Thoracic Aortic “Aneurysms”

- Atherosclerotic
- Dissection
- Penetrating ulcer
- Mycotic
- Inflammatory (vasculitis)
- Traumatic
Aortic Imaging Options

• Catheter angiography
• Ultrasound (TEE or TT)
• MRI
• MDCT
MDCT is the Workhorse

- Non-invasive
- Patients easily monitored
- Fast
- Readily available
- Less operator dependent
- Easily understood
- Good surgical roadmap (Recons)
Atherosclerotic Aortic Aneurysm

- Elder hypertensive; smoker
- Most discovered incidentally
- Symptoms, with advanced disease
  - Mass effect
    - Stridor, cough,
    - Hoarseness, dysphagia
  - Rupture
    - Chest pain, hemoptysis, hypotension
Thoracic Aortic Rupture

- Pre-existing aneurysm
  - atherosclerotic (mycotic, vasculitis)
- Dissection
- Penetrating atherosclerotic ulcer
<table>
<thead>
<tr>
<th>CT Findings</th>
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<tbody>
<tr>
<td>• Abnormal contour of aortic lumen</td>
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<tr>
<td>• Contrast outside borders of aorta</td>
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<tr>
<td>• High attenuation fluid outside aorta</td>
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<tr>
<td>mediastinal hematoma</td>
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<tr>
<td>hemopericardium, hemothorax</td>
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Aortic Dissection

- Hypertension (90%)  
  50-75 years old, 75% men
- Cystic medial necrosis
- Coarctation
- Bicuspid aortic valve
- Prior cardiac (aortic valve) surgery
- Pregnancy (3rd trimester)
- Cocaine abuse, weight-lifting
Aortic Dissection
Requisite Imaging Information

• Is a dissection present?
• Is it type A or B?
Aortic Dissection

Most common acute aortic syndrome

- Type A  (60%)
  Surgery usually

- Type B
  Medical management unless
  hemorrhage
  continued pain
  vascular compromise
  pseudoaneurysm formation
Type A Dissection
Surgical Emergency

- Pericardial tamponade
- Coronary or cerebral ischemia
- Aortic insufficiency
Aortic Dissection
Classic Pathogenesis

- Intimal tear
- Blood splits aortic media
- Intimomedial flap
  true/false channels
- Distal re-entry tear(s)
Aortic Dissection

Pathogenesis

• Intimal Tear (80%)
  creation of patent false lumen
  association cystic medial necrosis

• Rupture of vasa vasorum
  intramural hematoma
  may rupture into true lumen
  “atypical” dissection
Intramural Hematoma (IMH)

Hematoma within the aortic wall

- Aortic Dissection
  - rupture vasa vasorum
  - thrombosed false lumen
- Penetrating Atherosclerotic Ulcer
- Arteritis
Suspected Aortic Dissection
CT Technique

• Pre and post contrast (thorax/abdomen/pelvis)
• 0.625-1.25 collimation
• 90-125 ml (Optiray 350)
  4-5 ml/sec
  bolus triggering
• Post-processing
  reformatted 2D (sagittal, coronal, oblique)
  multiplanar, 3D
• ? ECG gated thoracic portion
CT: Acute Aortic Dissection

Pre-contrast Images

- Intimal calcium displacement
- High attenuation thrombosed false lumen
- Mediastinal, pleural, pericardial blood
CT: Acute Aortic Dissection
Post-contrast Images

- Intimal flap
- Thrombosed false lumen
- Narrowed true lumen
- (Delayed enhancement false lumen)
- Organ ischemia
True vs. False Lumen Generalizations

- True lumen smaller
  origin of coronaries, celiac, SMA, right renal arteries

- False lumen larger
  generally less opaque
cobweb sign
may rupture
CT: Thoracic Aorta
Multiplanar, 3D Reconstructions

- Rarely helpful for diagnosis
- Aids communication with surgeons
displays anatomic relationships
pre-operative planning
great vessel involvement
cross-clamping
CT: Intramural Hematoma

- Smooth, hyperdense crescentic aortic wall thickening (> 7mm)
  much easier to see on non-contrast images
- Lack of contrast enhancement
- Inward displacement intimal calcification
Natural History of Intramural Hematoma

Variable

- Develop more classic dissection (12%)
- Resolve (34%)
- Enlarge, pseudoaneurysm, rupture (54%)
Complications of Aortic Dissection

• Rupture
  leak into mediastinum
  pericardium, pleural space
  pulmonary artery adventitia

• Malperfusion
  major branch involvement
  (static or dynamic)
  concave true lumen
  intimointimal intussusception (windsock sign)
Penetrating Atherosclerotic Ulcer

Ulceration of advanced atherosclerotic plaque

- Penetrates internal elastic lamina
- Hematoma of media
- Can cause pseudoaneurysm and rupture
- 94% affect mid → descending aorta
Penetrating Atherosclerotic Ulcer
CT Findings

• Extensive atherosclerotic disease
• Focal contrast filled outpouching
  surrounded by intramural hematoma
Atheromatous plaque with ulcer
no contrast beyond plaque

Penetrating atherosclerotic ulcer
associated intramural hematoma
beyond intima
Penetrating Ulcer Treatment

• Like dissection
  prognosis worse
• Complications
  pseudoaneurysm
  dissection
  rupture
Fate of Intramural Hematoma

- Regress
- Pseudoaneurysm formation rupture
- Form classic dissection
Aortic Transection

- 16% of MVA deaths
- 85% die immediately (rupture)
- 50% remaining die in 24 hours
- <4% survive 6 months
- > 90% of aortograms done for possible diagnosis are negative

Tear, adventitia initially intact

90% of aortograms done for possible diagnosis are negative
CXR: Aortic Transection

- Sensitive, limited specificity
  Mediastinal widening
  especially if done supine
- More specific, less sensitive
  Left apical cap, no rib Fx
  Aortic knob obliteration
  Shift nasogastric or ET tube
  Left main bronchus depression
  Left paraspinal widening
MDCT: Aortic Transection

• Close to 100% accuracy if performed and interpreted expertly
• Signs
  - pseudoaneurysm beyond left SCA
  - sudden change caliber descending aorta
  - irregular aortic contour; thrombus
  - intimal flap
  - blood contiguous with aorta (almost all)
  - active bleeding
Minimal Aortic Injury

May not see mediastinal hematoma
Traumatic Aortic Injury
Atypical Locations

• Ascending aorta
• Arch
• Proximal great vessels
Traumatic Aortic Injury Pitfalls

- Congenital anomalies
  - Ductus diverticulum
  - Right aortic arch
  - Persistent left superior vena cava

No mediastinal hematoma

- Non-aortic injury (spine, pericardium)
Anterior Mediastinal Blood

*Not* a sign of aortic injury
usually due to venous bleeding
look for sternal fracture
look for arch vessel injury
CT: Aortic Transection

- Aorta is normal
  STOP (precludes angiography)
- Not sure or contiguous blood
  Angiogram (rarely needed) or TEE
- Positive

- Detects other injuries
  pneumothorax, fractures, lung hemopericardium
MDCT: Traumatic Aortic Injury

Precise characterization of injury has major influence on treatment

- Aortic stent
  favorable anatomy, not good operative risk
- Surgical repair
  poor anatomy for stenting
- ? Nothing
  minimal aortic injury