



Beth Israel Deaconess
Medical Center

Life-Threatening and Urgent: Intramural Hematomas

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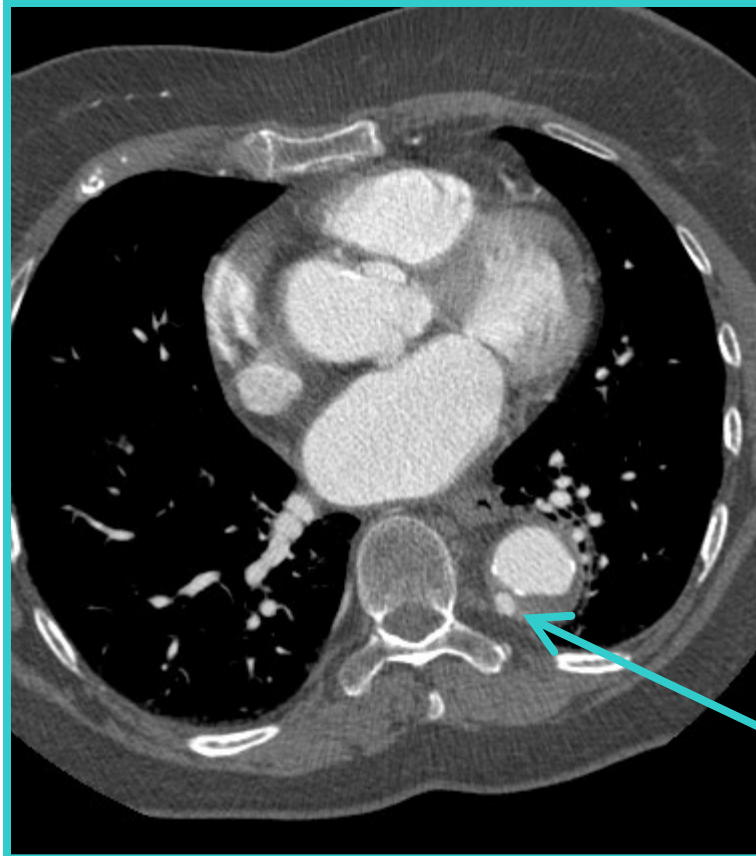


Our Patient's Presenting History and Physical Findings

- HPI:
 - 87-year-old female
 - p/w acute, pleuritic mid-thoracic CP, SOB; onset while riding in car
- Relevant PMH/PSH:
 - HTN
 - CAD (s/p stents x3)
- FH, SH: Non-contributory
- PE:
 - Vitals:
 - Temp: 97.4 °F, Pulse: 80, RR: 19, O2 sat (RA): 98%
 - **R-sided BP: 139/53; L-sided BP: 152/65**
 - CV: RRR, no m/r/g; equal, palpable pulses in all four extremities [EKG nl]
 - Neuro: NI mentation, speech intact, no focal deficits



Diagnostic Imaging: Our Patient's CT of the Chest/Abdomen



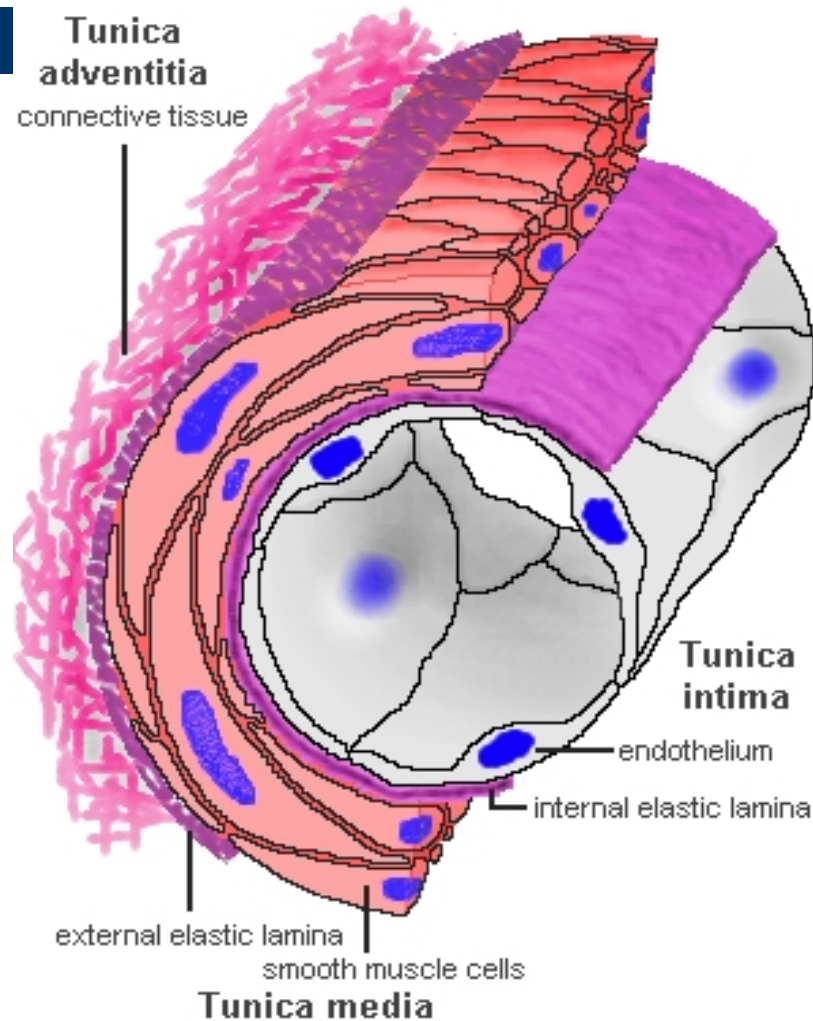
Intramural
hematoma

Early
penetrating
aortic ulcer

Both images: Axial C+ CT Chest/Abd; from BIDMC, PACS



Stepping Back: A Review of the Layers of a Major Vessel





Tintinalli *et al.* *Tintinalli's Emergency Medicine: A Comprehensive Study Guide*, 7e. Columbus, OH: The McGraw-Hill Companies; 2011.

Acute Aortic Syndromes (AAS): A Brief Overview

Hall *et al.* *Principles of Critical Care*, 3e. Columbus, OH: The McGraw-Hill Companies; 2005.

1. Penetrating aortic ulcer (PAU): *ulcerated atherosclerotic plaque* penetrates tunica intima, hemorrhages into media
2. Ruptured or leaking aneurysm: *sheer stress-related outpouching* of all vessel layers; classically in descending aortic (abdominal) location – sometimes grouped with other AAS, as etiology overlaps and aortic tear similarly possible
3. Intramural hematoma (IMH): *vasa vasorum injury in adventitia*, hemorrhage into media without a radiographically visible intimal tear (differentiating feature from dissection)
4. Dissection: *tunica intima tears (intimal flap visible)*, blood extravasates into media, creating a “false lumen”



Acute Aortic Syndromes (AAS): A Pictorial Schematic

Crawford, M.H. *Current
Diagnosis & Treatment:
Cardiology, 3e.*
Columbus, OH: The
McGraw-Hill Companies;
2009



Penetrating ulcer



**Intramural
hematoma**



Dissection





Tintinalli et al. *Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 7e.* Columbus, OH: The McGraw-Hill Companies; 2011.
Hall et al. *Principles of Critical Care, 3e.* Columbus, OH: The McGraw-Hill Companies; 2005.

Epidemiology of AAS

1. PAU

2. Ruptured or leaking aneurysm

3. IMH

4. Dissection: 15/million cases annually

However, PAU and IMH are much more common than dissection overall, and therefore, are important to recognize.

PAU and IMH:dissection = 3000:5

- Overall annual incidence: 9-16/100,000 cases (M > W by 2:1)
 - Average age = 63 years
- 22% patients die before a diagnosis is reached – requires high index of clinical suspicion!
 - Without treatment, 3-month mortality is 85-90%



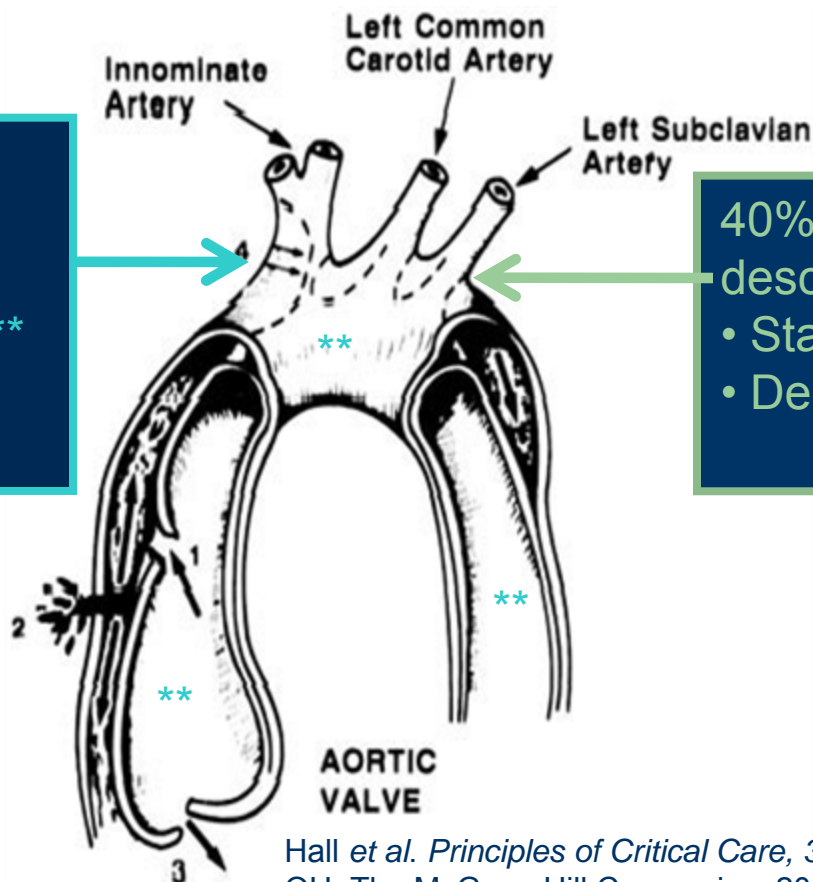
Anatomical Classification of AAS

60% involve the ascending aorta:

- Stanford Type A
- DeBakey Type I**
- DeBakey Type II

40% involve only the descending aorta:

- Stanford Type B
- DeBakey Type III



Hall et al. *Principles of Critical Care*, 3e. Columbus, OH: The McGraw-Hill Companies; 2005.



Key Risk Factors: Medial Weakening and/or Increased Intimal Stress

< 40 years (dissection most common)

- Connective tissue disorders
 - Marfan's Syndrome
 - Ehlers-Danlos Type IV
- Aortic anomalies
 - Congenitally bicuspid valve
 - Coarctation (e.g. Turner's Syndrome)
- Cocaine or MDMA abuse
- Blunt trauma
- Pregnancy (3rd trimester)

> 50 years (any AAS, but PAU and IMH more common in older pts)

- ***Chronic HTN***
- Tobacco use
- Age; male sex
- Iatrogenic trauma
 - Intra-aortic balloon pump
 - Intra-operative: cardiac or aortic procedure
 - Cardiac catheterization
- Prior cardiac surgery



Tintinalli *et al.* *Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 7e.* Columbus, OH: The McGraw-Hill Companies; 2011.

Typical Clinical Presentations of AAS

- Abrupt retrosternal CP radiating to intrascapular area:
 - “Sharp”, “ripping”, or “tearing” (for 90%: severe/worst pain of life); associated with sense of doom
- Symptoms depend on affected structures:
 - **Coronaries:** Anterior MI
 - **Pericardium:** Tamponade
 - **Carotids:** CVA; syncope; Δ MS; focal neurologic deficits
 - **Subclavians:** UE ischemia
 - **Ilio-femorals:** LE ischemia
 - **Celiac/Mesenterics:** Bowel ischemia or infarction
 - **Renals:** ARF
 - **Esophageal compression:** Dysphagia
 - **Adjacent nerve compression:** Hoarseness; Horner’s syndrome
- PE findings:
 - AI murmur (32%) with *Type A*
 - Pulse asymmetry or generalized pulse deficit (15%)
 - HTN (49%) or shock (18%)



Tintinalli *et al.* *Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 7e.* Columbus, OH: The McGraw-Hill Companies; 2011.

Poor Prognostic Indicators in AAS

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Our Pt's Clinical Presentation

- **Abrupt retrosternal CP** radiating to intrascapular area:
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Menu of Radiologic Options for Suspected AAS

Test	Sensitivity	Specificity	ACR* Rating	Special Notes
CXR	Low	Low	9	First-line eval. of CP; portable; but 20% falsely negative Used to r/o alt. diagnoses
CTA (+C)	90-100%^	87-100%^	9	Definitive dx; quick
MRA (\pm C)	92-96%	100%	8	If CT c/i and pt not in <u>acute hemodynamic compromise</u>
TEE	99%	98%	8	Portable; requires experienced operator; requires intubation

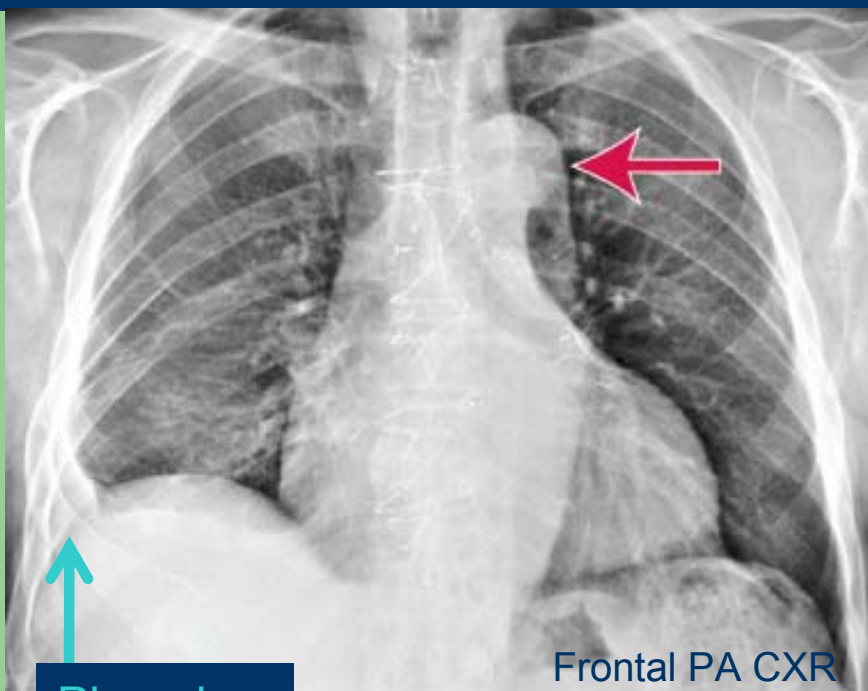
^Based on studies of conventional CT; multi-detector helical CT is more common today and its sensitivity and specificity approach 100%.

*American College of Radiology
Mammen, L, *et al.*, ACR Appropriateness Criteria® acute chest pain—suspected aortic dissection. American College of Radiology (ACR); 2008.



Tintinalli *et al.* *Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 7e.* Columbus, OH: The McGraw-Hill Companies; 2011.

Companion Pt 1: Findings on CXR



Frontal PA CXR



Lateral CXR

Pleural
effusion
(blunter
CP angle)

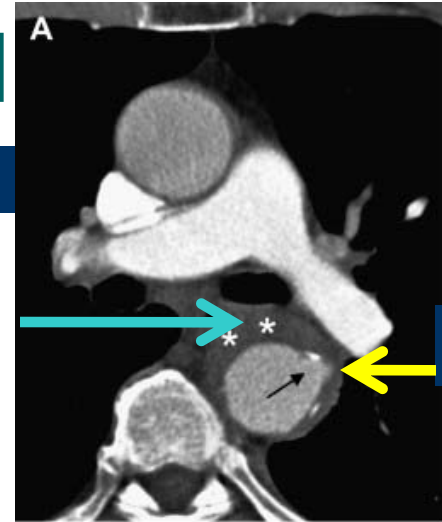
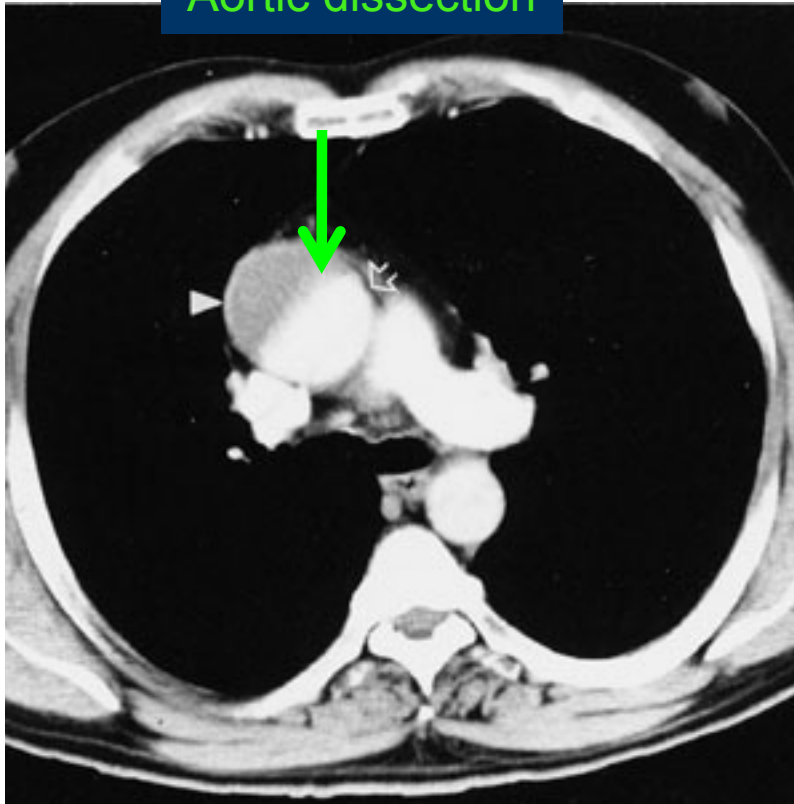
Prominent aortic contour; widened mediastinum

Note: These findings are *not* specific for AAS. Additionally, a luminal displacement of aortic wall calcification is now considered “a finding of limited value and may be misleading” (Mammen, L, *et al.*, ACR Appropriateness Criteria® acute chest pain—suspected aortic dissection; 2008.).

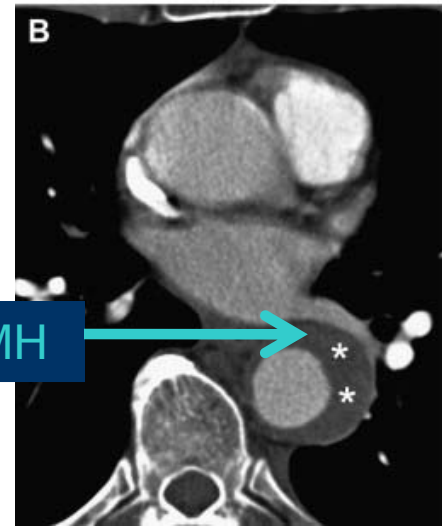


Companion Patients 2 and 3: Axial C+ CT Chest/Abd

Aortic dissection



PAU



IMH

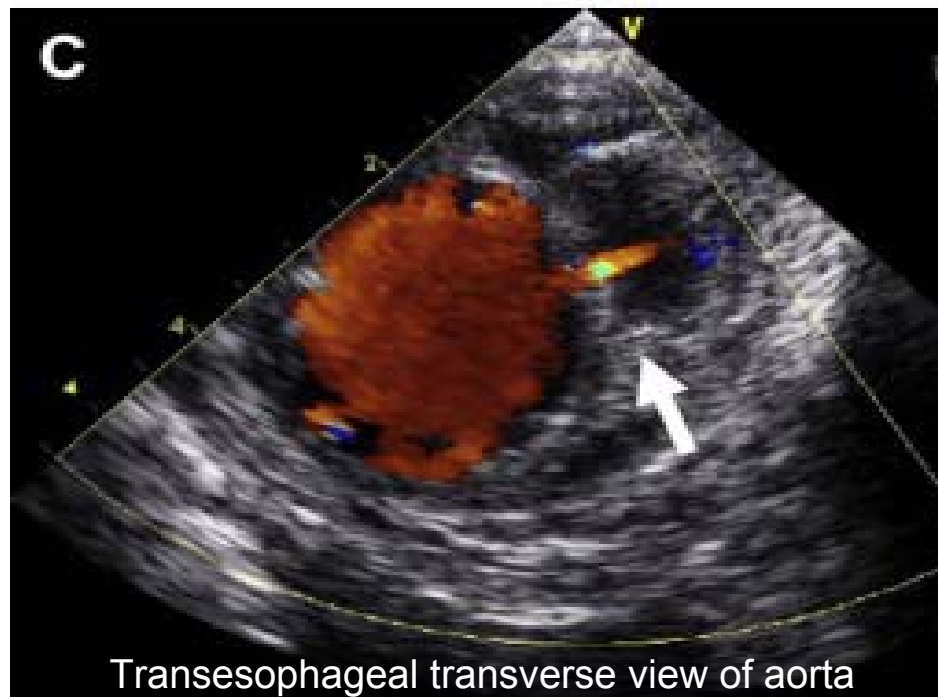
Hall et al. *Principles of Critical Care*, 3e. Columbus, OH: The McGraw-Hill Companies; 2005.

Eggebrecht et al. *Eur J Vasc Endovasc Surg*. 2009; 38(6): 659-65.



Companion Pt. 4: IMH on TEE

Active bleeding from aortic lumen
into IMH visible using Doppler flow



Note: Apart from requiring esophageal intubation and an experienced operator, TEE is less sensitive for detecting AAS in the distal ascending aorta and proximal arch because of obscuration by the trachea and L mainstem bronchus.

Transesophageal transverse view of aorta

Eggebrecht *et al.* *Eur J Vasc Endovasc Surg.* 2009; 38(6): 659-65.



Back to Our Pt: Tx of Type B IMH

- 80% of pts with Type B pathology survive on medical management
- Goal: ↓BP to <110, ↓dP/dt (shear stress)
 - β-blockers (↓HR)
 - Nitrates
 - Nitroprusside
- Pt's BP controlled with IV nitroglycerin, *but* her CP persisted



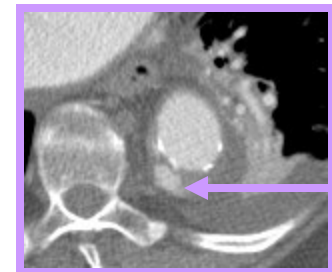
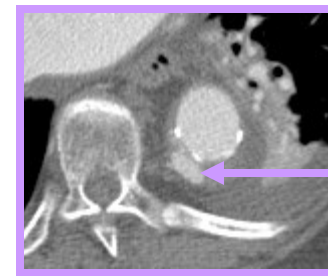
Out Pt's Repeat CT Abd + Chest Showed Expansion of the IMH



Original IMH

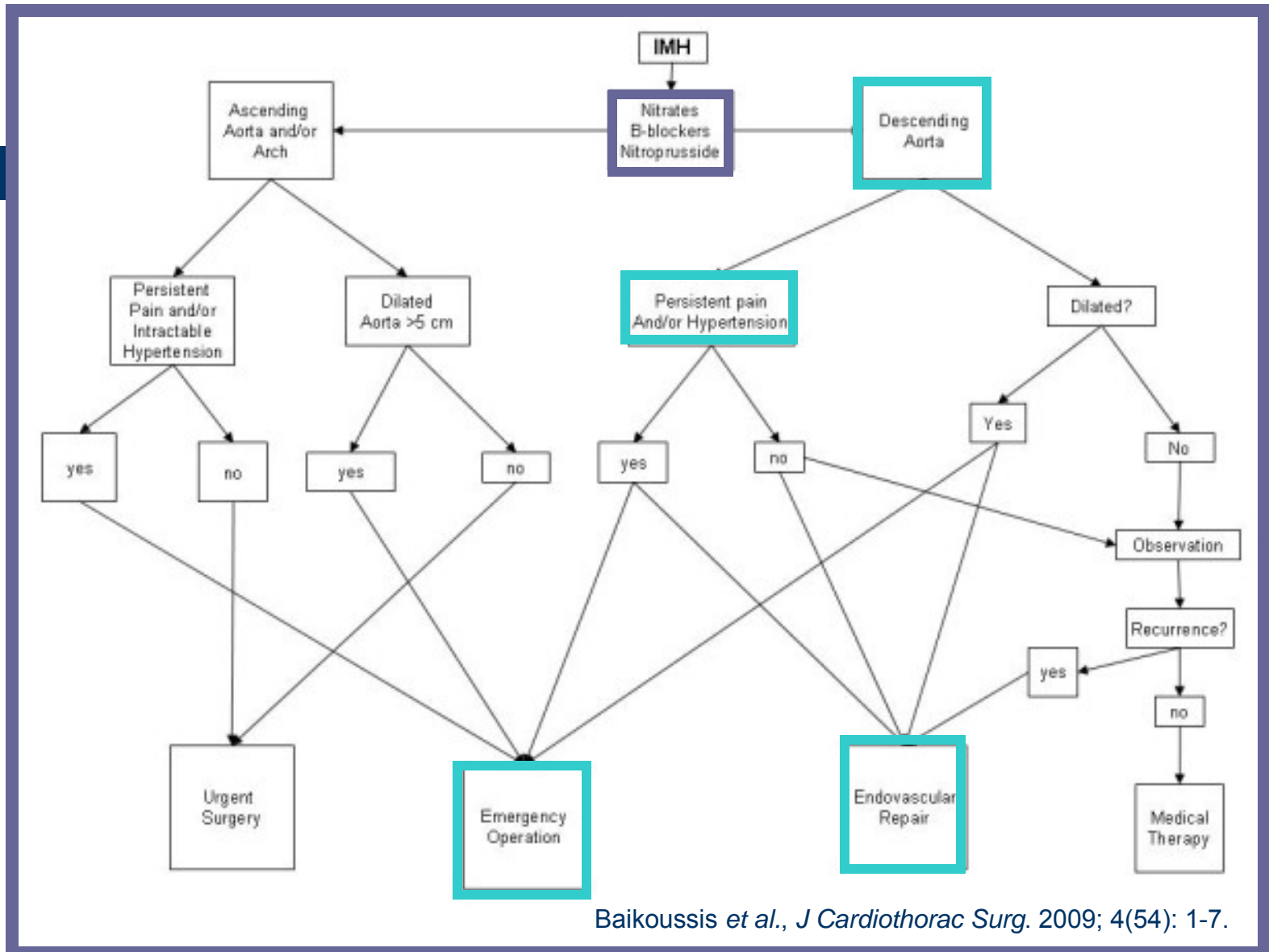


Expanded IMH





IMH Decision Tree



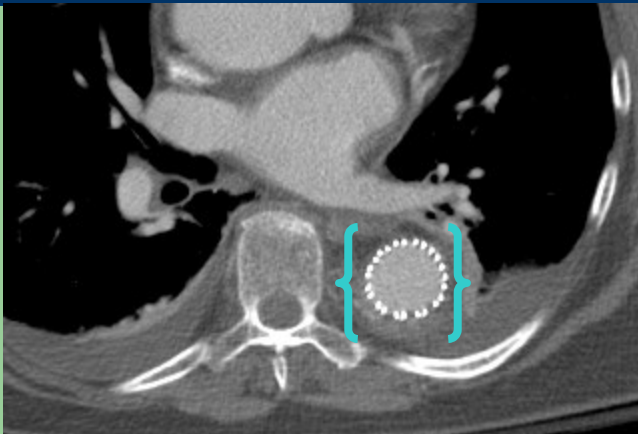


Surgical Intervention

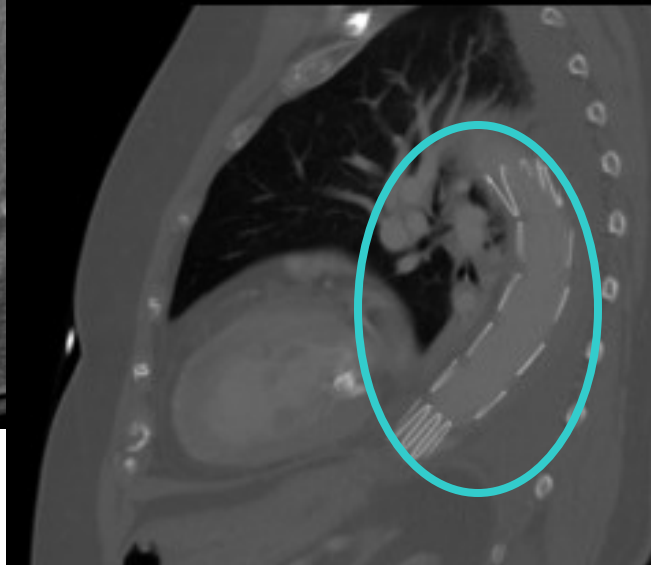
- BP controlled in ED with IV nitroglycerin
 - Had persistent pain and extension of IMH
- Referred to vascular surgery
 - 4 days later: thoracic endovascular aneurysm repair (TEVAR), under U/S and fluoroscopic guidance
 - Stent graft positioned 2-3 cm above **celiac artery**
 - Endovascular repair associated with median survival of 89.8 months
 - However, history of PAU+IMH associated with greater rates of TEVAR failure, compared with IMH alone



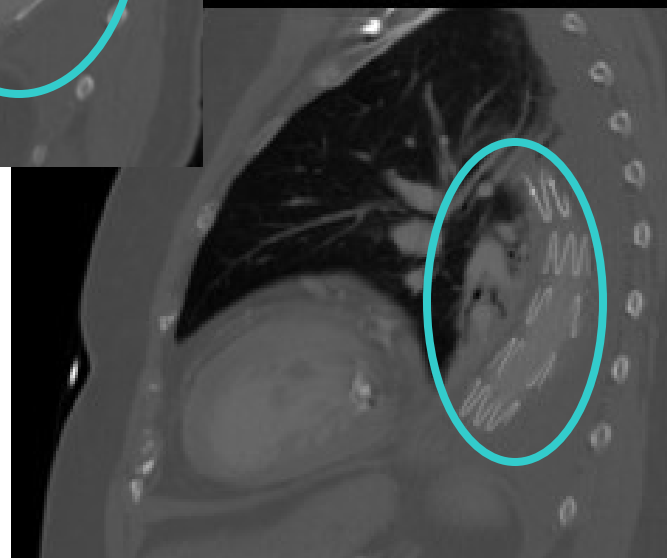
Post-op Images of our Pt: Successful TEVAR



Axial C+ CT Chest/Abd



Both images: Sagittal
C- CT Chest/Abd



- 6 mos later: doing well
- Plan: re-evaluate in 1 year



Grateful Thanks to...

- Leo Tsai, MD
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- Fellow students in Core and Advanced Radiology, May 2011



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