MDCT Findings in Penetrating Thoracic Trauma

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Learning Objectives

1. Review the imaging techniques and protocols
2. Review the spectrum of imaging findings
3. Highlight the potential pitfalls in image interpretation
Introduction

Causes of penetrating trauma

• Stab
• Gun shot
• Fall
• Motor vehicle collision
• Bomb blast
• Superficial wound in penetrating trauma can be deceivingly small
• Fast acquisition and multiplanar / volume reconstructions in MDCT now critical to diagnosis

Entry wound of stab injury to the right lateral chest wall (arrow). Note the radio opaque skin markers.
Imaging Protocol

- Place radio-opaque markers at the site of entry wound
- CT parameters
  - collimation: 0.6mm (depending on the scanner)
  - 120kV
  - 140-240mA
- Intravenous contrast: 80ml of contrast @ 3cc/sec, delay of 25 sec
Selective use of delayed scanning

ECG gating not routinely performed

Reconstruct axial, sagittal and coronal images at 2.5-3.0 mm thickness

Review all the images at soft tissue, lung and bone windows

Maximum intensity projection and volume rendered imaging are helpful
Diagnostic Approach

• Systematic approach

• Awareness of the clinical details such as mode of injury, number of entry and exits wounds

• Trace the trajectory of the wound using the presence of abnormal air, blood, fluid or foreign bodies

• If there is hematoma, look for the source of active extravasation
• Look for hidden and subtle positive findings, for example laceration within the consolidated/collapsed lung
• Do not neglect coexisting or associated injuries
• Equivocal findings require close clinical and possible imaging follow up
Spectrum of Imaging Findings

- Heart and Pericardium
- Vessels
- Lungs
- Pleura
- Diaphragm
- Bones
- Chest wall
Heart and Pericardium

Pneumopericardium: Air within pericardial sac

Hemopericardium: Dense fluid in pericardial sac

Layered hemopericardium and cardiac tamponade. Note the indentation of RV*

Cardiac tamponade. Note the reflux of contrast into the IVC and hepatic veins*

*Courtesy of JW Oxtoby, University Hospital of North Staffordshire, Stoke-on-Trent
Trajectory of the bullet implying myocardial laceration

Anterior mediastinal hematoma

LV hematoma adherent to the lacerated myocardium

Repaired traumatic VSD
Streak artifact from dense contrast in the SVC

Streak artifacts from high density objects (arrows). *Bullet in the LV

Differentiate LV thrombus from normal structures like papillary muscles and trabeculations
Partial left subclavian artery injury with contrast extravasation

Ductus diverticulum, mimics pseudoaneurysm

Right axillary vein injury

*Courtesy of JW Oxtoby, University Hospital of North Staffordshire, Stoke-on-Trent
Other possible vascular injuries

- Transection
- Pseudoaneurysm
- Dissection
- Occlusion
- Arteriovenous fistula
Lungs

Apical lung laceration. Note the pulmonary edema due to fluid overload.

RML laceration

Laceration and surrounding contusion in the right lower lobe.
LLL lung laceration with air-hemorrhage level

Complications

• Infection
• Abscess
• Broncho-pleural fistula
• ARDS

Laceration of the LLL with organized clot in the pseudo-cavity
Contrast pooling in the left pleural cavity from a left subclavian artery injury

Left pneumothorax

High density effusion indicating right hemothorax

Tension pneumothorax with mild mediastinal shift to the right side

Pleura
Is the tip of the chest tube within the lung?

Note the major fissure in the next slice

Kinked chest tube
Thin hypodense line along the periphery of the lung - artifact

Small left pneumothorax
Diaphragm

Herniation of intra abdominal fat through diaphragmatic injury

Trajectory of the weapon in a stab injury implying a diaphragmatic tear (arrow heads)

Pellet in the left hemidiaphragm
Rib fracture due to stab injury

Rib fracture with extrapleural hematoma

Shattered left scapula from shot gun injury (arrow). Note the flail ribs
3D volume rendered image of left scapular fracture due to stab injury

3D volume rendered image showing flail chest in a case of penetrating chest injury
Chest wall

Chest wall emphysema

Intramuscular hematoma with active contrast extravasation

Intramuscular hematoma in the left pectoralis minor muscle
Conclusion

• It is critical for radiologists to have a systematic approach and be aware of the variety of thoracic CT findings to ensure accurate and prompt diagnosis.