



CHEST TRAUMA

THE RADIOLOGIST'S PART

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Basics

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Emergency unit

- **Coordinator**
- **Traumatologist: extent, primary focus, sequence of procedures, selection of pts.**
- **Anesthesiologist: life functions**
- **Radiologist: US, RTG**
- **Chest surgeon**
- **Other staff**

Basics

- **25% trauma-related deaths (2nd after head)**
- **Incidence of injuries:**
 - 1. head**
 - 2. extremities**
 - 3. chest**
- **High mortality rate:**
 - cardiac and large vessel injury**
 - tracheobronchial tree**
 - oesophagus**

Radiologist at the Emergency

- **Ultrasound: the FAST protocol**
Fluid chest yes/ no
abdomen yes/no
- **RTG: pneumothorax TENSION?**
hemothorax
tubes and lines malposition



Traumatologist's decision

Operation now

or

CT

Radiologist is a part of the resuscitation team

CT

- **CT protocol:** Brain
C spine
IV contrast Whole body scan, ca. 35 s



- **Image postprocessing:** MPR in 3 planes (windows?)
MIP or volume rendering if needed
- **Speed of report**
- **Practical issues:** transferring planes, view on the patient, monitors, tubes, IV lines, suspends for fluids, lead jackets, fixation devices, tables, gloves, wipes, chest tubes

Structures

- **Penetrating injury x closed blunt trauma**
- **Pneumothorax, haemothorax**
- **Parenchyma: contusion, bleeding, laceration**
- **Mediastinal structures:**
 - trachea**
 - bronchi**
 - heart**
 - vessels**
 - oesophagus**
- **Skeletal structures:**
 - spine**
 - ribs, sternum**
 - clavicle, shoulder**
- **Diaphragm**
- **Abdominal and other organs**

Life threatening injuries

- **Airway obstruction**
- **Laryngotracheal injury,**
- **Tension pneumothorax**
- **Open pneumothorax**
- **Flail chest**
- **Massive pulmonary contusion**
- **Massive hemothorax**
- **Cardiac tamponade**

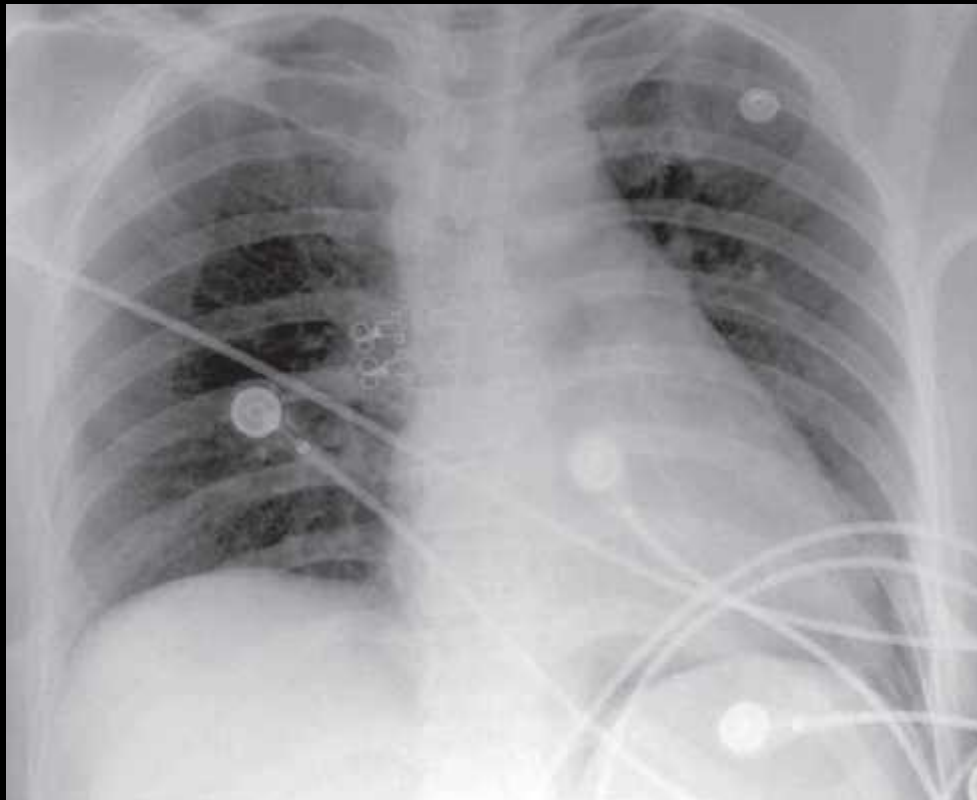


Blunt trauma

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Pneumothorax

- **15-40% blunt chest trauma (CT)**
- **10-50% of PNOs not seen on Chest X-ray**



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Chest trauma: the radiologist's part

Pneumothorax

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Pneumothorax

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- **10-50% of PNOs not seen on Chest X-ray**
- **Chest tube needed?**
- **CAVE! Tension PNO**



Haemothorax

- **Blood in pleural space (blood density 35-70 HU)**
- **From lungs, wall, heart, mediastinal vessels**
- **From abdominal organs with ruptured diaphragm**
- **Massive haemothorax 11**



Haemothorax

- Blood in pleural space (blood density 35-70 HU)
- From lungs, wall, heart, mediastinal vessels
- From abdominal organs with ruptured diaphragm
- Massive haemothorax 1l
- Sonography volume estimation:
1 cm ~ 100 ml



Pulmonary contusion

- 17-70% of chest injuries
- Coup and countercoup



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Pulmonary contusion

- **17-70% of chest injuries**
- **Coup and countercoup**
- **CT immediately, CXR 6+ hrs**

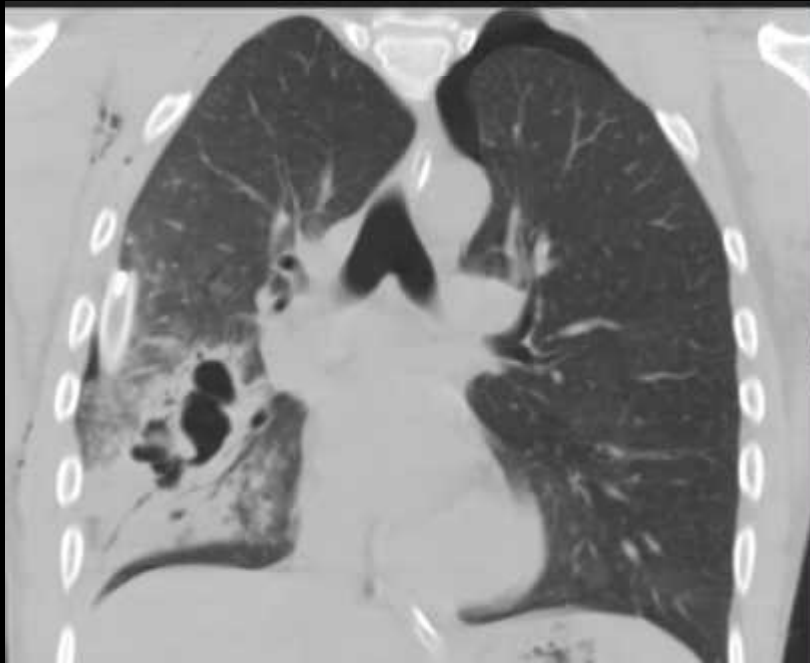


Pulmonary contusion

- 17-70% of chest injuries
- Coup and countercoup
- CT immediately, CXR 6+ hrs
- Patches appearing > 1 day are probably not contusion
- **CAVE!** Aspiration, pneumonia, fat embolism

Pulmonary laceration

- Filled with air, blood or both



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Pulmonary laceration

- Filled with air, blood or both
- More common in children and young adults



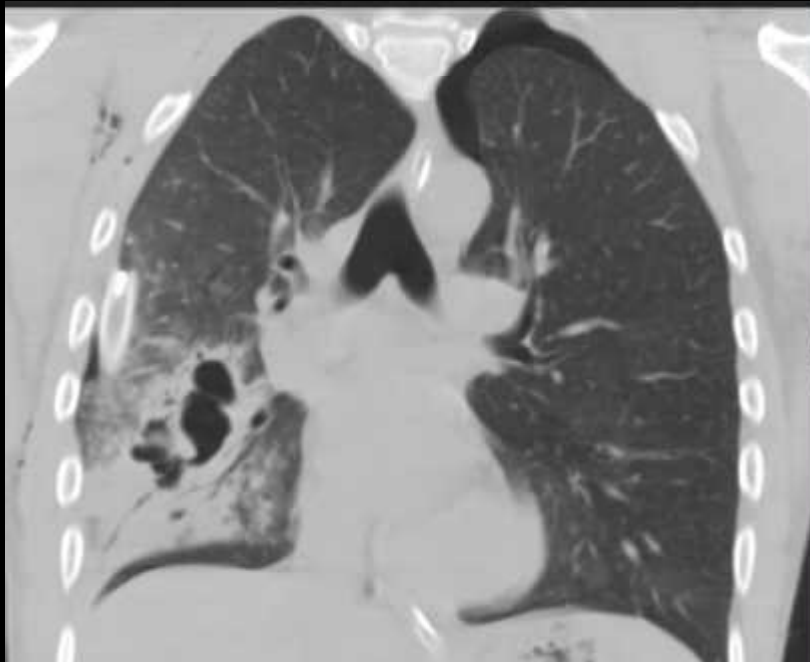
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Pulmonary laceration

- Filled with air, blood or both
- More common in children and young adults
- Resolution in months



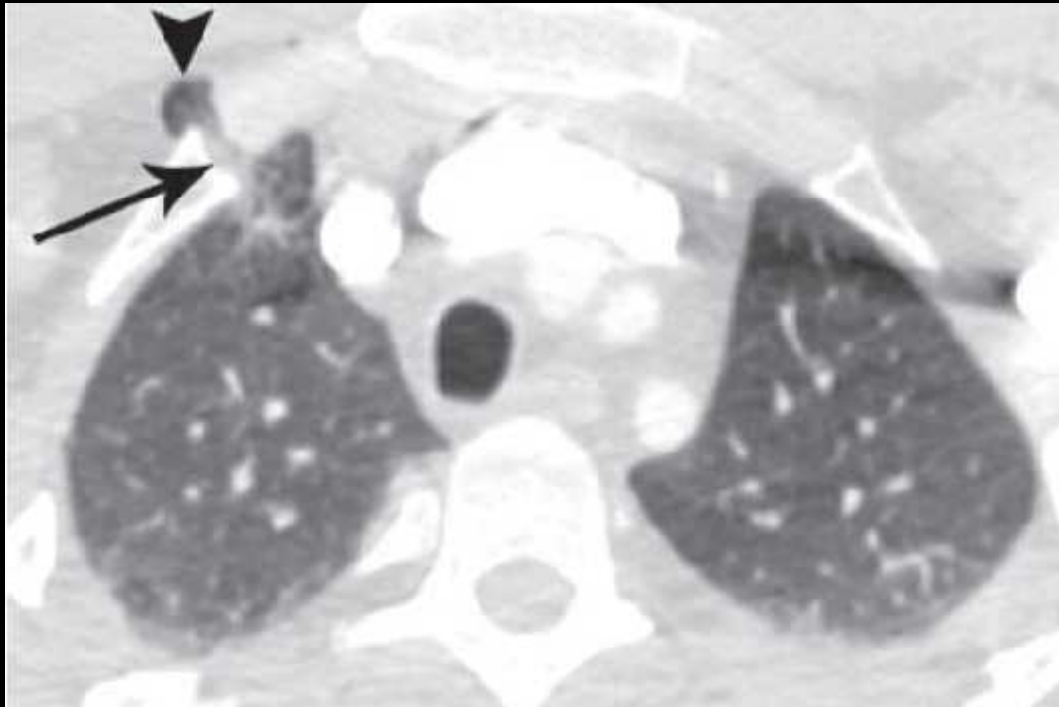
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Lung herniation

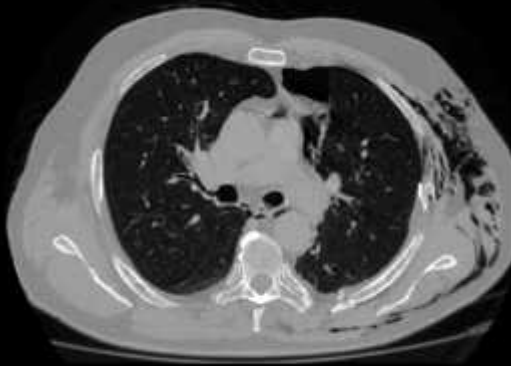
- Chest wall defect



Kaewlai R et al: Multidetector CT of blunt thoracic trauma. Radiographics. 2008 Oct;28(6)

!Airways!

- 0,2-8% of chest injury patients
- Most patients die before reaching emergency unit

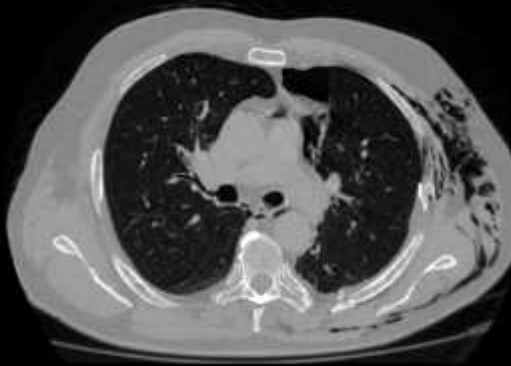


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Chest trauma: the radiologist's part

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- Persistent PNO despite chest tube- think of airway defect

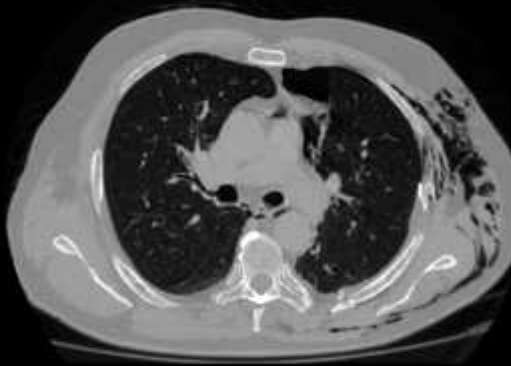


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Chest trauma: the radiologist's part

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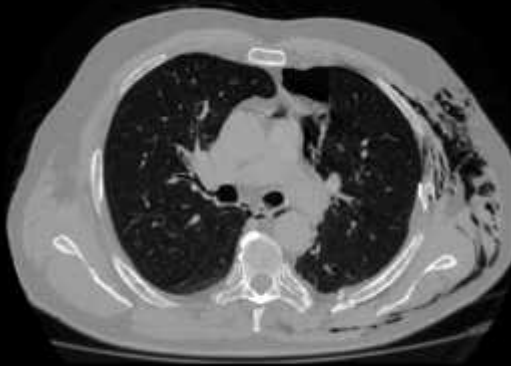


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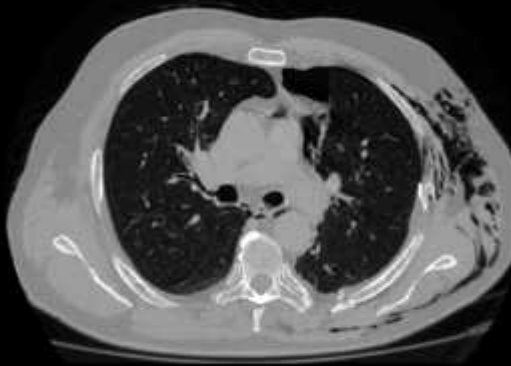


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Chest trauma: the radiologist's part

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- **Most patients die before reaching emergency unit**
- **Persistent PNO despite chest tube- think of airway defect**
- **Complete bronchial transection- „fallen lung sign“**
- **Tracheal laceration- endoscopic control?**
- **Complications common: obstruction, pneumonia, absces empyema, bronchiectasis**

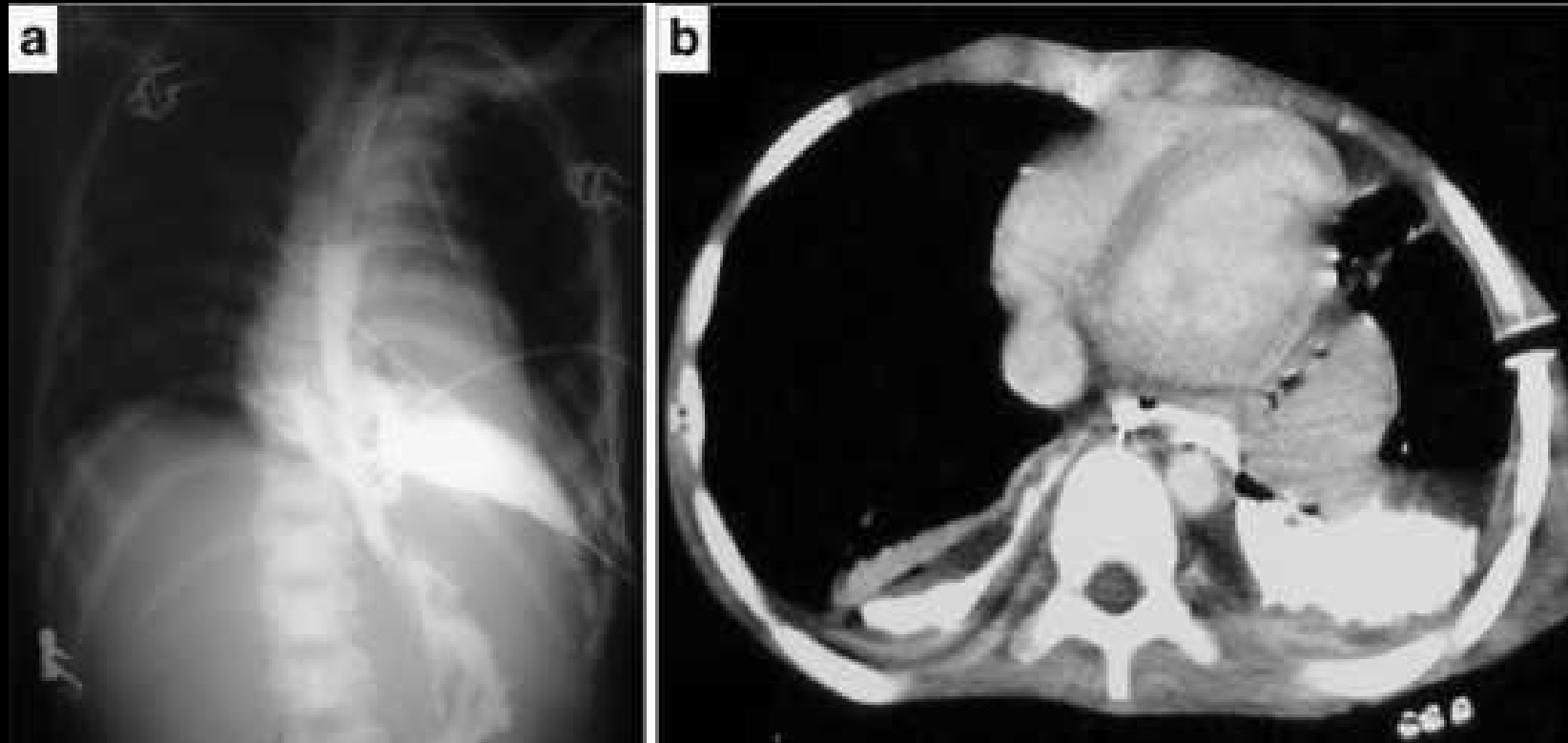


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Oesophagus

- **Extremely rare**



Oikonomou A, Prassopoulos P: [CT imaging of blunt chest trauma](#) Insights Imaging. 2011 June; 2(3):

! Heart !

- **Dangerous! Cardiac output ca. 5 l/min**
- **Clinical suspicion, ECG, cardiac enzymes**
- **ECG-gated scanning?**



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Chest trauma: the radiologist's part

! Aorta !

- **80-90% die before reaching emergency unit**
- **50% of survivors die within 1 week**
- **Cause of 10-15% car accident deaths in the U.S.**



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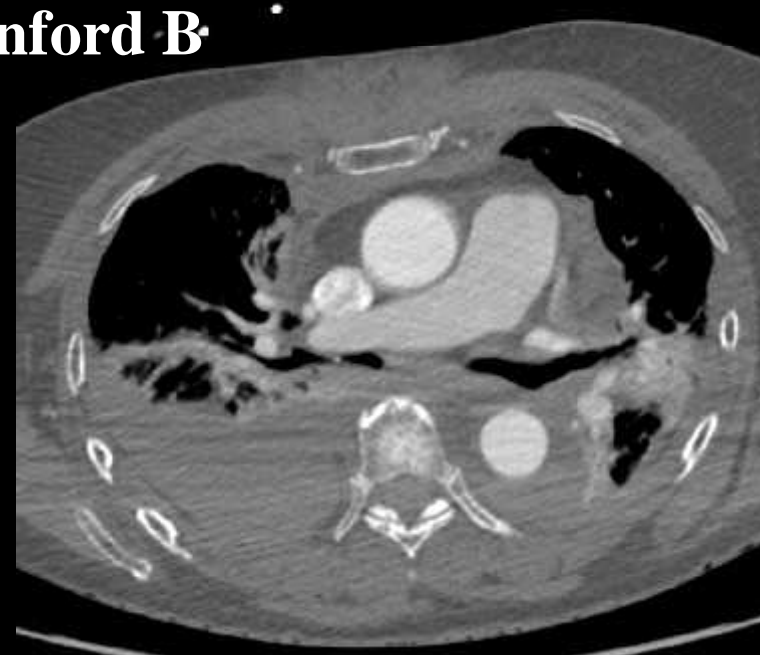
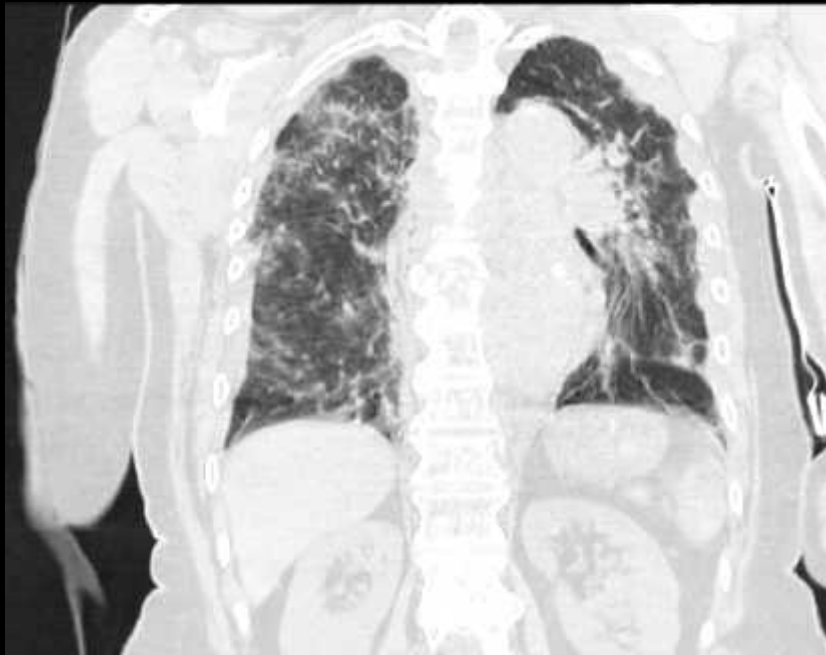


Chest trauma: the radiologist's part

! Aorta !

- **80-90% die before reaching emergency unit**
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- **Cause of 10-15% car accident deaths in the U.S.**
- **Traumatic dissection: Stanford A**

Stanford B



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Other arteries

- **Mammary, carotid, subclavian, intercostal**

Diaphragm

- 2-6% of blunt chest injuries



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Chest wall

- **Common**
- **Fractures, hematoma, emphysema**



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! Flail chest !

- >3 ribs, each with >2 fractures
- Clinically paradoxical chest movement



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Chest trauma: the radiologist's part

Flail chest

- **>3 ribs, each with >2 fractures**
- **Clinically paradoxical chest movement**
- **Important marker of severe injury**



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Flail chest

- **>3 ribs, each with >2 fractures**
- **Clinically paradoxical chest movement**
- **Important marker of severe injury**
- **> 50% will have surgery**



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Flail chest

- **>3 ribs, each with >2 fractures**
- **Clinically paradoxical chest movement**
- **Important marker of severe injury**
- **> 50% will have surgery**
- **Prolonged ventilation**



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Malpositioned tubes



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Penetrating trauma

Penetrating trauma



<http://www.newscientist.com/article/dn16281-gallery-virtual-autopsies-dissect-humans-and-animals.html>

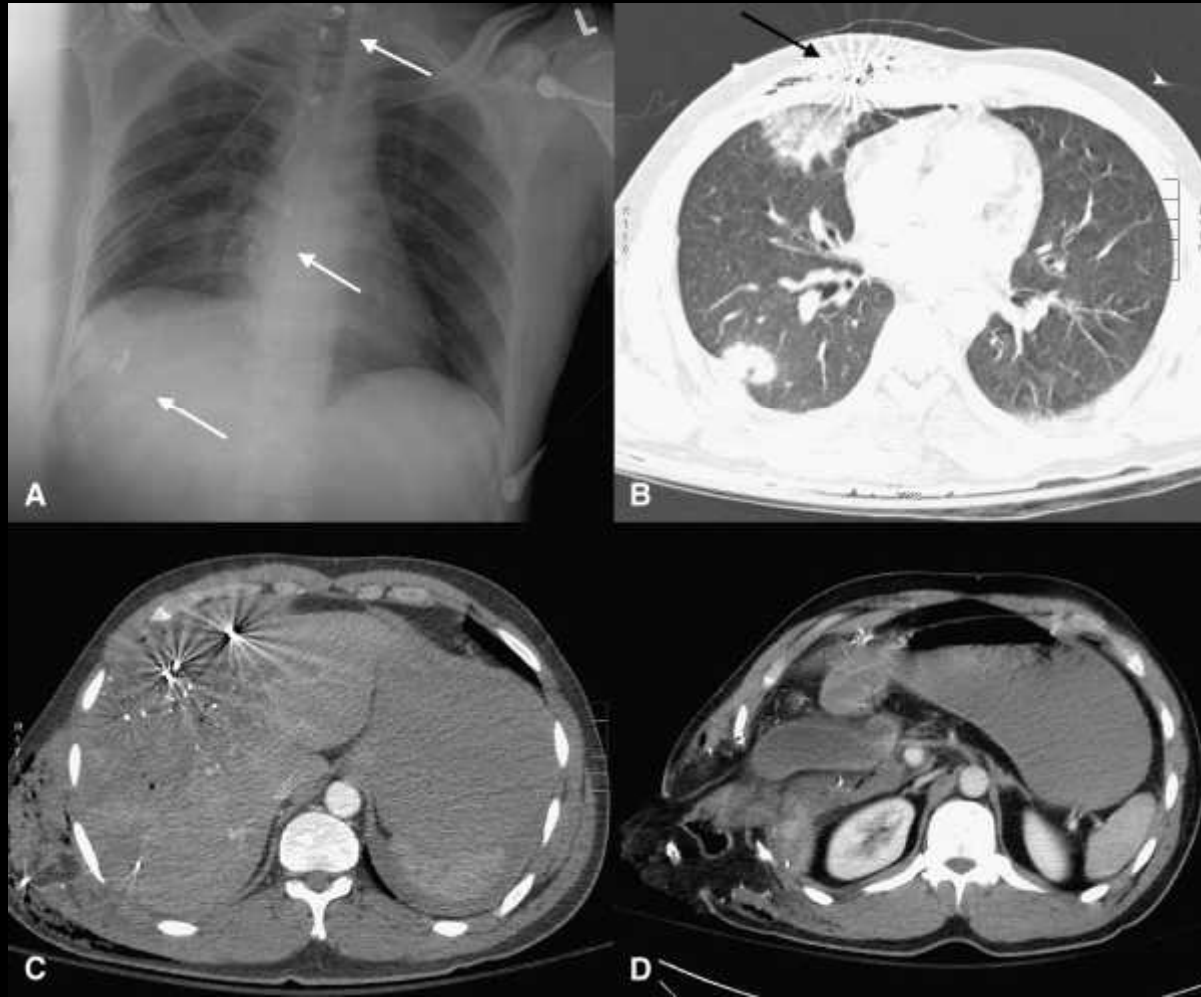
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Penetrating trauma

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Penetrating trauma



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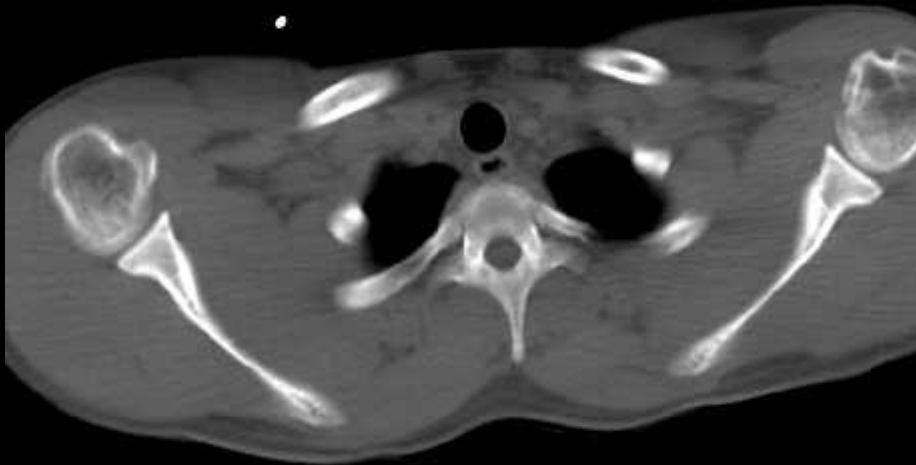
Challenging cases

- **Horizontal fractures**



Challenging cases

- **Horizontal fractures**



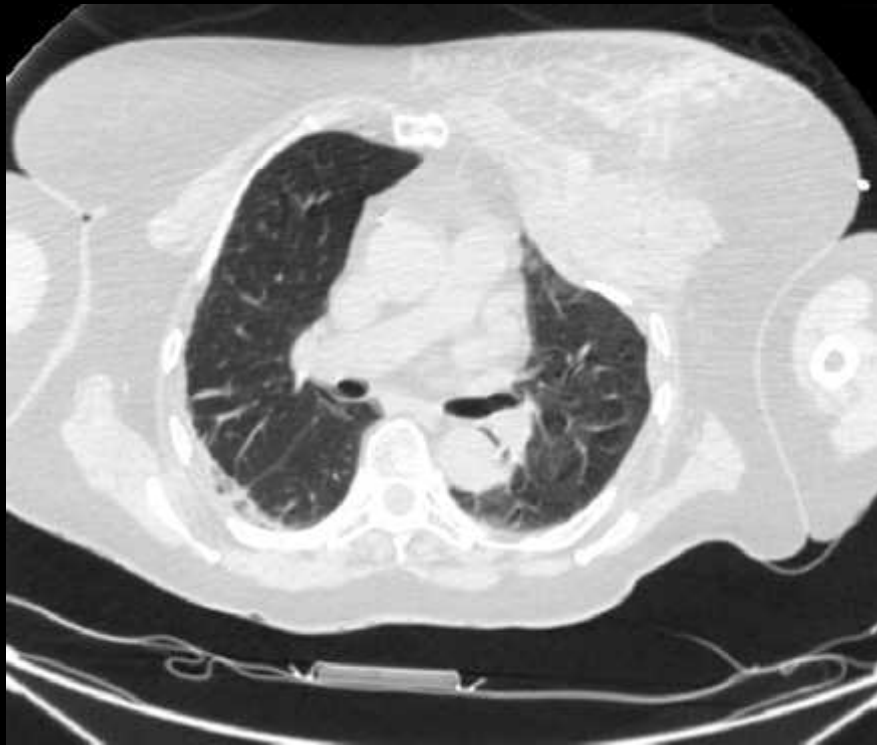
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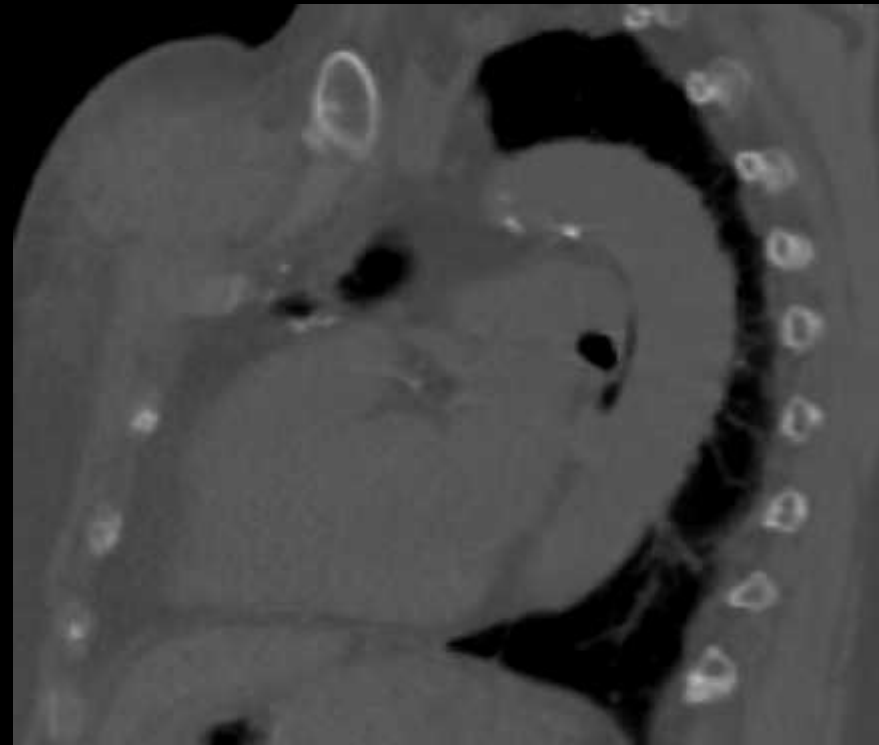
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Challenging cases

- **Small air leaks- mediastinum, pericardium**



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Challenging cases

- **Massive emphysema- bad visibility on ultrasound**



Challenging cases

- Heart and aorta- motion artifacts



Thank you for your attention



Surgat Clinic



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