Radiologic Diagnosis of Thoracic Aortic Aneurysms

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Background

- Incidence 6 cases per 100,000 patient years
  - Less common than AAA
  - Incidence increasing over last 30 years
- Typically 6\textsuperscript{th}-7\textsuperscript{th} decade
- Males 2-4 x > than females
- Familial predisposition
- Expand less rapidly than AAA
Risk Factors

- Atherosclerosis
- CT disorders
- Infection: salmonella, staph aureus, syphilis
- Bicuspid Ao valve and coarctation => post-stenotic dilatation
- Trauma: deceleration injuries
- Takayasu’s and Giant Cell arteritides
Pathophysiology

- Atherosclerosis
  - Proteolytic factors in inflammatory plaques destroy elastin and collagen, weakening vessel wall

- Cystic medial degeneration
  - Elastic tissue fragmentation
  - Separation of elastic and muscular elements of media by amorphous ECM
  - Provides substrate for HTN and other insults
Categorization of TAA: by location

- Ascending: Ao valve to innominate artery
- Arch: involving any of the branch vessels
- Descending: distal to the left subclavian artery
Complications of TAA

- Rupture – universally fatal except in rare cases of containment
- Embolization – stroke, infarct
- Dissection – stroke, infarct, renal failure, paralysis
- Sepsis – undetected mycotic aneurysms and pseudoaneurysms
Aneurysm vs. Pseudoaneurysm vs. Dissection

- Aneurysm = 3 layers; >1.5x nl diameter; blood within vascular system
- Pseudoaneurysm < 3 layers; contains adventitia +/- media
- Dissection of media via intimal flap => blood filled channel in middle-outer 1/3 of laminar planes

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Treatment

- Size = 1° determinant of rupture; uncommon <5cm or expansion <1cm/year
- Surgery if >5.5 cm or sx
- Untx TAA>6cm => risk rupture or dissection 6.9%, death 11.8%/year (Davies et al).

Clinical Presentation

- Asx in absence of expansion or bleeding
- Sx related to mass effect or circulatory compromise
- Up to 13% patients have multiple aortic aneurysms

=> Most commonly detected as incidental finding on plain film
CXR: Radiologic Findings

- Not used for diagnosis
- Aortic silhouette abnormal 80-90% cases
  - Diffuse widening mediastinum
  - Mediastinal mass
  - Pleural effusion
  - Displacement of NG tube to the right
  - change in aortic contour over time**
CXR: Radiologic Findings

- Aneurysm seen as mediastinal mass adjacent to aorta
- Can be indistinguishable from 1° lung cancer

[Website Link](http://www.aic.cuhk.edu.hk/web8/thoracic_aortic_aneurysm.htm)
CXR: Radiologic Findings

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Diffuse dilatation of descending aorta and arch
Can be difficult to distinguish from tortuous or ectatic aorta
CXR: TAA Rupture

- Widened mediastinum
- Right hemothorax
- Change in aortic contour compared to previous CXR

=> With high clinical suspicion, more sophisticated study needed to confirm dx and size determination
Primary Diagnostic Modalities

- Aortogram
- CT/CTA
- MRI/MRA
- TEE
Aortogram

- Gold standard until 1990s
- Replaced by helical CT and MRI/MRA
- Reserved for resolution of v. small vessels or pts unable to breathhold

No evidence of dissection. Ectatic descending aorta with a penetrating ulcer on the lateral wall.

Harris and Rosenbloom. Images in Clinical Medicine. NEJM 1997; 336 (26): 1875, Figure 1.
CT: Descending Aortic Aneurysm

- Best for emergent settings
- Widely available, less expensive than MRI
- Delineates morphology, pattern, distribution of thrombus and calcification

Harris and Rosenbloom. Images in Clinical Medicine. NEJM 1997; 336 (26): 1875, Figure 1.
CT: Additional Benefits

- Hyperdensity identifies acute injury
- Visualization of dissection and intimal flap
MRI

- Shows lumen and vessel wall; best assessment of true size
- Excellent vessel anatomy and surrounding structures
- Least renal toxicity
- Time consuming; not for unstable patients

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MRA

- 3D Gado MRA shows blood flow
- CINE imaging gives functional assessment of Ao valve; can show intimal flap
- Does not visualize adventitia well

=> Differences in treatment make visualization of entire aorta critical.

home.earthlink.net/~radiologist/tf/060302.htm
MRI Coronal View: Ascending Aortic Aneurysm

- Signal loss in ascending aorta c/w stenosis
- Aneurysmal dilatation 4.6 x 4.1 cm at main PA
- Smooth dilatation
- No lumenal irregularity
- No coarctation
MRI Sagittal View: Thoracoabdominal Aneurysm

Eccentric mural thrombus vs. thrombosis of prior false lumen along anterior wall

TAA arising from arch to suprarenal aorta
No evidence of dissection currently

PACS, BIDMC
MRI: Thoracoabdominal Aneurysms

1.5 cm cyst left lobe liver

Tortuous descending aorta

Multiple bilateral renal cysts

Infrarenal aneurysm

PACS, BIDMC
Assessment with TEE

- Not used for dx but provides functional information
- Good for unstable patients
- Blind spots vs. CT and MRI;
- Operator dependent

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TEE: Radiologic Findings

- Severe atherosclerosis
- Mildly enlarged descending aorta
- Eccentric thickening of one wall
- Echogenicity consistent with thrombus or IMH

Harris and Rosenbloom. Images in Clinical Medicine. NEJM 1997; 336 (26): 1875, Figure 1.
Patient J.D.

- 77 year old male with chest discomfort, pressure between scapulae and hoarseness
- PMH: COPD, prior asbestos exposure, PVD, HTN
- PSH: s/p aortobifemoral bypass graft
- Elevated creatinine
Contrast-enhanced CT at Presentation

- Disruption of inferior wall of aortic arch c/w pseudoaneurysm or contained rupture
- Adjacent mediastinal hematoma
- Pleural plaques c/w asbestos exposure
Contrast-enhanced CT at Presentation

- Disruption of inferior wall of aortic arch c/w pseudoaneurysm or contained rupture
- Adjacent mediastinal hematoma
Contrast-enhanced CT 3 Days Later

- Increased size of mediastinal hematoma adjacent to pseudoaneurysm
- Increased pleural effusion, possible subacute hemothorax
Take Home Points

- **Helical CT** gives rapid assessment of major pathology; good for:
  - Acutely symptomatic
  - Question of additional thoracoabdominal pathology

- **MRI** gives excellent detail; good for:
  - Asymptomatic and hemodynamically stable
  - Surgical planning
  - Patient contraindications
Take Home Points (cont’d)

- TEE good for functional assessment
- Non-angiographic modalities best for assessing non-lumenal anatomy
References

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