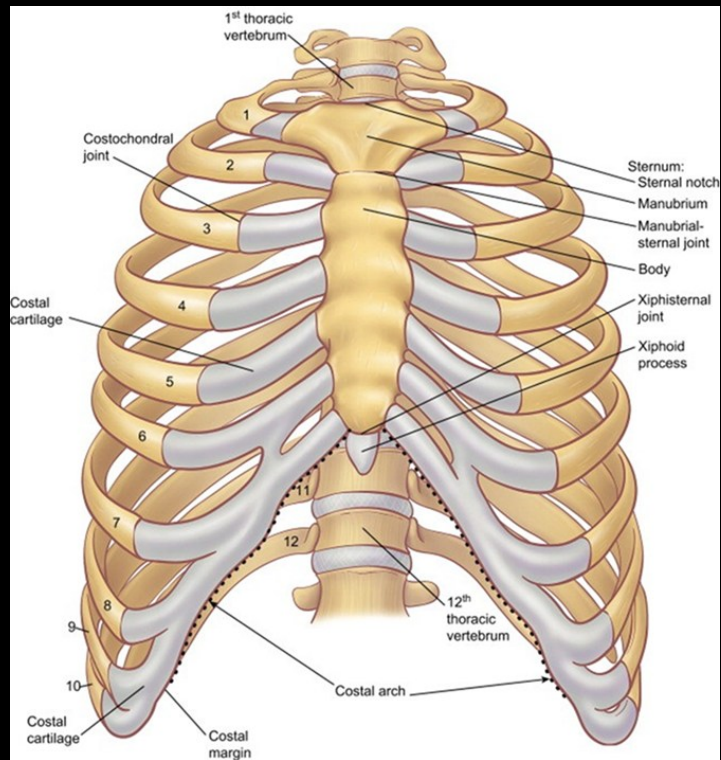
sag

Case 1. 78M. Day 6



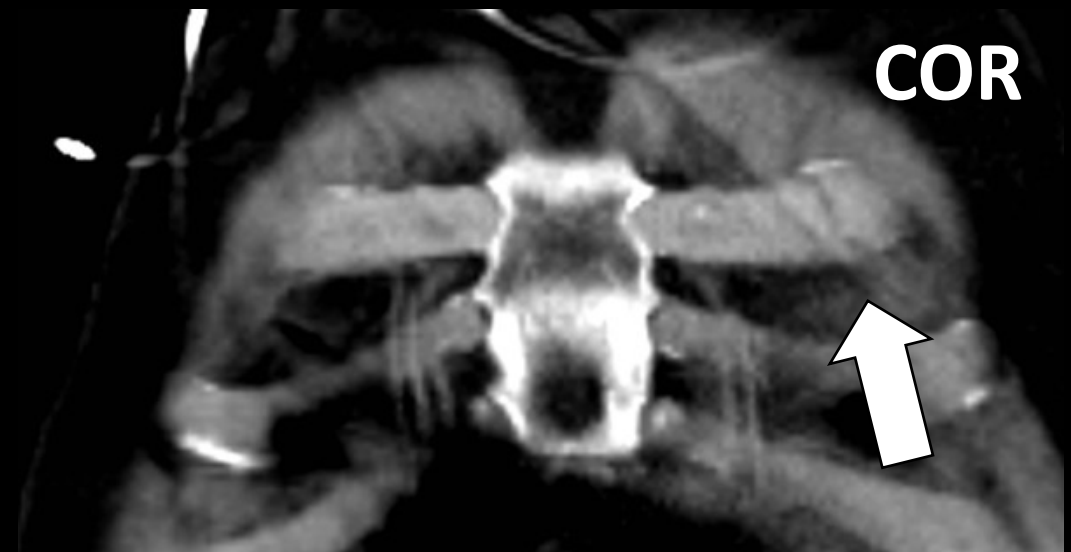
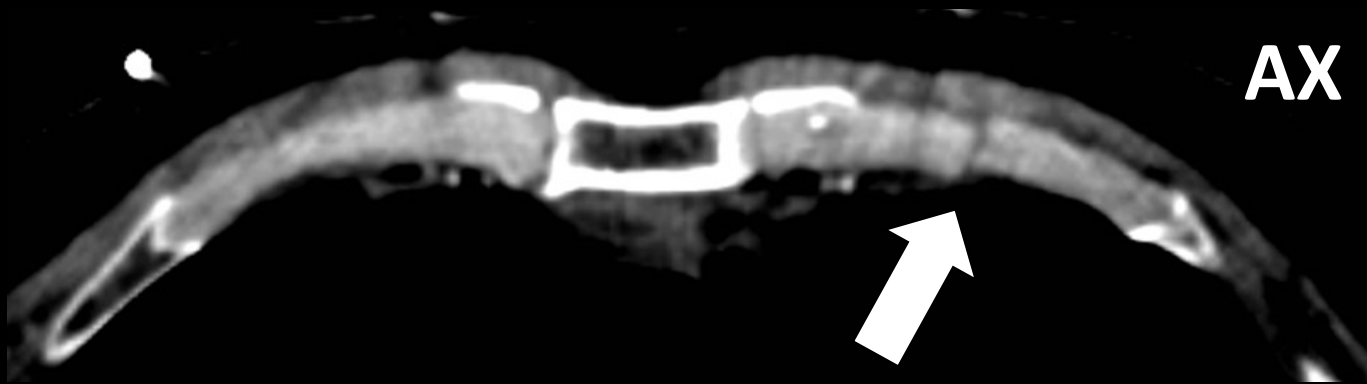
- CRP rising
- No fever
- Chest tube removed

Case 2. 51M, MVC

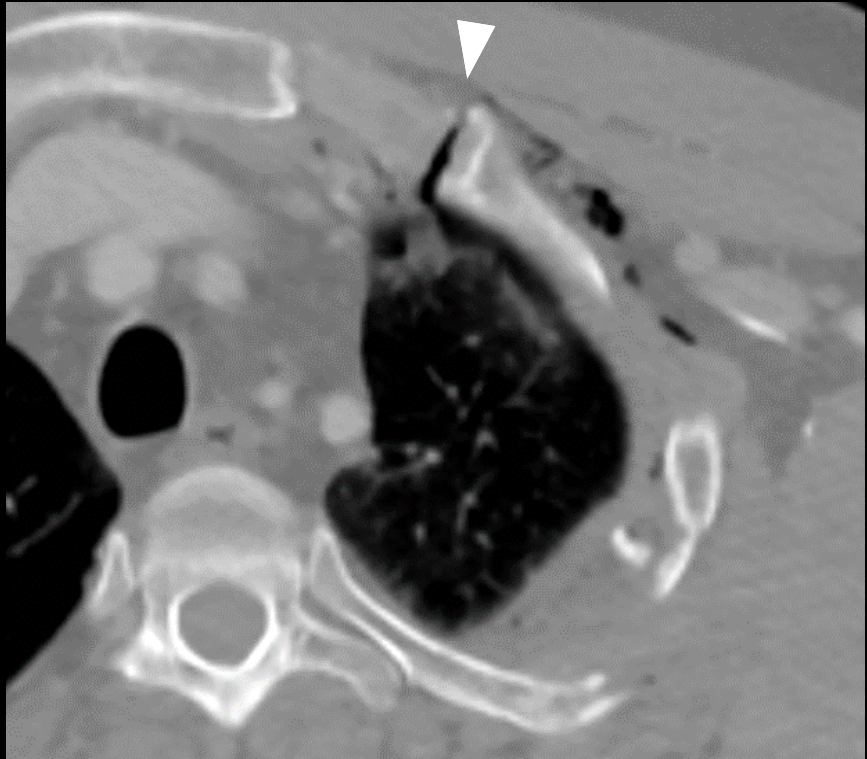


Case 3. 53M, fall. Non-dislocated CC fx

The subtle ones are easy to miss

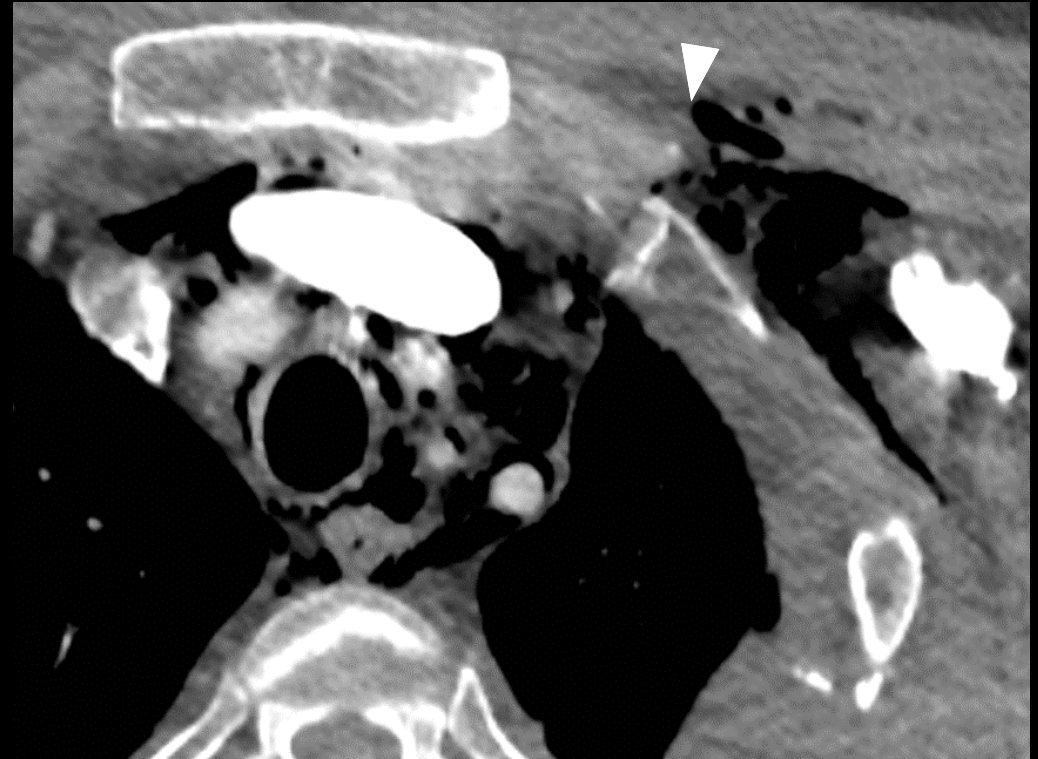


Case 4. 43M, MCC



AX

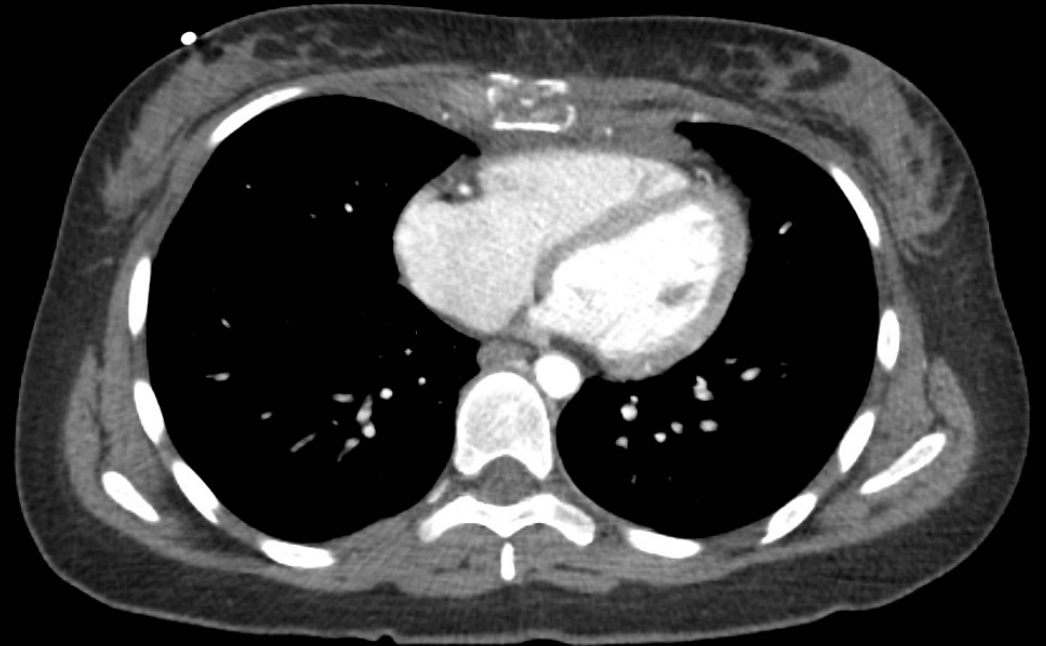
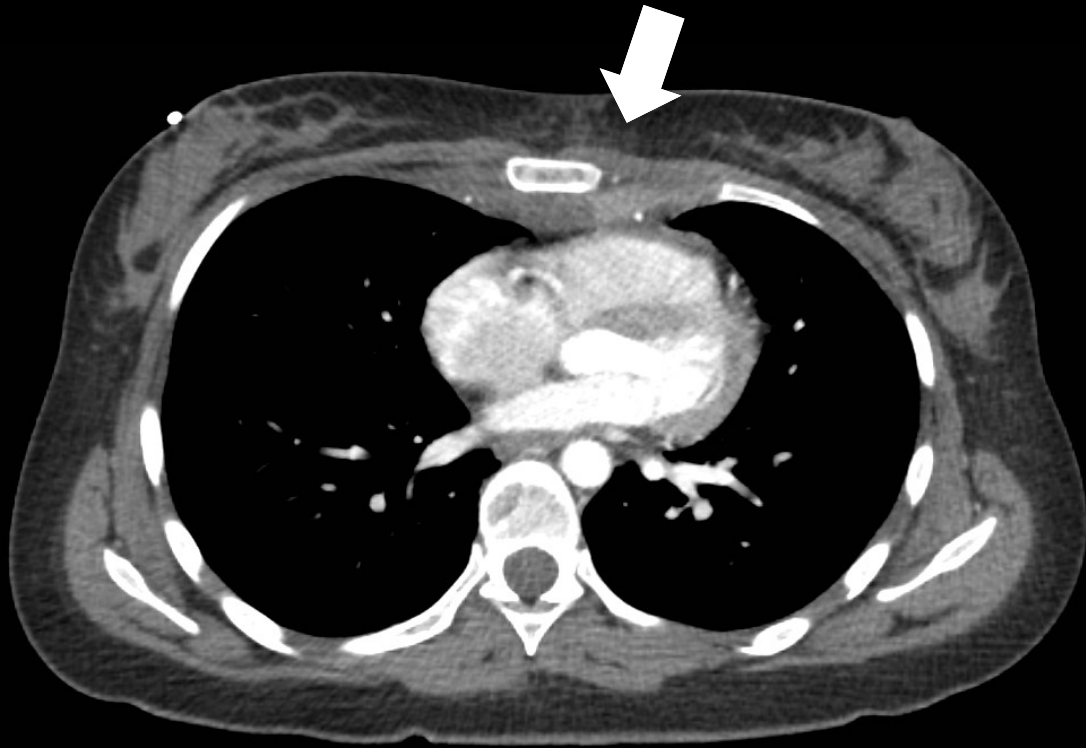
trauma-CT, left 1st rib



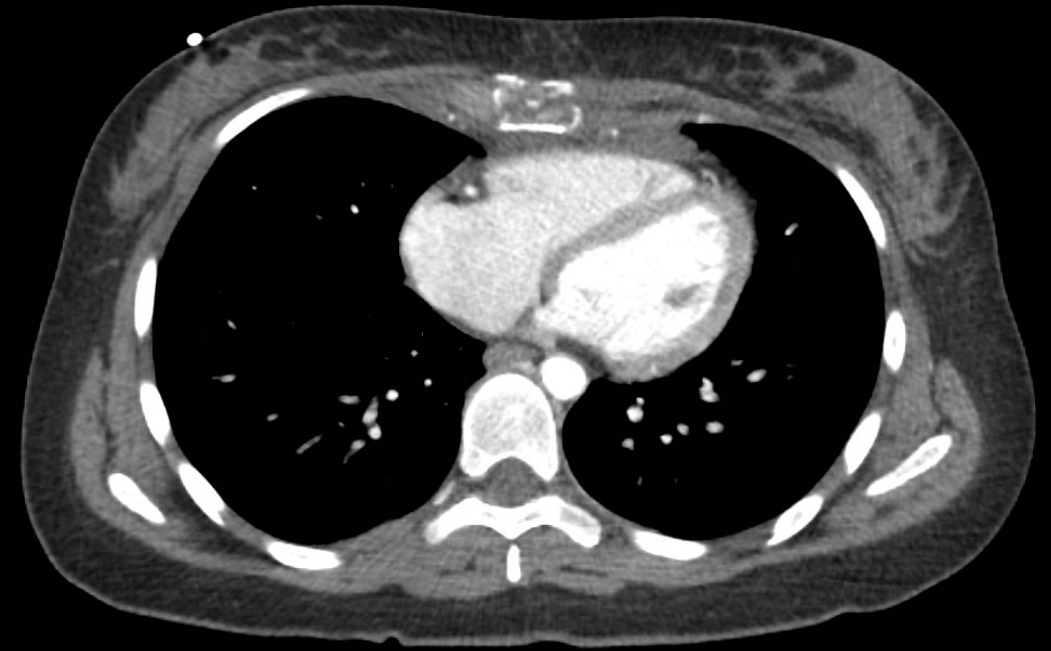
AX

day 3

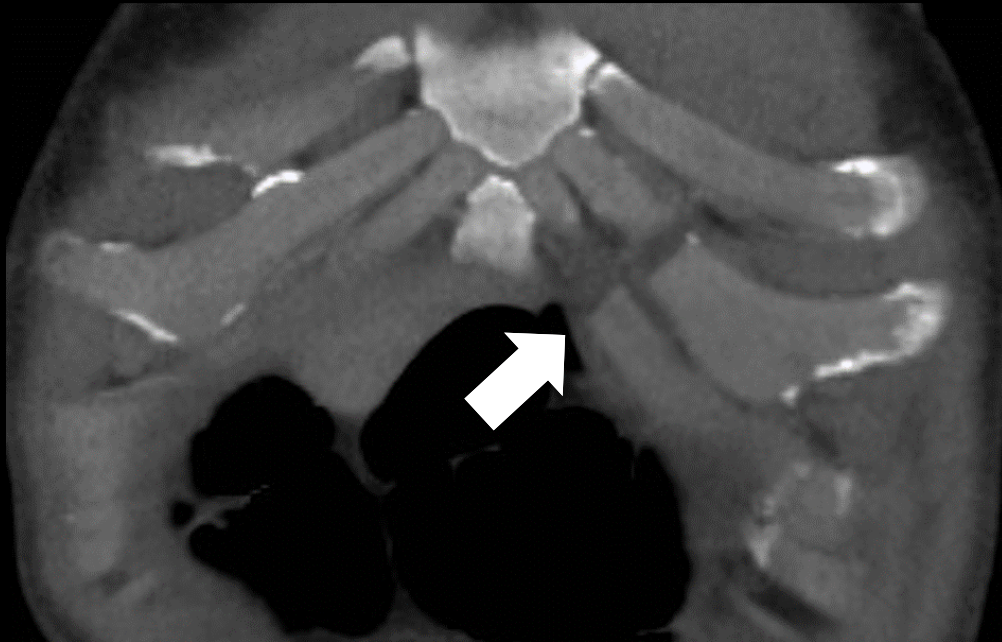
Case 5. 22F. Fall from a height. Posterior dislocation.



Case 5. S for sternum and sagittal!

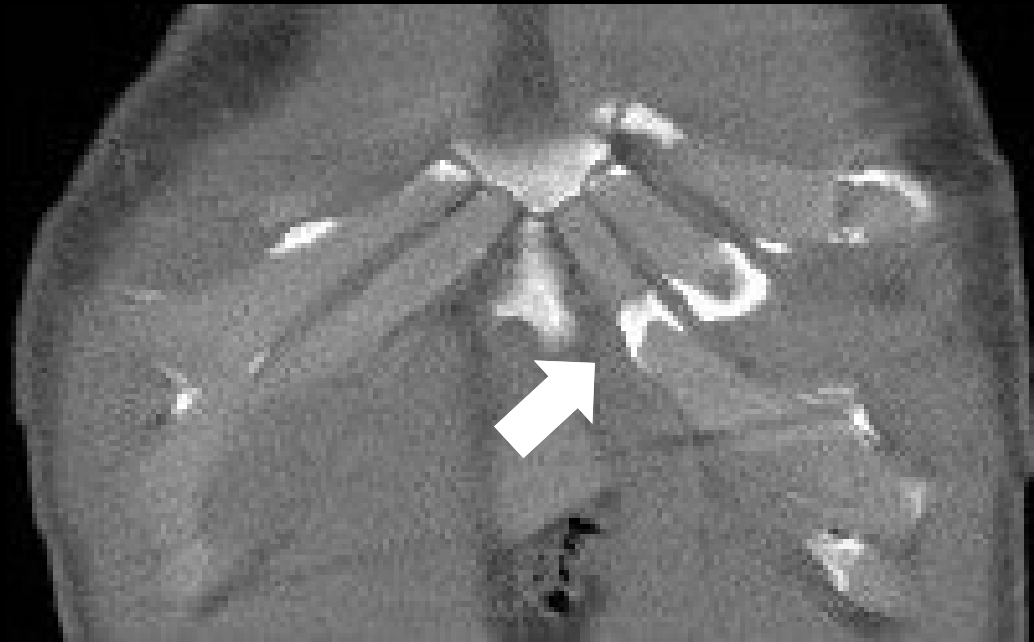


Posttraumatic calcifications – a stable union?



COR

39 yo M, fall



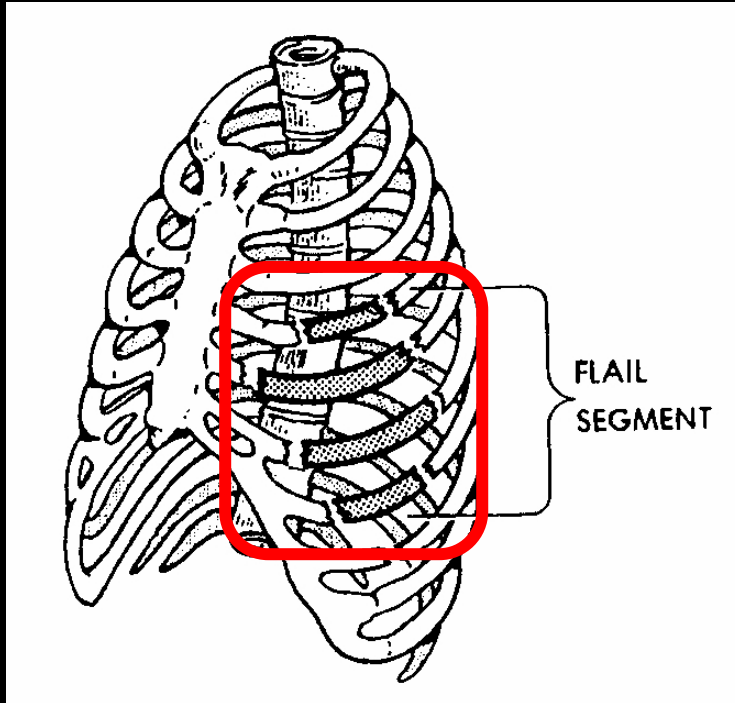
COR

14 months later

Piao Z, Takahara M, Harada M, Orui H, Otsuji M, Takagi M, Ogino T. The response of costal cartilage to mechanical injury in mice. *Plast Reconstr Surg.* 2007

Nummela MT, Pyhältö TT, Bensch FV, Heinänen MT, Koskinen SK. Costal cartilage fractures in blunt polytrauma patients - a prospective clinical and radiological follow-up study. *Emerg Radiol.* 2022.

Flail chest



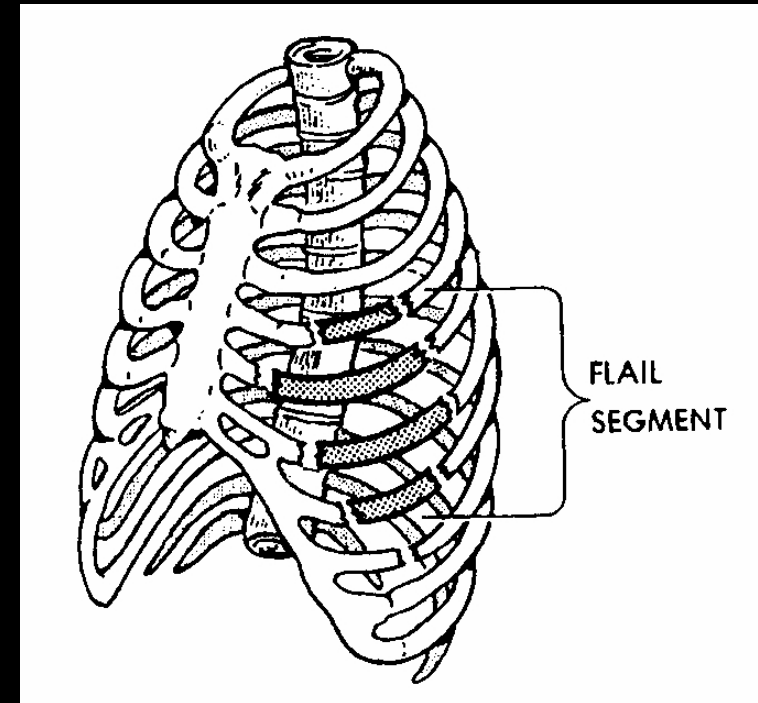
≥ 3 contiguous
segmental rib fxs

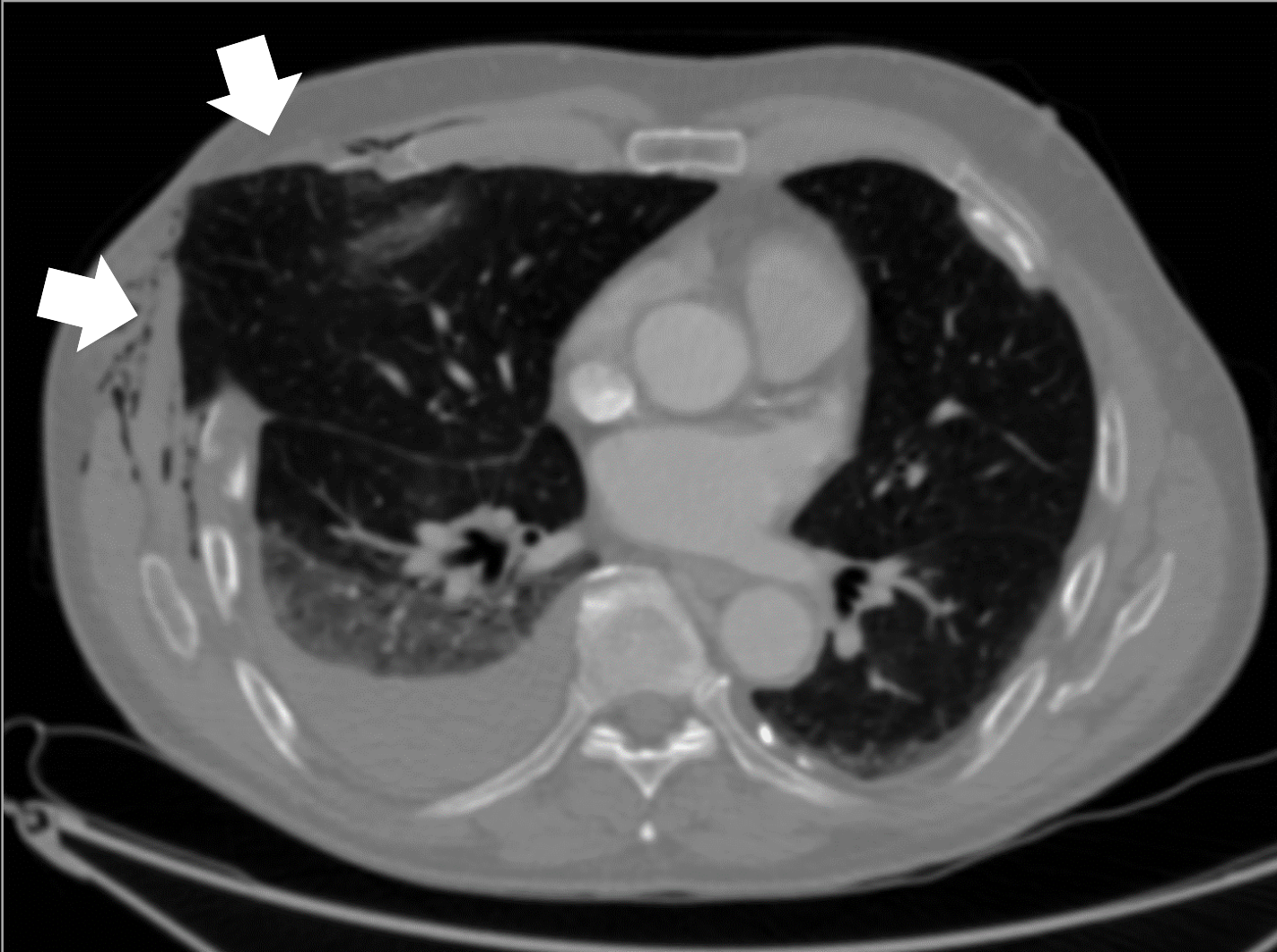
Mortality rate
16 - 33%

Velmahos et al. Int Surg. 2002 Oct-Dec;87(4):240-4.
Battle et al. Emerg Med J. 2015 Dec;32(12):961-5.
Nirula et al. World J Surg 2009;33(1):14–22.
Dehghan et al. J Trauma Acute Care Surg. 2014 Feb;76(2):462-8.

Flail chest

- **flail segment in CT**
 - rib fractures, costochondral fractures
 - Several injuries, patient doing fine
- **clinical flail chest**
 - Muscle splinting – eventually wears out
 - Paradoxical movement
 - Proper breathing, coughing
 - Sufficient analgesia





"CLASSIC" INDICATIONS FOR SSRF

- Lung herniation
- Open fractures
- Non-union

Surgical stabilization OF RIB fractures (SSRF)

Possible
indications for
SSRF*

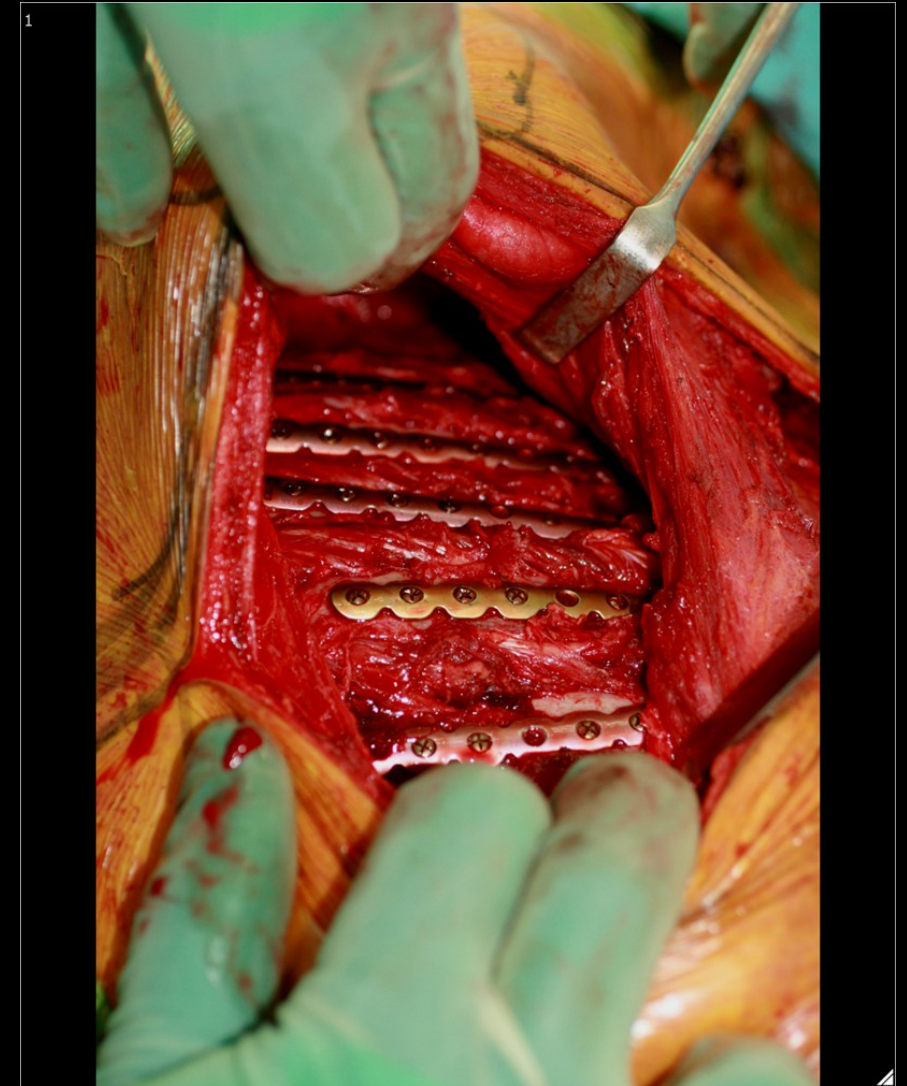
- Prolonged intubation
- Poor chest wall mechanics
- Respiratory failure
- Uncontrolled pain

No significant TBI

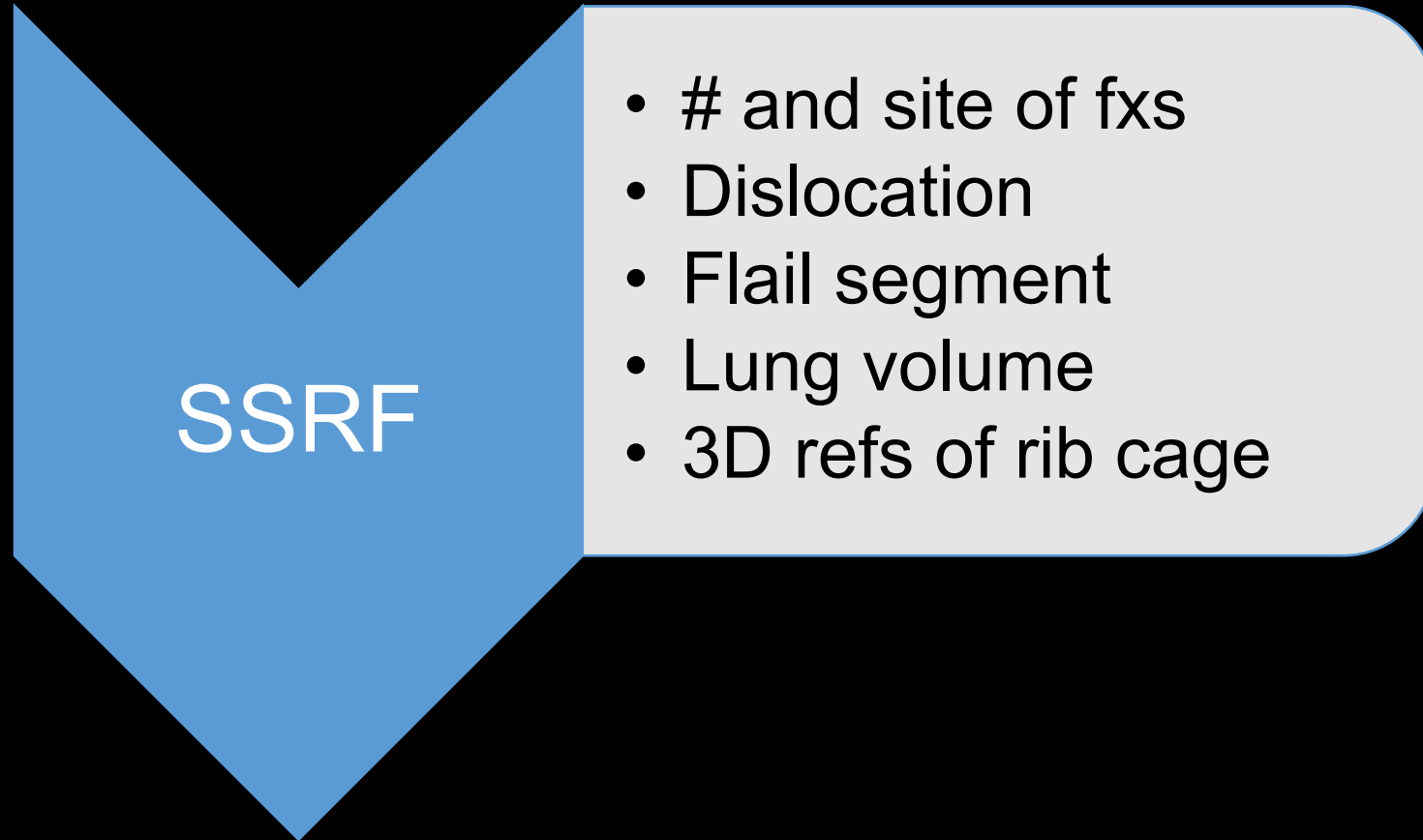
*Indications at Töölö Hospital/Helsinki University Hospital

Senejkian, Nirula. Crit Care Clin 33 (2017) 153–165

Lafferty et al. Bone Joint Surg Am. 2011;93:97-110



SSRF – what the surgeon needs to know



Pieracci et al. J Trauma Acute Care Surg 2015; 78(3): 883-887.

SSRF - CONSIDERATIONS

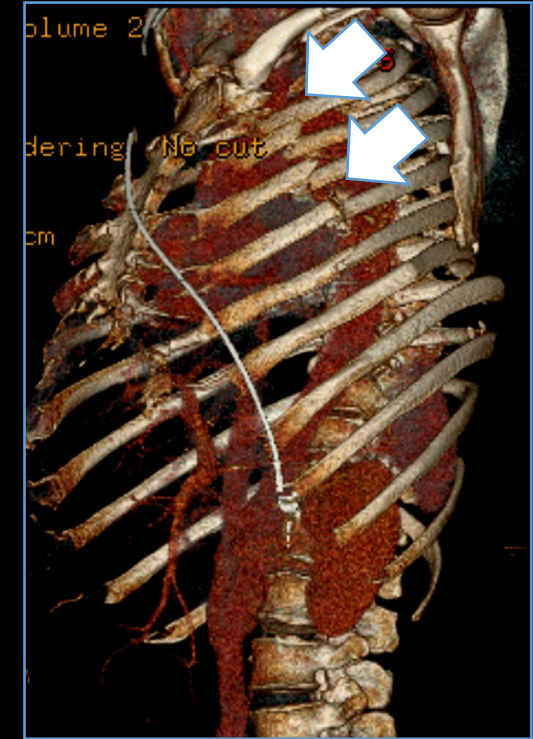
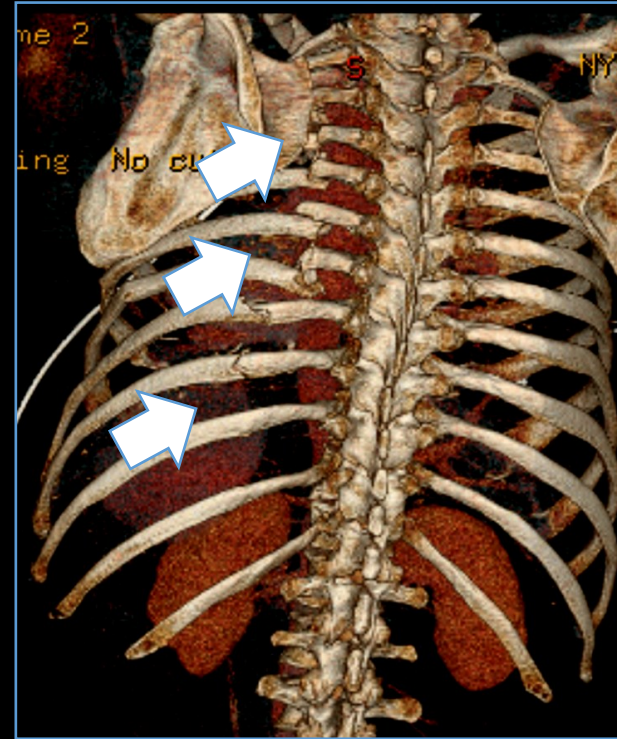
No significant TBI

3D reformats for
preop planning

Ribs 3 - 8

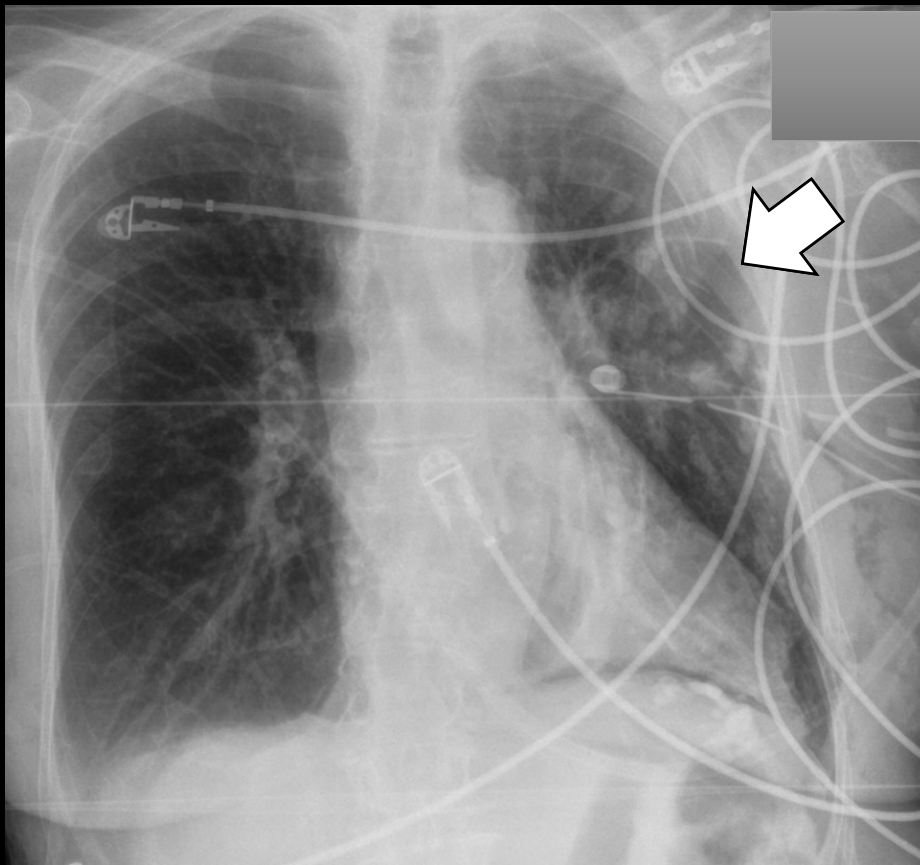
“Specific indications for fixation
remain to be elucidated.”

Senejkian, Nirula. Crit Care Clin 33 (2017) 153–165



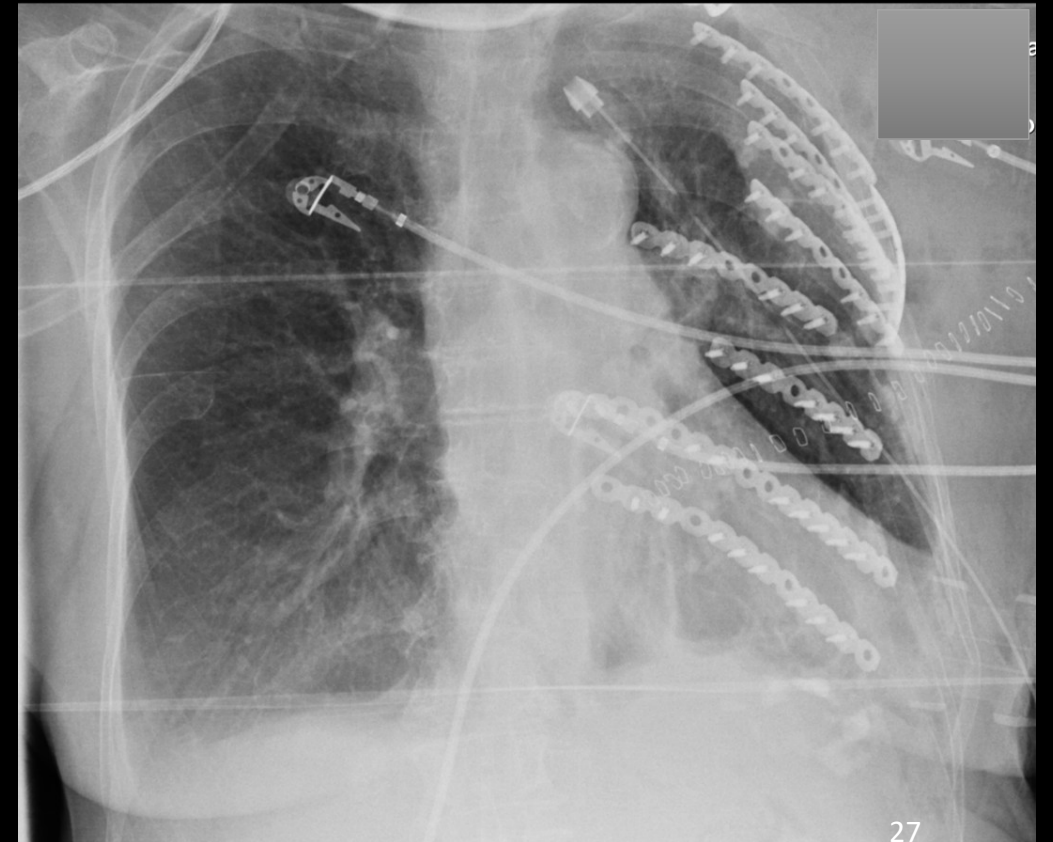
“Despite the advantages of SSRF and its growing popularity,
it remains not uniformly considered in trauma centers”

Sermonesi *et al.* Surgical stabilization of rib fractures (SSRF): the WSES and CWIS position
paper. *World J Emerg Surg* 19, 33 (2024)



Case 6. 83F, BCA, day 3
Flail chest

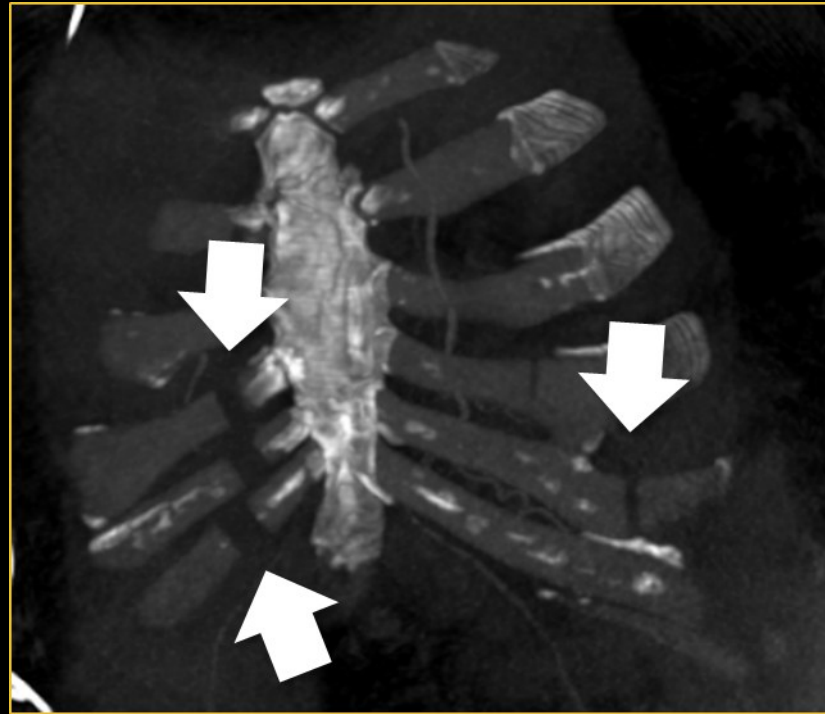
Day 6, plates



**SURGICAL STABILIZATION
OF RIB FRACTURES (SSRF)**

Case 7. – SSRF for sternal flail

Bilateral
costochondral fxs
and
posterior rib fxs



64M, MVC.
Day 7



Anterior SSRF



Photo credit: Riku Kettunen

Thank you! Kiitos!



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