MDCT in Acute Respiratory Distress Syndrome and Multi-trauma

Noah Stites-Hallett
Advanced Radiology clerkship
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Patient History

- 27 yo M presents as transfer from outside hospital (OSH) after crashing his moped
- Self-presented to OSH, was responsive, moving all 4 extremities
- CXR demonstrated bilateral pneumo(hemo)thoraces
  → was intubated and bilateral chest tubes placed
- CT → demonstrated many injuries, including an aortic arch injury for which he was medflighted
Additional Patient History

- PMH: None per OSH
- Meds: None per OSH
- Allergies: None per OSH
- Social Hx: Unattainable
- Family Hx: Unattainable
Physical Exam

- Vitals: T 100.1, HR 92, BP 102/45, MAP 6, CVP 16, Wt 120 kgs
- Vent setting: PC 20/5, FIO2 0.7, RR 20, TV 521, last ABG 7.36/45/135
- General: Intubated, sedated → non-responsive
- HEENT: NC, small facial contusion mid-upper lip
- Neck: Supple, no JVD, no bruits, in Aspen collar
- Pulm: Scattered rhonchi bilaterally, crackles lower lungs
- Cardiac: RRR, nl S1 S2, no m/r/g
- Abdomen: Soft, non-distended, no pulsatile masses, no organomegaly
- Extremities: WWP, no peripheral edema, 2+ pulses throughout
Labs

• No electrolyte abnormalities
• BUN 18, Cr 1.2
• CBC → WBC 14.6, Hct 29.7 (Hgb 10.2), Platelets 209
• INR 1.1

• Repeat CT performed (11 hours after accident)
Axial Abdominal CT: Rib fracture
Axial Abdominal CT: Rib fracture
Comminuted Sternal Fracture

Coronal reconstruction

Sagittal reconstruction
Axial Thoracic CT: T1 fracture
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Axial Thoracic CT: T1 fracture
Axial Thoracic CT: T1 fracture
Axial Thoracic CT: T1 fracture
Axial Thoracic CT: Aortic Pseudoaneurysm
Devascularized

Axial Abdominal CT: Splenic injury
Axial Thoracic CT: Lung window

- Endotracheal tube
- Contusion
- Chest tube
- NG tube
- Ground-glass

MGH AMICAS
Axial Thoracic CT: Lung window

- Residual pneumothorax
- Contusion
- Chest tube
- Residual hemothorax
Axial Thoracic CT: Lung window

Chest tube
Contusion
Axial Thoracic CT: Lung window

- Chest tube
- Contusion
- Residual pneumothorax
Summary of Injuries

- Multiple rib fractures
- Comminuted sternal fracture
- T1 fracture (non-displaced)
- Aortic pseudoaneurysm
- Splenic devascularization
Patient’s decline

• Over next week:
  – Increasing FIO$_2$ requirement
  – Rising CO$_2$

• Daily AP chest x-rays demonstrated worsening bilateral alveolar infiltrates
  – pulmonary contusions fully declare after about 6 hours so new infiltrates had to be secondary to a new pathological process

• Chest CT repeated at day 6
Septal thickening

Diffuse bilateral ground glass infiltrate
Air bronchograms

Day 6

Diffuse bilateral ground glass infiltrate

Septal thickening

Day 1

Axial Thoracic CT Comparison
Day 1

Day 6

Diffuse ground glass infiltrate

Axial Thoracic CT Comparison
ARDS pathophysiology
Normal Alveolus

Ware LB, Matthay MA. The acute respiratory distress syndrome. NEJM. 2000;342:1334-49.
ARDS Alveolus

- Infection (pneumonia, sepsis)
- Inhalation (toxic injury)
- Trauma (lung or extrathoracic injury)
- Hemodynamic (shock)
- Metabolic (pancreatitis)
- Others

Ware LB, Matthay MA. The acute respiratory distress syndrome. NEJM. 2000;342:1334-49.
ARDS Histology

Hyaline membrane
Overall distortion/destruction of lung/alveolar architecture
Neutrophils
Diagnostic Criteria for ARDS

- A clinical diagnosis:
  - \( \text{PaO}_2:\text{FiO}_2 < 200 \), regardless of PEEP
  - Bilateral pulmonary infiltrates on CXR
  - Wedge pressure \(< 18\text{mm Hg}\) or no clinical evidence of elevated left atrial pressure
Image Findings in ARDS

• CXR findings:
  – No initial findings → wait 24 hours
  – Diffuse, bilateral pulmonary (alveolar) infiltrates

• CT findings:
  – Ground glass opacities → patchy and diffuse
  – Consolidation → mostly in dependent regions
  – Air bronchograms, bronchial dilation
  – Pleural effusions → common but not necessary
Treatment of ARDS

• Intubation
  – Lower lung volume ventilation (6cc/kg)
  – PEEP
  – Conservative fluid management (goal of near even input and output)
  – Nitric oxide
  – Supportive therapy

• Treat initial cause (pneumonia, sepsis, etc)
Patient follow up

- Remained in ICU for 31 days for ARDS
  - Rib/sternal fractures: Conservative management
  - T1 fracture: Deemed non-operable so patient placed in halo
  - Aortic pseudoaneurysm: Endovascular stent placed
  - Splenic injury: Non-operable conservative management

- Transferred to floor for 5 days then discharged
References

• Ware LB, Matthay MA. The acute respiratory distress syndrome. NEJM. 2000;342:1334-49.

• Kollef MH, Schuster DP. The acute respiratory distress syndrome. NEJM. 1995;332(1):27-37


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