Acute aortic syndrome:
- acute life-threatening abnormalities of aorta assoc. with intense chest or back pain, traditionally include:
  - Aortic dissection (AD), Intramural hematoma (IMH), Penetrating atherosclerotic ulcer (PAU)
- RARE: 2.6–3.5 /100k/yr in US (~4/100k/yr for myocardial infarction)
- LIFE THREATENING

Vilacosta, Heart 2001
Acute Aortic Syndromes
Imaging Strategy

Precontrast series
• recommended in acute setting

CTA series
• CTA chest-abdomen-pelvis
  • scanning range:
    • thoracic inlet → femoral a. bifurcation !!
  • Gated chest + (abd.-pelv. non-gated CTA)

3mm/3mm
1mm/0.7mm

Acute Type B Dissection
Evaluation of femoral artery access for intervention

49 y/o man
• acute chest pain; RR 170 / 20
Gated CTA of chest (+ abd pelv) r/o aortic disease

CT of the Thoracic Aorta

The contour irregularity in the ascending aorta is
A. clearly a pulsation artifact
B. favor artifact, but aortic lesion not ruled out
C. can’t tell
D. likely aortic lesion, but artifact possible
E. definite aortic lesion
Aortic Dissection and its Variants

Pathology and Classification

Aortic Dissection: Manifestation of a Diseased Media

- Marfans (fibrillin)
- Ehlers Danlos IV (collagen)
- familial TAA
- severe hypertension !!!
- normal aging

‘cystic medial necrosis’ (Erdheim)
- elastolysis (elastic & collagen fiber loss)
- mucoid degeneration
- smooth-muscle cell loss and dedifferentiation

Classic Aortic Dissection

- false lumen within the media
  \(\text{‘intimal flap’}=\text{inner }2/3\text{ of med }+\text{ intima} \rightarrow\text{ intimo-media flap}\)

- entry tear (primary intimal tear [PIT])
- exit tear(s) (‘reentry tear’, fenestrations)

Acute Type-A Dissection

CTA
- primary intimal tear

DSA
- true / false lumen (DSA)
Acute Type–A Dissection

True versus False Lumen

QUIZ 45 y/o man
- 3 wks dyspnea, no 'pain'
- on TTE: type A dissection

This is an aortic dissection, which begins in ...

A. aortic root
   (filling defect in root is dissection flap)
B. mid ascending aorta
   (filling defect in root is artifact from aortic valve, but tiny abnormality in mid ascending aorta
C. distal ascending aorta
   (mid ascending aorta and root is normal)
D. aortic arch

True versus False Lumen
48 yo man
- hx of crack cocaine use;
- outside hx of type-A IMH
  which was evacuated, but not repaired

Aortic dissection: Primary Intimal Tear (PIT)
- Small PIT
- Circumferential PIT with 'pseudonormal'
  ascending aorta
- Prolapse
- Intimal intussusception

Aortic Dissection - Classification

Clinical
- acute dissection (< 2 weeks symptoms)
- chronic dissection (> 2 weeks)

Anatomic
- location and extent of dissection flap
  (true/false lumen)
- presence and location of primary intimal tear

Aortic Dissection

Stanford Classification (dissection flap)
- Type A: intimal flap involving ascending aorta
- Type B: no involvement of ascending aorta


QUIZ

An aortic dissection with the dissection flap starting in
the aortic arch* is classified as

A. Type A aortic dissection
B. Type B aortic dissection
C. Not defined in Stanford Classification

*Aortic arch: thoracic aorta between brachiocephalic and left
subclavian artery origins
**Aortic Dissection**

**Stanford Classification**

- **Type A**: intimal flap involving ascending aorta
  - Immediate surgery

- **Type B**: no involvement of ascending aorta
  - Conservative, unless complicated

*(pre-stentgraft era)*

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**Aortic Dissection and its Variants**

Side Branch Malperfusion Syndromes

- Mortality:
  - Coronary arteries ~ 25%
  - Cerebral arteries/parapl. ~ 45%
  - Renal (ATN, hypertens.) ~ 50-70%
  - Mesenteric ~ 50-95%
  - Peripheral (extremity) ~ 45%

- Diagnosis:
  - Clinical and labs (not CT imaging)

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**Role of CT in Side-branch Malperfusion**

- Identify anatomy to explain mechanism causing ischemia
  - Determines treatment!

**Possible mechanisms**

- Local obstruction at branch ostium
- Limited inflow into true lumen (true lumen collapse, due to compression by false lumen)

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**Local Side Branch Involvement in Dissection**

- **Uncomplicated**
  - Natural fenestration ('reentry tear', if large)

- **Local flow-limiting lesions**
  - Torn flap within branch / w stenosis
  - Diss. ext. into branch(es) / w stenosis
  - Windsock in branch / w stenosis/occlusion
Aortic dissection with true lumen collapse

Intima

Aorta

mesenteric and renal ischemia

PIT: primary intimal tear
RET: re-entry tear

False Lumen: Outflow

branch a. (renal)

PIT

false lumen (FL) (inter-costal)

RET

No RET

true lumen collapse

aortic 'windsock'

Type B dissection

true lumen collapse,
left renal artery occlusion with stent-placement

Type B dissection

stent-graft repair

courtesy G. Rubin

Type B dissection

stent-graft repair
52 y/o hypertensive man  
- acute bowel ischemia  
- acute type B dissection  
- severe abdominal pain radiating to back  
- decreased bowel sounds  
- Creatinine 1.7 (H); Lactic Acid 3.4 (H)

Aortic Dissection and its Variants

Dissection Variant: Limited Intimal Tear (Limited Dissection)

Have you ever seen a 'limited dissection' on a CT scan?

A. yes, definitely (called in dictation)
B. maybe (not sure what a 'limited dissection' is)
C. no, cannot be seen on CT, MR, or US

ESC Task force, European Heart Journal (2001)  
AHA/ACC/ATS/ACR [...] Guidelines, Circulation 2010

class 1: classic dissection  
class 2: intramural haematoma  
class 3: discrete/subtle dissection 'limited dissection'  
class 4: penetrating athero-sclerotic ulcer  
class 5: iatrogenic and traumatic dissection
Dissection variant: Limited Intimal Tear

8 surgical cases, none of whom diagnosed preoperatively with imaging.

Top, TEE of patient 2 whose initial clinical presentation was suspicious for aortic dissection but in whom no dissecting flap or hematoma was found, although aortic aneurysm was noted.

CT of the Thoracic Aorta

- 60 yo man (h/x: hypertension)
- Several days of achy, diffuse chest/back/neck pain
- tt-Echo: aneurysmal dilatation of ascending aorta, no dissection

⇒ CTA

unenhanced MDCT: 2.5mm

Limited intimal tear
(dissection variant)
**Dissection Variant**

**Limited Intimal Tear**

- through intima into media
- "bulging" of residual wall
- no false lumen / no flap
- linear filling defects from undermined edges

**Classic Dissection**

**False lumen**

- within the media
- entry / exit tear

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**QUIZ**

54 y/o man

severe chest pain when waterskiing

- negative workup for acute MI
- stress-echo aborted for aortic aneurysm → CT

CTA, non-gated 3mm section thickness

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**QUIZ**

**WHAT IS AN APPROPRIATE NEXT STEP?**

A. this is an aortic lesion, take the patient to OR immediately

B. this could be an acute aortic lesion, repeat CT with gating, clear coronaries, then to OR

C. this is an aortic aneurysm, follow up CT/MR/TTE in 1, 3, and 6 months and annually, take to OR when >5.5 cm

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**RC 212: Acute Aortic Disorders**

www.stanford.edu/~dominikf/RSNA/