**IMH and PAU**

*Intramural hematoma and penetrating atherosclerotic ulcer*

Dominik Fleischmann
Stanford Radiology

www.stanford.edu/~dominikf/RSNA

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**62 year old man with hypercholesterolemia and hypertension;**

* presents to the ER after squeezing chest pain in the morning, some back pain

* ECG: dynamic T-wave inversion. ER physician requests CT before IV lysis (AT3 antagonist).

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**Intramural Hematoma**

- Non-contrast CT

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**Intramural Hematoma** (traditional Def.)

- Thrombosed channel within the media
- 'no communication between true and false lumen'

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**Acute aortic syndromes**

- Aortic dissection [70-90%]
- Classic aortic dissection
- Intramural hematoma
- Dissection variant
  - Limited intimal tear = limited dissection
- Intramural hematoma [5-25%]
- Penetrating atherosclerotic ulcer [5-15%]
- with intramural hematoma

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Intramural Hematoma

**Quiz**

What are the small contrast opacities in aortic wall?

A. primary intimal tear  
B. endoleaks  
C. fenestrations at side branch origins  
D. penetrating atherosclerotic ulcers  
E. this is no IMH

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**Intramural Hematoma**

**Traditional definition** (as opposed to AD): blood within aortic media, absence of direct communication with true lumen (no tear, no dissection flap, no flow)

**Modern view** (1): communications often exist:
- isolated PIT (primary intimal tear) w/o flow
- small side-branch communications ('branch artery pseudoaneurysms' (2), 'natural fenestrations', 'puddles')

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**(1)** AHA/AATS Practice Guidelines, Circulation 2010;121:e266-e369
(2) Williams, J Vasc Interv Radiol. 2006;17:765-771

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**IMH Prognosis**

**ACUTE** (somewhat less grave than acute AD)
- Type-A has >four times mortality (42%) of Type-B (8%) [IABP]
- Progression to dissection in 16%-36% (usually with persistent/recurrent pain)
- Regression: ~10%
  - IMH with PAU: 62%, IMH without PAU: 29%

**LATE FATE** (also a little better than AD)
- resolution, progression to dissection
- late aneurysm
Intramural Hematoma

TREATMENT

- **Type A**: surgery favored in West (expectant /w aggressive medical treatment in Asia)
- **Type B**: conservative; surgery or stent-graft if recurring, refractory chest pain, evidence of increasing extent and diameter
- long term f/u (1, 3, 6, 9, 12, 24mo, ..)

Acute aortic syndromes

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Penetrating Atherosclerotic Ulcer

Clinical Background

- Incidence: ~5-15% of acute aortic syndromes
- rupture of acute thoracic PAU = 21%-47%
- typically descending aorta, often multiple, with extensive atherosclerotic change

Patients with PAU: older than pts. w/ dissection

- more risk factors and co-morbidities
  - hypertension: 85%, chronic renal insufficiency: 31%
  - CAD: 61%; PAOD: 17%; CVA: 12%
  - AAA or TAA: 53%

Pathology

- Atherosclerotic ulcer
  - ‘ulcerated plaque’ (confined to intima)
  - may cause cholesterol embolism

extensive atherosclerotic change

Multiple PAUs

(73 y/o man)

QUIZ

c9 y/o man

chest/abd/pelv/lower extremity CTA r/o embolism (‘blue toe syndrome’)

Adventitia

Media

Intima

Heart. 2001; 85: 365

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What kind of lesion is seen in the aortic wall

A. acute penetrating atherosclerotic ulcer (PAU)
B. small atherosclerotic ulcer, causing embolism
C. focal dissection

### Pathology

**Atherosclerotic ulcer**
- 'ulcerated plaque' (confined to intima)
- may cause cholesterol embolism

**Penetrating atherosclerotic ulcer (PAU)**
- penetrates through internal elastic lamina into media, +/- hematoma formation

Adventitia Media Intima

Heart 2001; 85: 365
**Pathology**

CT cannot resolve aortic wall layers → 'Ulcer Like Lesions'

**Radiology (CT)**

CT cannot resolve aortic wall layers → 'Ulcer Like Lesions'

NON-ACUTE?
- non-penetrating a. ulcer,
- chronic, healed PA ulcer,
- small aneurysm

ACUTE?
penetrating atherosclerotic ulcer
1. IMH: always acute
2. Pain !!

**QUIZ**

72 y/o woman
chest pain: 20-Oct-05

What kind of lesion is seen in the aortic wall

A. acute penetrating atherosclerotic ulcer, rupture (consider stent-grafting)
B. cannot rule out small PAU, recommend follow up (treat if growing and/or symptomatic)
C. chronic atherosclerosis (leave alone)

**QUIZ**

72 y/o woman
chest pain: 20-Oct-05
f/u: 20-Dec-06 (stable, asymptomatic)

cannot rule out PAU without IMH – need follow up!

**QUIZ**

Ulcer like lesion of the thoracic aorta

83 y/o woman
shortness of breath
pleuritic chest pain → PE CT

Dec 2005
What is the nature of this ulcer-like lesion of the aorta?

A. acute penetrating atherosclerotic ulcer /w rupture (immediate stent-grafting)
B. not sure, no typical pain, but cannot rule out PAU (recommend non-contrast CT to look for IMH, comparison with priors, if available)
C. looks ‘chronic’, send patient home (recommend follow up, like chronic aneurysm)

83 y/o woman
shortness of breath
pleuritic chest pain
→ PE CT

QUIZ

Ulcer like lesion of the thoracic aorta

Oct 2000
Dec 2005

QUIZ

83 y/o man with acute chest pain
non-contrast
CTA

QUIZ

What is the aortic abnormality?

A. chronic atherosclerotic aneurysm → routine follow-up / surveillance
B. type-B (descending aorta) intramural hematoma → blood pressure / pain control
C. acute penetrating ulcer with IMH and pleural effusion → consider stent grafting soon
D. acute PAU with IMH and rupture → immediate stent-grafting

83 y/o man with acute chest pain
non-contrast
CTA

QUIZ

Penetrating Atherosclerotic Ulcer

Treatment
- Type A: ascending aorta (rare) surg. repair
- Type B: small, stable, uncomplicated: conservative w. f/u
- leaking / rupture, growing, cont. symptoms: surgical, stent-graft, or both (debranching)

Prognosis
- perioperative mortality from 7.1% to 25%, neurologic deficit up to 28.6% of cases.
- stent-graft low perioperative morbidity and mortality (19% and 12%, respectively)

Demers et al., Ann Thorac Surg 2004;77:81-86
80-year-old woman, no significant PMH
• presenting with anterior left-sided chest pain and nausea/vomiting.
• Enlarged mediastinum on chest x-ray.

- Y-graft from ascending aorta to both common and left carotid, stent extension into arch

- Pre - Stentgraft
- Post - Stentgraft
  Endoleak of under-arch aneurysm
Mediastinal Hematoma
- Ascending IMH
- Arch aneurysm
- Descending PAU

What is the cause of the patient’s acute aortic syndrome (and mediastinal hematoma)?

A. Type A intramural hematoma?
   (needs ascending aortic repair)
B. Rupturing arch aneurysm?
   (arch replacement)
C. Penetrating atherosclerotic ulcer in desc. aorta?
   (stent-graft in Descending aorta)

Diagnosis?
(A) Type A intramural hematoma?
(B) Rupturing aneurysm?
(C) Penetrating atheroscl. Ulcer?

Leaking Aneurysm / w Rupture
Stentgraft, desc. aorta, patient died 48 h later

Intramural Hematoma
- IMH is not a disease
- IMH is an imaging finding
  - in AD, and PAU, (and trauma, rupturing aneu,...)
  - dynamic

Look for
- location/extent: Type A vs Type B
- presence/absence of PAU or intimal tear
  - if present, location of PAU or intimal tear
- signs of rupture / progression

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**Acute aortic syndromes**

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Diseased media

Diseased intima

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**Thank You ...**