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CT-A in Trauma

MDCT of Mediastinal Injury

Vascular Injury in Mediastinal Trauma
Major Aortic Branches

Dissection / thrombus: left common carotid
Branch vessel injuries

Right subclavian artery avulsion
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Innominate Artery PsAn

Aortic Injury

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Essentially all aortic injuries are accompanied by mediastinal hematoma (abnormal chest radiograph) but this may be very minimal.

Helical CT, and particularly MDCT, are adequate to diagnose or exclude the vast majority of aortic injuries.

Negative CT $\implies$ no angiography or CT follow-up.

A positive CT $\implies$ no aortogram to confirm.

Use of MDCT screening for blunt chest trauma reliably establishes or excludes aortic injury

A rare equivocal CT requires catheter angiography and TEE may be helpful.
Precise characterization of injury has major influence on treatment

- **Aortic stents**: favorable anatomy, not good operative risk
- **Temporary non-operative management**: severe concurrent injury
- **Long-term non-operative management** (blood pressure control): poor operative risk, minimal injury
- **Surgical repair**: Good surgical candidate, favorable anatomy, poor anatomy for stenting
- **Anticoagulation for intimal injury**

**CT Signs of Aortic Injury**

Pseudoaneurysm
CT Signs of Aortic Injury

Coarctation: small aorta sign

Traumatic coarctation
Small abdominal aorta
CT Signs of Aortic Injury

Contour Abnormality

CT Signs of Aortic Injury

Intimal Flaps
CT Signs of Aortic Injury

- Retrocrural hemorrhage (15-20%)
Atypical Aortic Injuries

- Thrombus – embolization
- Dissection
- Active bleeding
Emboli from aortic injury

Renal embolic infarcts from aortic thrombus
Traumatic aortic dissection

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BE CAREFUL: Atypical Locations
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Atypical location

Bleeding
Ascending Aortic
PsAn
Atypical Location: Arch and LCC
Atypical Location: ARCH

Aortic Arch
Proximal branches

Multifocal intimal flaps
BE CAREFUL: Congenital Anomalies

Ductus diverticulum
Ductus diverticulum

- Smooth wall
- Obtuse margins with aorta
- No intimal flaps
- No mediastinal hemorrhage
- No retained contrast on “wash out”
Aberrant Rt. SCA and intimal tear

Left SVC
Right aortic arch; aberrant and atrophic left subclavian artery

Diverticulum of Kommeral (D): Aortic arch pseudoaneurysm
CHALLENGING CASES

USE THE TECHNOLOGY !!

Atypical pseudoaneurysm: calcified ductus remnant
Subtle aortic injury (minimal mediastinal blood)
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Ductus remnant:
Aortic spindle

Aortic Injury with minimal mediastinal hemorrhage
Subtle injury & minimal periaortic blood

Intimal tear, but no mediastinal blood
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Aortic Injury?
YES, BUT NO MEDIASTINAL BLOOD

Aortic Injury or Ductus?
DUCTUS
Intimal tear: No mediastinal blood: Resolved 2 days later

Distraction T-spine
Intimal flap
Aortic injury?  Probably not, old injury?, aortic spindle

3-floor fall: Aortic Injury ???
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Outcome

- Patient had positive transesophageal sonography
- Aorta opened at surgery – NO injury
- 1-month hospitalization from complications of thoracotomy

Tracheobronchial Trauma

- 0.4 - 1.5% after blunt trauma
- Very high pre-hospital mortality (70-80%)
- Thoracic trachea > cervical trachea
- Right mainstem > Left mainstem
- Typically within 2.5 cm of carina
- Diagnosis *not established acutely* in 70%
Tracheobronchial Trauma

- Mechanisms
  - Compression of closed glottis
  - Crush (spine & sternum)
  - Traction across carina with compression
  - Shearing during deceleration
  - Tranverse force*: cables, tree limb, clothes-line, rope

  * produces tear with 3 kg force versus 11 kg force for longitudinal force

Radiologic Findings

- Progressive, extensive air leak despite chest tube
- Pneumothorax despite chest tube
- Endotracheal balloon overdistension
- Ectopic endotracheal tube or balloon
- Fallen lung sign
- Deformity of mainstem bronchus
- Air outline of mainstem bronchi
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Diffuse air leak as an indirect sign of airway injury

Fallen Lung with Tension Pneumothorax
Tracheo-bronchial Injury

Trans-tracheal GSW
Tracheobronchial Injury

- Progressive, persistent air leak
- Fallen lung
- Ectopic ET tube
- Abnormally shaped balloon
- Direct air leak – CT
- Deformed mainstem bronchi

Peritracheal Air Sign:
Double Wall Mainstem Bronchi
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Right mainstem bronchus rupture

GSW Trachea
More proximal tracheal injury less common to have pneumothorax

Inflation of endotracheal balloon does NOT rupture airway (75 ml)

Accuracy of spiral CT alone 71%*

*Chen JD, Shanmuganathan K, Mirvis SE, et al. AJR 2001
Esophageal Trauma

- Trauma accounts for < 10% injuries
- Iatrogenic most common
- Blunt 96 cases reported 1900 - 1988
- Variable mechanisms:
  - Crushing
  - Direct penetration
  - Traction (hiatus)

- Lacks specific symptoms, often late
- Radiography: Non-specific (widened mediastinum, mediastinal air near tear, left pleural fluid)
- CT: same findings, but may perform after esophagram to increase sensitivity
- Esophagram - endoscopy
Esophageal Disruption

Esophageal Trauma

- Consider with any potential penetrating mediastinal trauma
- CT helps define missile tract to assess likelihood of injury
- Gas from esophagus (not under pressure) stays near esophagus
- Can spiral CT with contrast swallow establish diagnosis directly?
- Consider tracheal and vascular injury
Thoracic esophagus entrapped in T-spine dislocation

Cardiac-Pericardial Injury

- Tamponade: blood, air, anterior mediastinal hematoma, gastric herniation
- Pericardial herniation
- Perforation - rupture
- Contusion
Cardiac-Pericardial Trauma

Pericardial hemorrhage with tamponade

Pericardial tamponade with elevated CVP

Biatrial rupture
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Cardiac Air

Tamponade

Tension

Pneumopericardium
Broncho-pericardial fistula, S/P dilation: 

Cardiac herniation

Intrapericardial gastric herniation
Pericardial rupture and cardiac subluxation

Cardiac Tamponade from IMA bleed
Thank You!