MDCT of Non-Traumatic Aortic Emergencies

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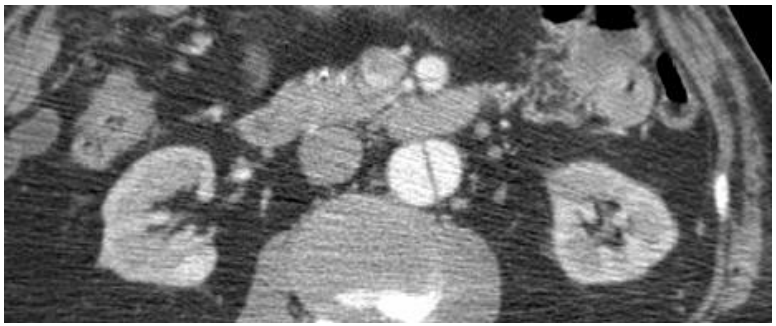
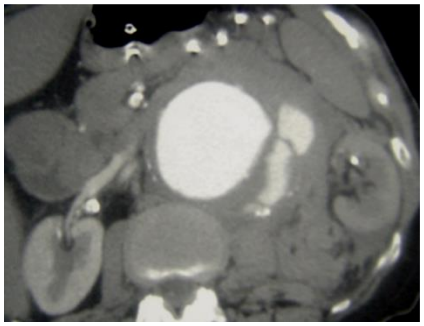




Introduction

- Multi-detector CT (MDCT) is the test of choice for imaging of suspected non-traumatic aortic emergencies for numerous reasons: speed, wide availability, very high accuracy for the presence or absence of disease and the extent of disease and complications, and the identification of alternative diagnoses
- Radiologists need to be familiar with the spectrum of common and uncommon manifestations of acute aortic disease, as well as technical CT considerations and potential pitfalls in diagnosis
- (I have no relevant disclosures)

Outline

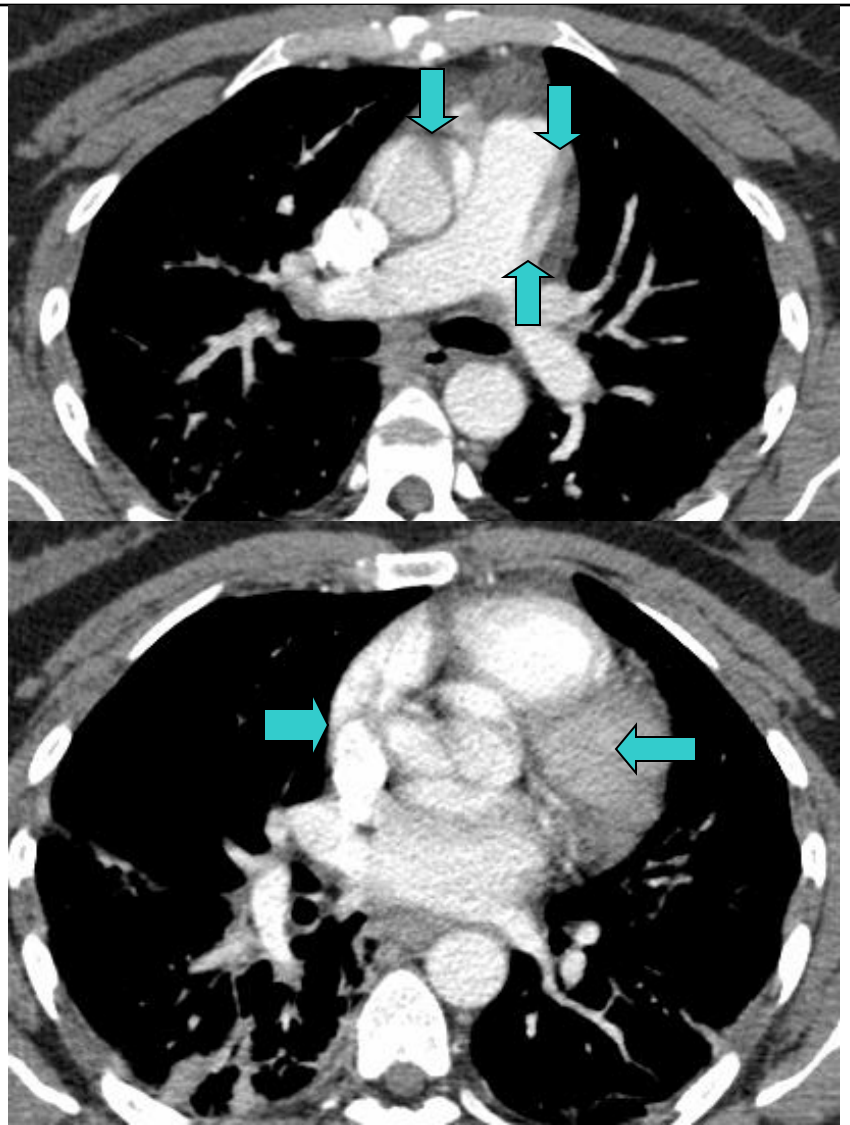
- A) Technique: non-enhanced versus enhanced, options for timing, reconstructions, and gating
- B) Aneurysm rupture and impending rupture: recognition on non-enhanced and enhanced CT, and pitfalls
- C) Aortic dissection, aortic intramural hematoma (IMH), and penetrating aortic ulcer (PAU): identification, classification, complications, and natural history
- D) Unusual disorders: mycotic aneurysm, aortitis, and aortoenteric fistula/graft infection

CTA Timing Options

- Timing of IV contrast delivery for aortic CTA: empiric, bolus tracking, test bolus, & variants
- Empiric delay adequate in 70 patients with infrarenal abdominal aortic aneurysms (AAA) imaged on MDCT (Macari M et al. Radiology 2001)
- We routinely bolus track all our CTAs, as do most practices; use rapid injection rate (3-4+ cc/sec)
- We routinely do coronal and sagittal MPRs and send to PACS for review – although diagnosis is almost always based on axial images
- Generally use 1 to 3 mm slice thickness
- We do not routinely cardiac gate or perform 'triple-rule out' CT protocols; can repeat with beta blockade or do TEE/MR for problem solving in very selected 'r/o dissection' cases with motion artifacts

Cardiac Motion Artifacts

- 41-year-old woman with chest pain and tachycardia
- Motion artifacts of ascending aorta and pulmonary artery; no dissection is present
- Note artifacts extend off ascending aorta
- *Artifacts are common but should be easily distinguishable from a true type A dissection in most cases*



Ruptured Abdominal or Thoracic Aortic Aneurysm

- Start with non-enhanced CT; usually sufficient if rupture is suspected (Vantine PR et al. Emerg Radiol 2014)
- Repeat with IV if: aneurysm present but no rupture &/or need to clarify status of branch vessels, or if negative and need to search for an alternative diagnosis
- Findings: peri-aortic hemorrhage in retroperitoneum (& peritoneum), indistinct aortic wall/disrupted calcification at rupture site(s); high-attenuation "crescent sign"; active arterial contrast extravasation; and with thoracic aneurysm rupture, reactive effusions and/or pleural/pericardial hemorrhage (Rakita D et al. RG 2007; Biancari F et al. Eur J Endovasc Surg 2013)

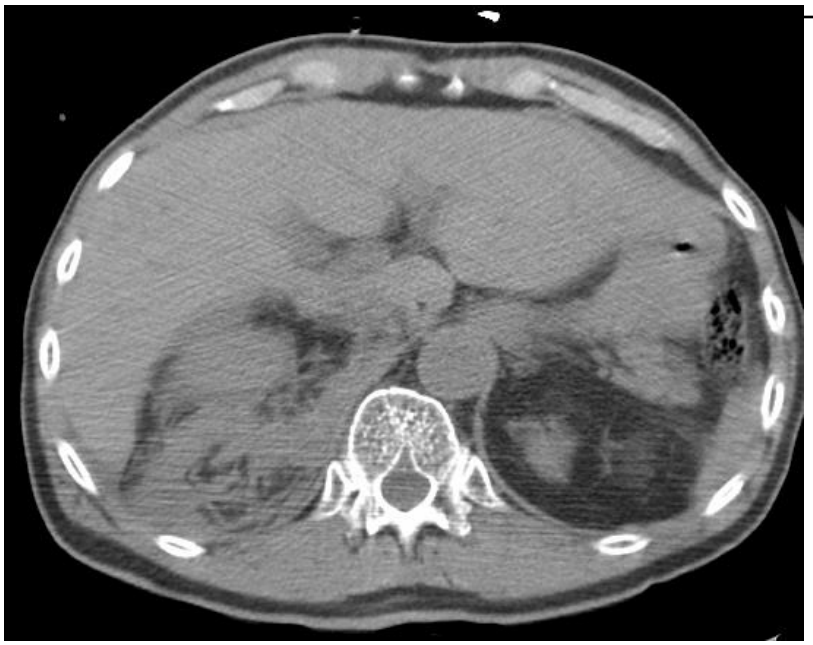
Ruptured Abdominal or Thoracic Aortic Aneurysm

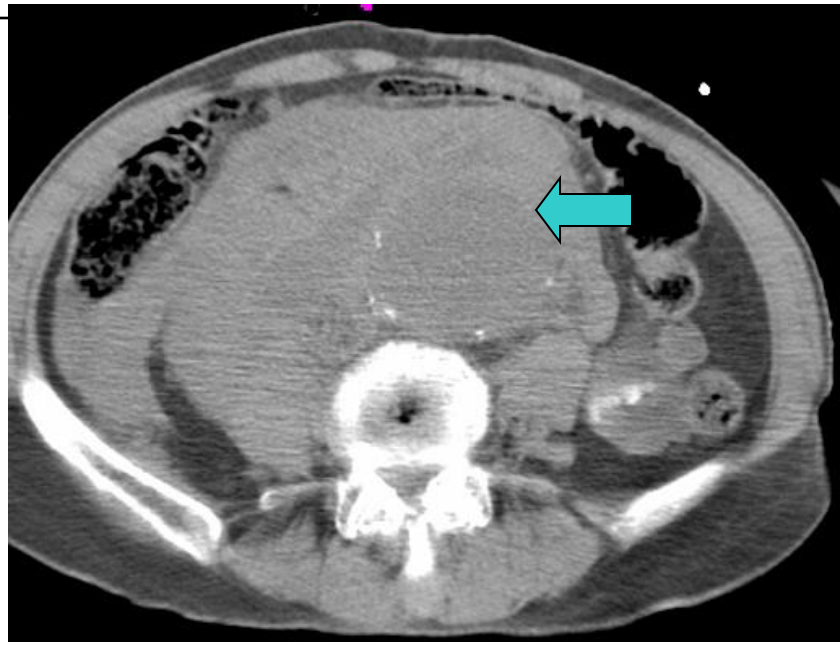
- Non-contrast versus CTA for acute aortic syndromes (Vantine PR et al. Emerg Radiol 2014):
- 34 positive CTAs, 83 negative CTAs; all had initial non-contrast images first
- 93% sensitivity, 96% NPV for non-contrast images alone; moderate radiologist agreement (initial decision rule phase of study)
- Enlarged aortic diameter alone was 82% sensitive & 83% specific
- Application of decision rule (including displaced aortic Ca^{2+}, increased wall density, & abnormal contour) to 35+ & 45- cases using C- images alone was 100% sens. & 74% spec.

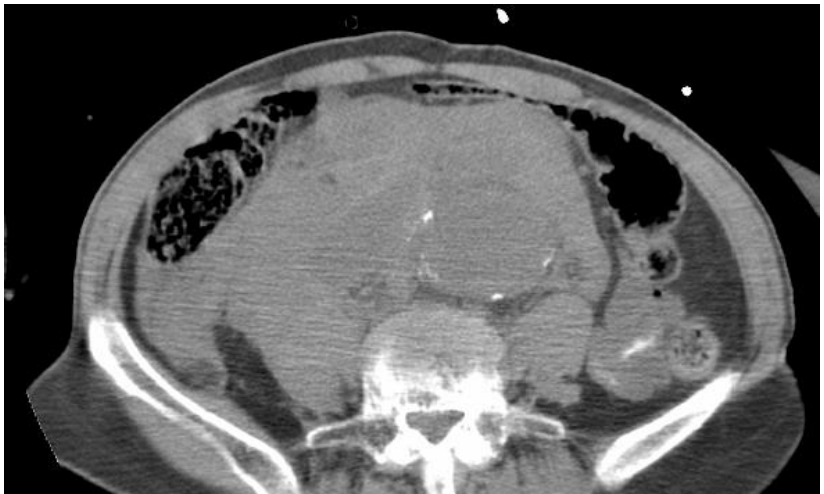
AAA Rupture, Non-Enhanced CT

- 80-year-old man with abdominal pain
- 8 cm infrarenal AAA with marked retroperitoneal hemorrhage
- Patient survived emergency surgery
- *Watch for incidental AAA and bleed from anticoagulation* – determine if the retroperitoneal hemorrhage has > 3 cm contiguity with the AAA, & no hct. effect (Federle MP et al. AJR 2007)

AAA Rupture, Non-Enhanced CT

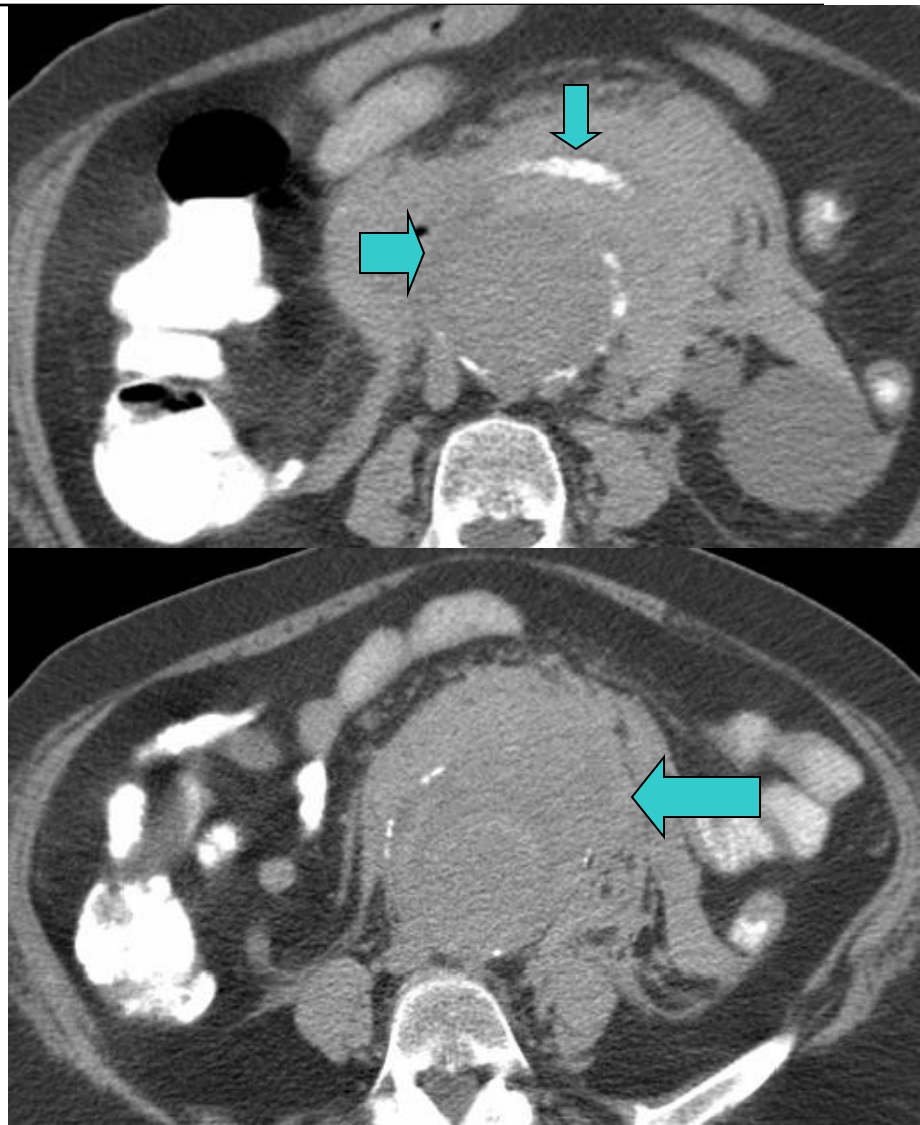






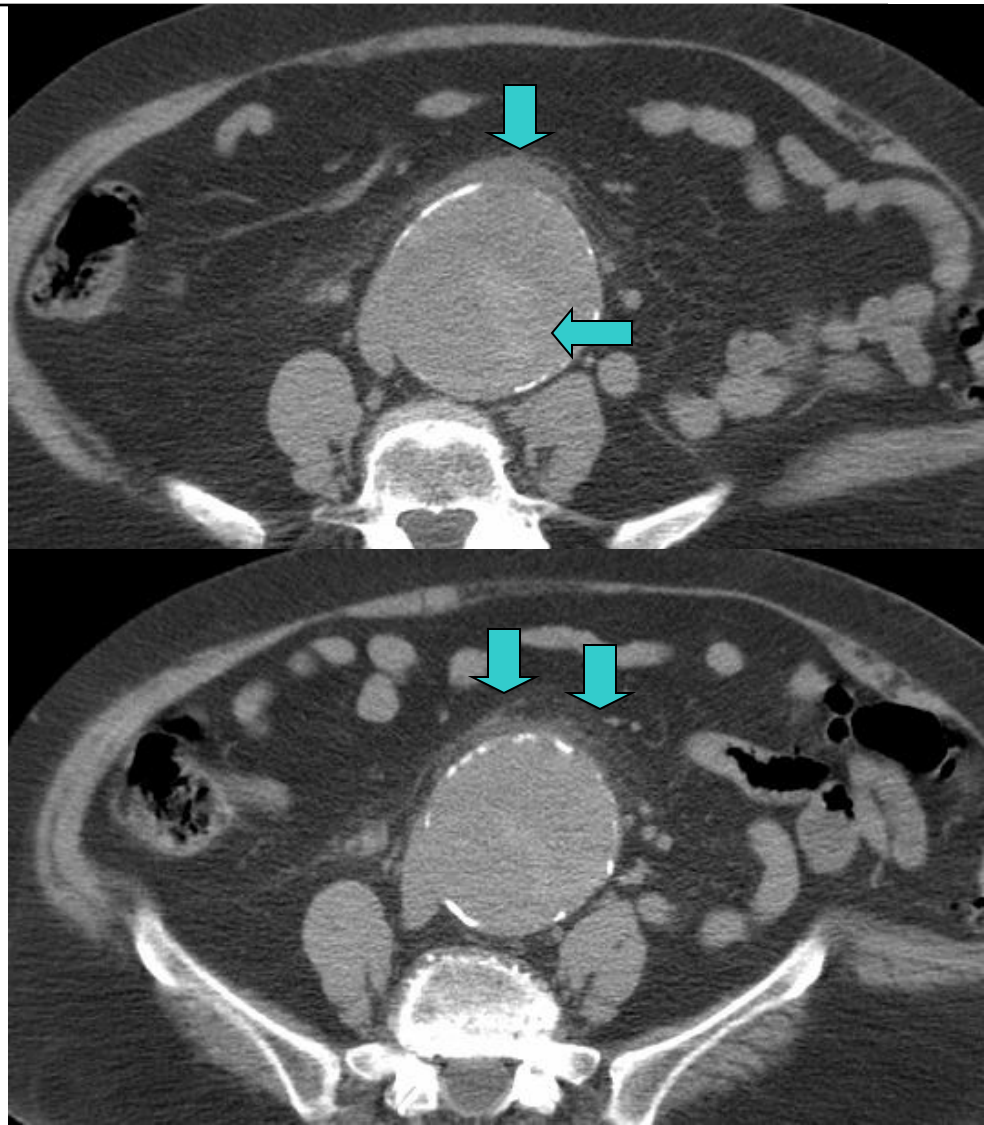
AAA Rupture, Non-Enhanced CT

- 80-year-old woman with left lower quadrant pain
- Ruptured AAA on non-enhanced CT (oral only; aneurysm/rupture was not anticipated)
- Note ill-defined anterior wall and absence of calcification
- Hematoma surrounds the duodenum



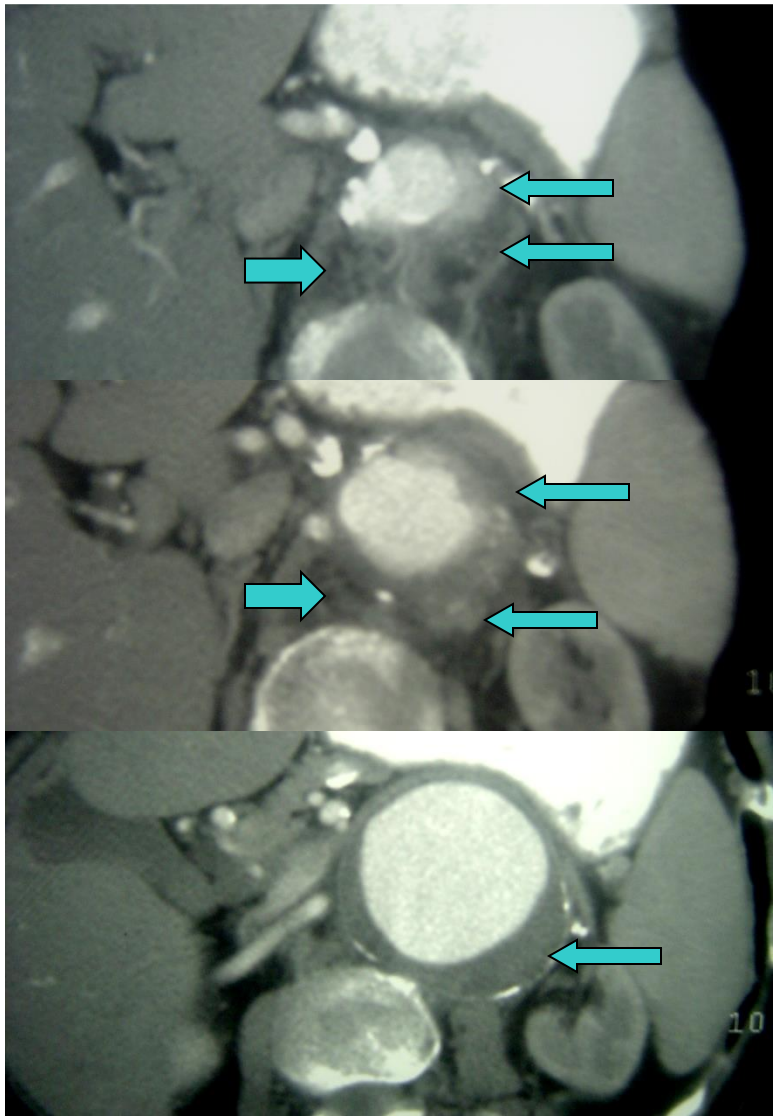
? Impending AAA Rupture

- 73-year-old woman with abdominal pain and back pain, r/o stone disease
- C- CT shows unanticipated 9 cm AAA with high-density thrombus, ? disruption of anterior rim calcification, and edema inferior to duodenum
- No prior CT exams
- ? Impending rupture vs. inflammatory aneurysm
- Impending rupture found at surgery



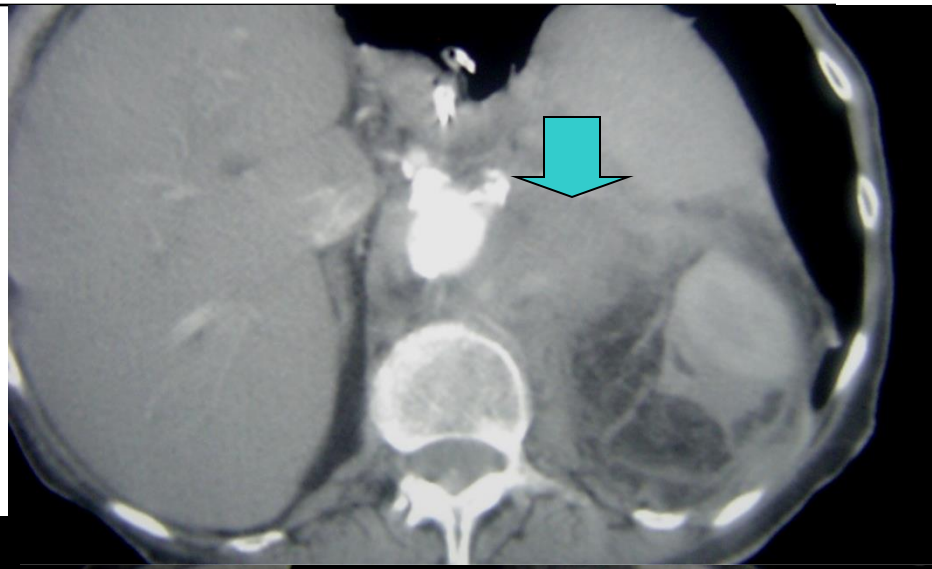
? Impending AAA Rupture

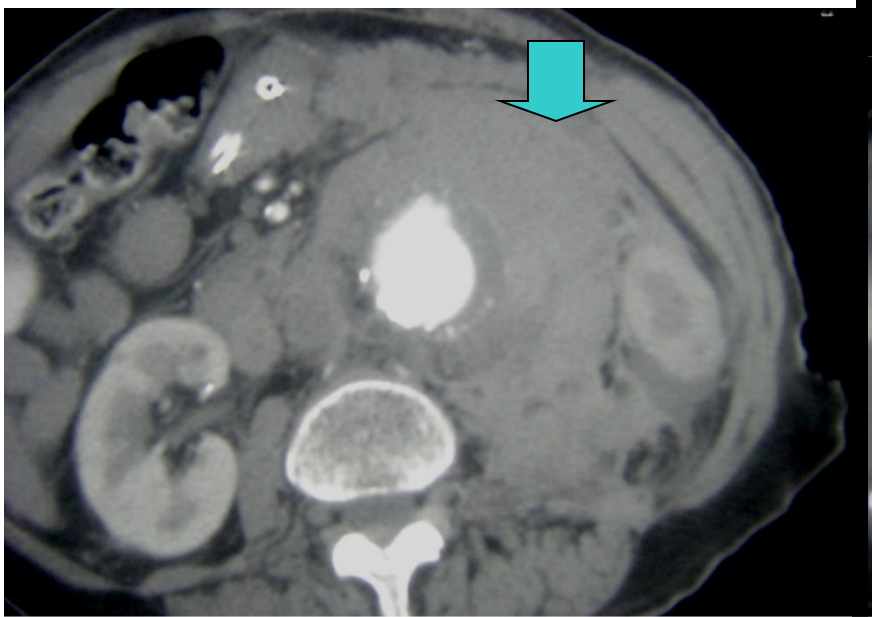
- 76-year-old patient with history of AAA and new abdominal pain
- CT interpreted as no evidence of rupture or impending rupture
- In retrospect, findings of impending rupture are present including haziness of fat, ill-defined superior aspect, the beginning of a pseudoaneurysm, and subtle “crescent sign”

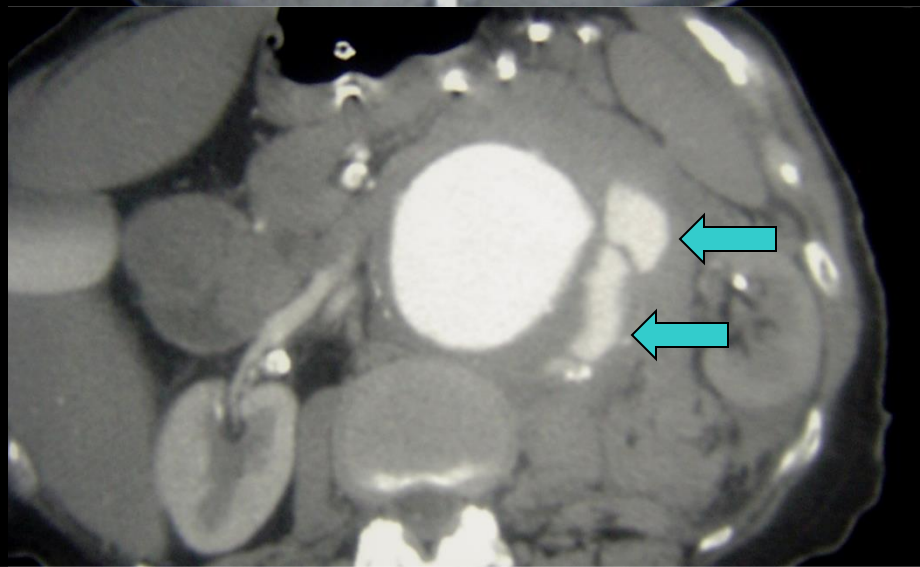


? Impending AAA Rupture

- CT 24 hours later for worsening pain shows marked interval change with active arterial contrast extravasation/ gross rupture

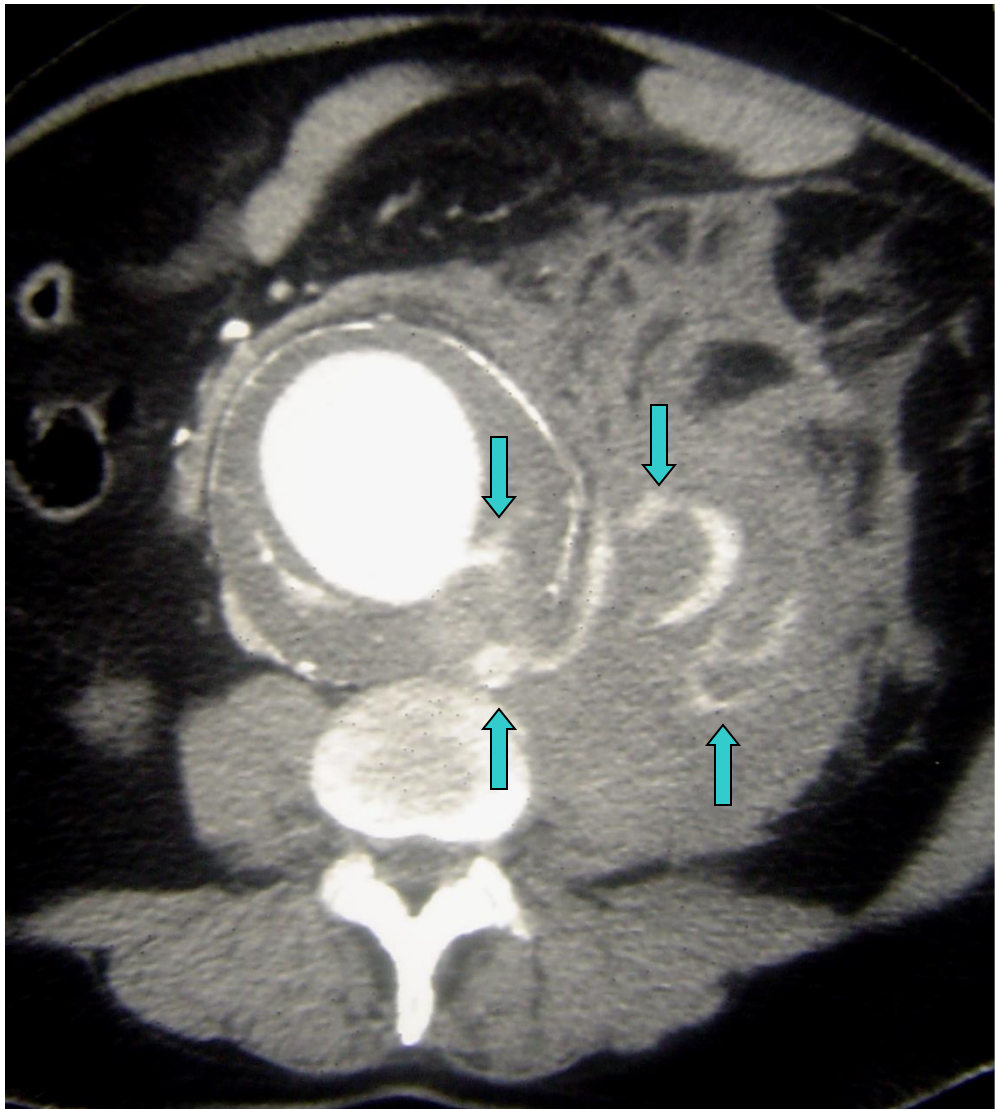






Active Arterial Contrast Extravasation - Leaking Aneurysm

- Older man with active arterial contrast extravasation from leaking abdominal aortic aneurysm
- (Case courtesy Evan M. Meiner, MD, Dept. of Emergency Medicine, North Shore University Hospital at Plainview)

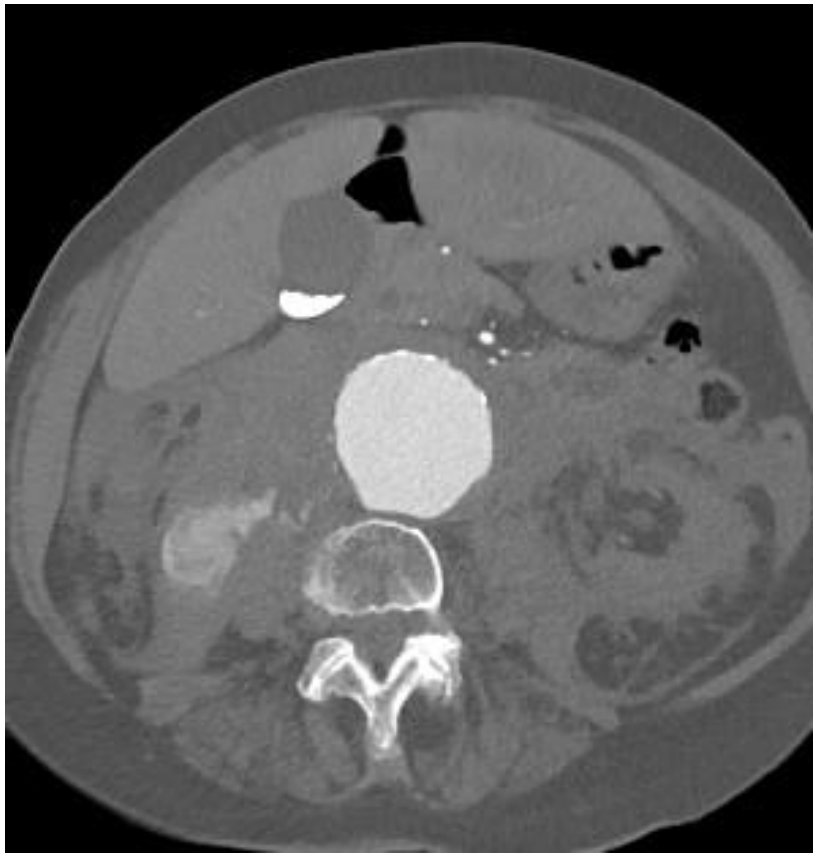


AAA rupture, non-contrast CT, then IV contrast-enhanced CTA

- 90-year-old woman with lower abdominal pain, nausea, and back pain, on Plavix
- Initial non-contrast CT, then CTA done immediately after per clinician request

AAA rupture, non-contrast CT, then IV contrast-enhanced CTA

- 6 cm AAA, wide interface of RP hemorrhage with the AAA; obvious active extravasation

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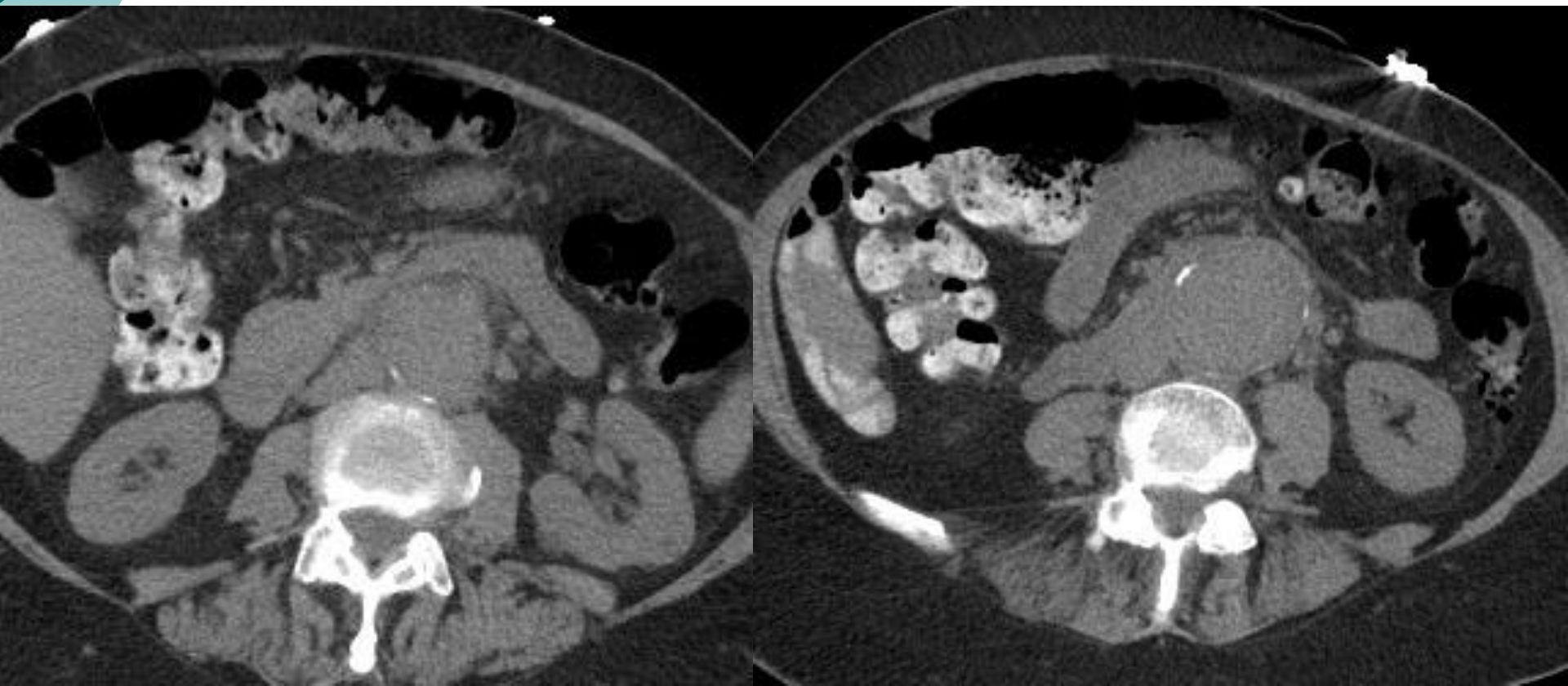
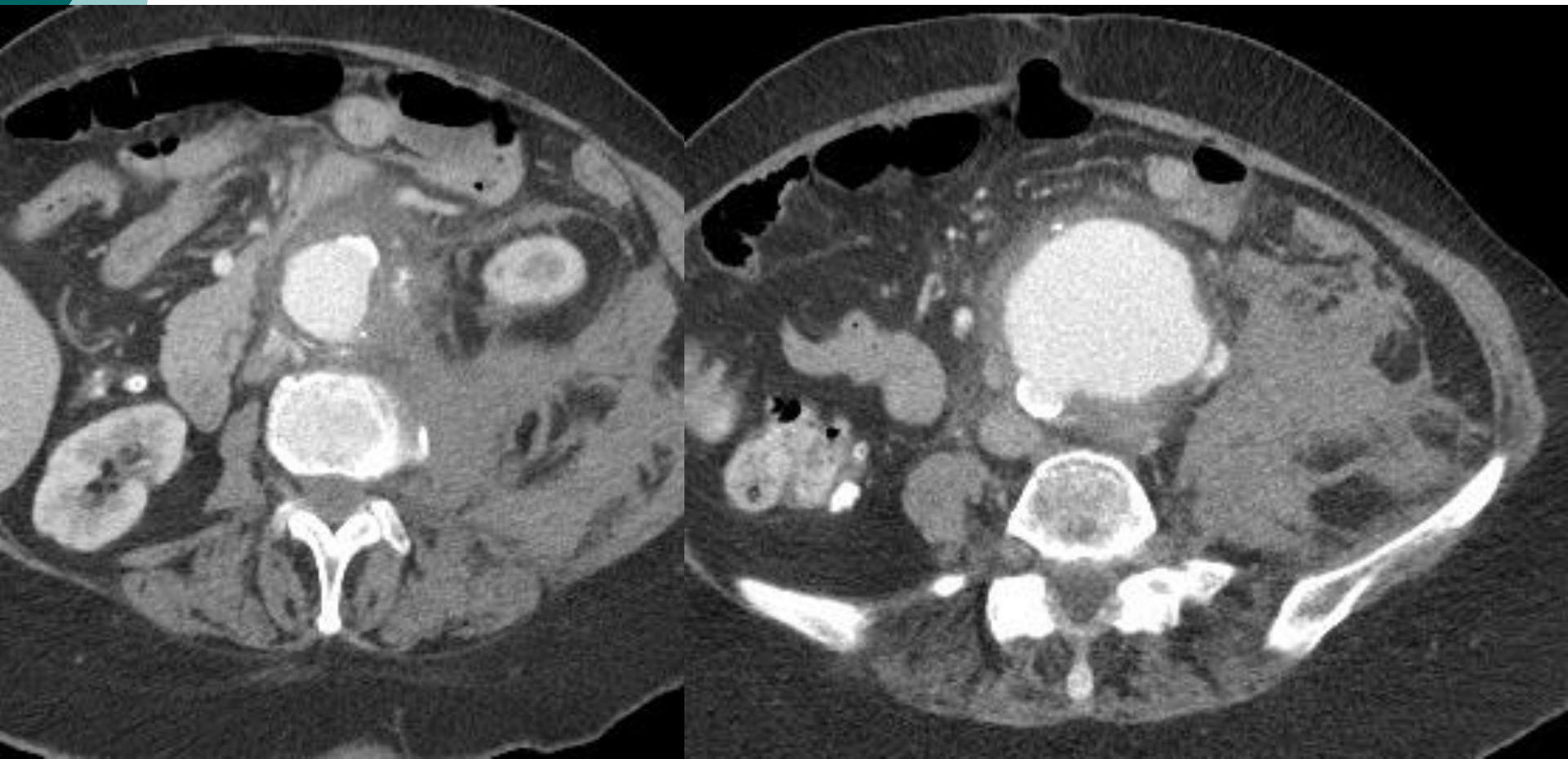
? Impending AAA Rupture

- 81-year-old woman with RLQ pain; CT with oral
- Haziness of fat/hematoma adjacent to 4.5 cm AAA, bulge, and crescent sign; ? early rupture



? Impending AAA Rupture

- 5 days later, patient presented with acute syncope, worsening pain

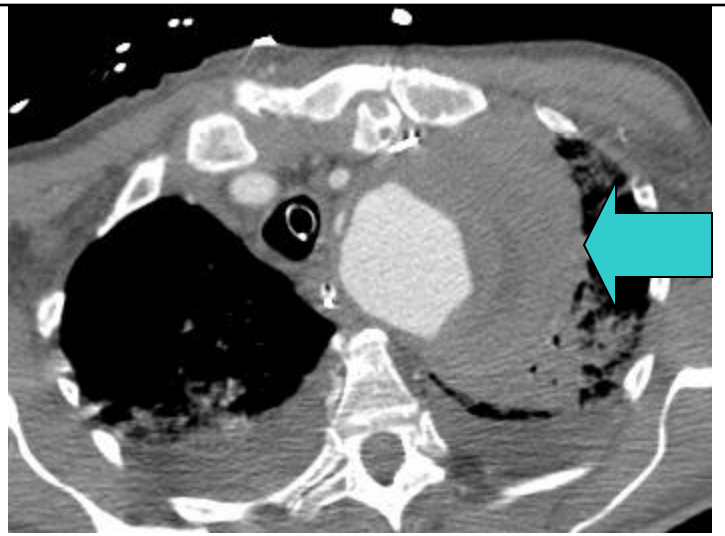


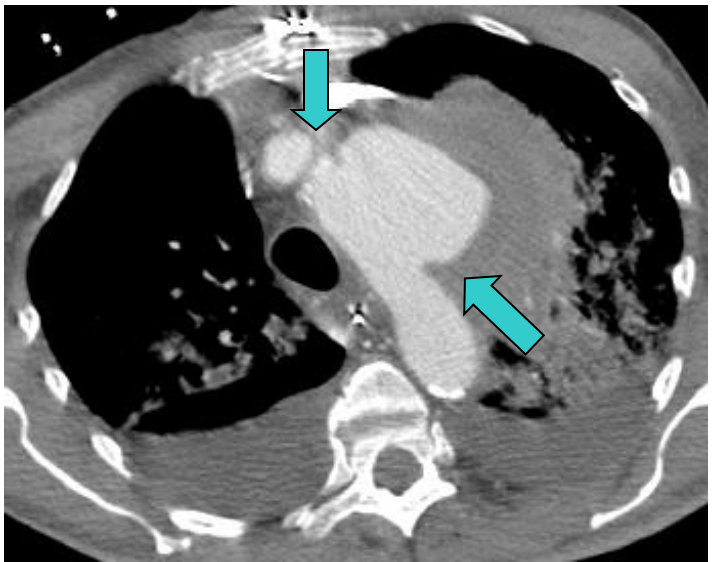
Aorticopulmonary Fistula

- Rare and usually fatal complication of a thoracic aortic aneurysm, & even rarer from aortic dissection
- Patients present with hemoptysis of varying severity
- CT does not show the fistula, but may reveal strong supportive evidence
- Small CT series or case reports (e.g., 1 atherosclerotic, 1 mycotic, 2 s/p aneurysm repair) reported (Coblentz CL et al. AJR 1988; Lempel JK et al. J Thorac Surg 2012)
- Do emergent open or endovascular graft repair (Wheatley GH et al. J Thorac Cardiovasc Surg 2007)

Aorticopulmonary Fistula

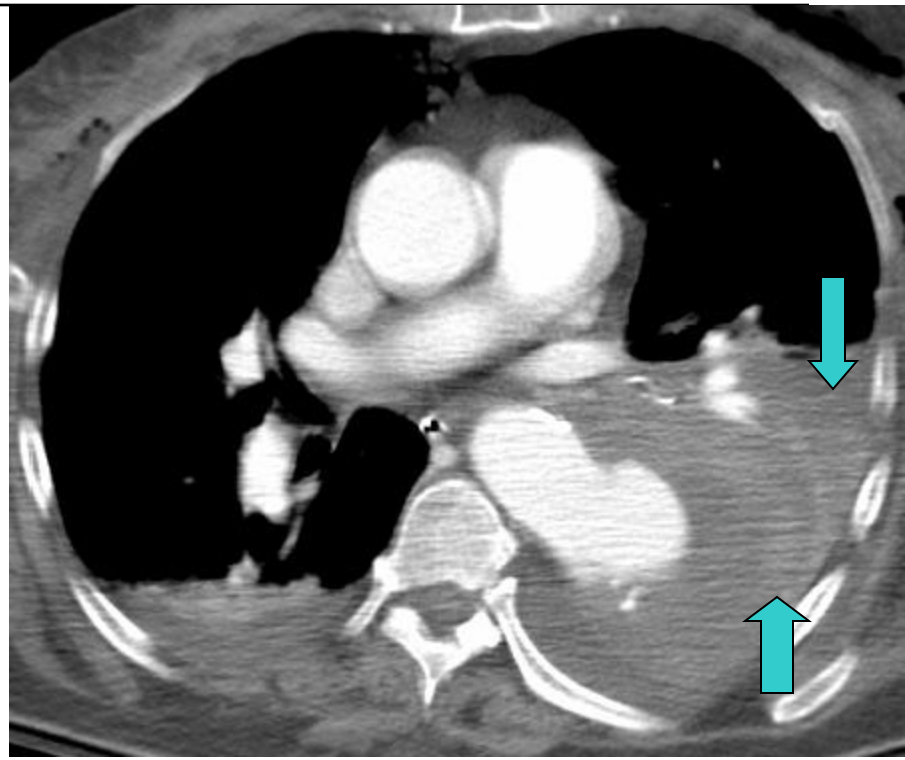
- 72-year-old man with widened mediastinum on CXR, massive hemoptysis, prior CABG, and history of trauma 10 years ago
- Large thoracic aortic aneurysm with marked surrounding hematoma; effusions & adjacent air-space disease
- Findings c/w partially-contained rupture; confirmed at surgery
- Patient survived





Aorticopulmonary Fistula

- 80-year-old woman status post cardiac arrest, with tracheal hemorrhage on intubation
- Ruptured lower thoracic aneurysm on CT; hemorrhage is contiguous with LLL

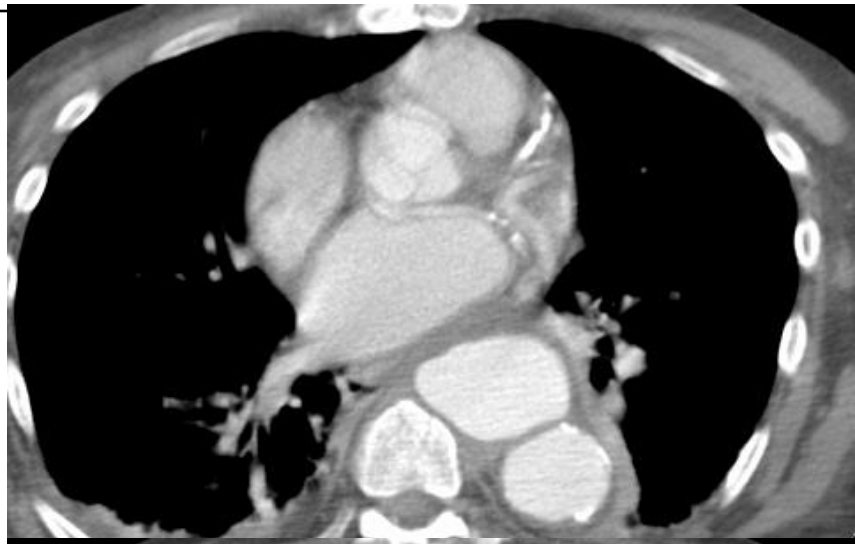


“Draped Aorta” Sign

- Report of 10 patients with “draped aorta” around adjacent vertebral bodies – sign of contained leak (subacute) (Halliday KE et al. Radiology 1996)
- - 7 patients had deficient posterior aortic wall and contained leak; 2 had mycotic aneurysm; 1 had pseudoaneurysm at aortic graft anastomosis
- - 3 patients had vertebral body erosions
- Similar findings in another small series (Apter S et al. Abd Imaging 2010)

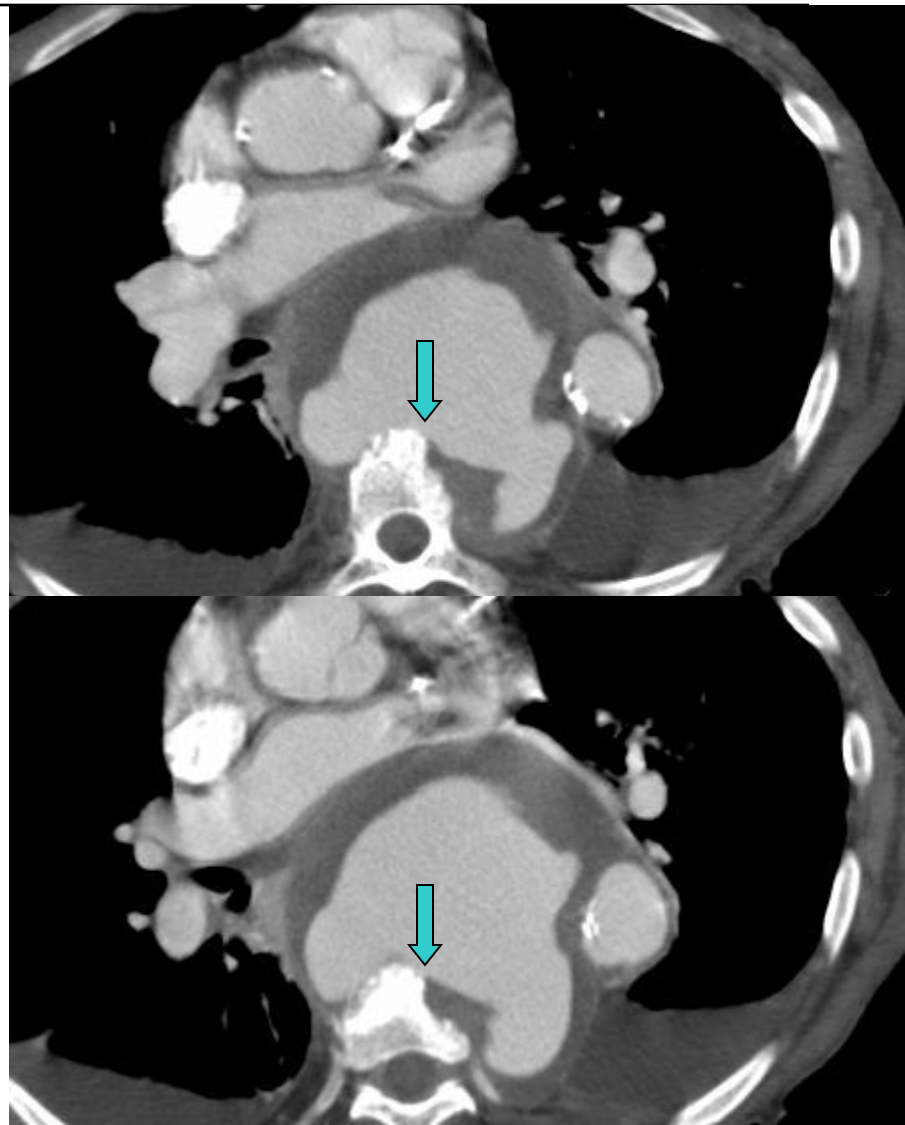
Aneurysm & Spinal Erosion/ Draped Aorta Sign

- 70-year-old man
- Initial CT - large lower thoracic aortic aneurysm



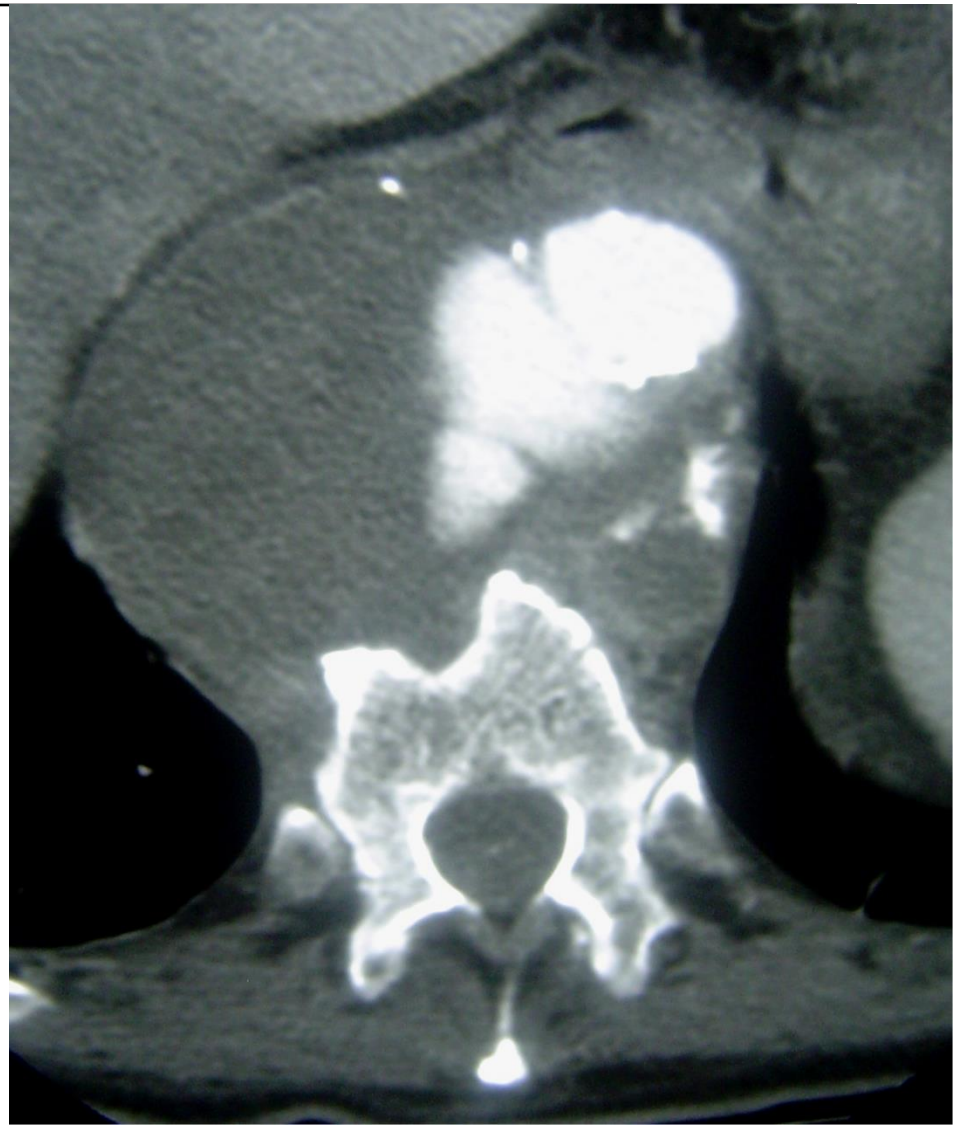
Aneurysm & Spinal Erosion/ Draped Aorta Sign

- New abdominal pain 6 months later
- Marked interval aneurysm growth, erosion of the adjacent thoracic vertebral bodies, the “draped aorta sign”, and left atrial compression



Draped Aorta Sign

- 84-year-old man with draped thoracic aortic aneurysm around eroded lower thoracic vertebral body
- Patient was asymptomatic



64-year-old man with acute CP/LBP – 8/11/2022 CTA, no prior imaging of relevance

- There was lots of controversy on how to manage this patient!

High-attenuation Crescent Sign

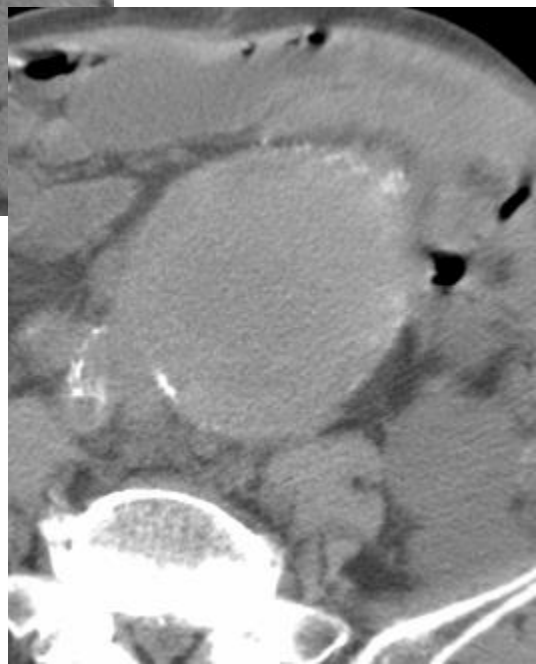
- High-attenuation crescent sign within thrombus of aneurysm on CT – found in 19 (13%) of 149 patients with AAA; was 77% sensitive and specific for aneurysm rupture/impending rupture (Mehard WB et al. Radiology 1994)
- Present in 11/52 (21%) AAA with rupture/ impending rupture in another series, but in none of 56 non-ruptured AAA (Siegel CL et al. AJR 1994)
- In 24/34 (71%) patients with rupture/impending rupture in a third series, *but also in 11/90 (12%) non-ruptured AAA* (Arita T et al. Radiology 1997)

High-attenuation Crescent Sign

- Represented acute hemorrhage at pathology, in ruptured AAA – clefts develop within thrombus, then ruptures
- Focal discontinuity in wall calcification found on CT in 4 of 52 ruptured AAA (2nd series)– but not reliable based on other reports
- *True sensitivity/specificity needs further study*
- Lumen irregularity/regularity had no correlation with rupture in the 2nd series
- Also watch vs. an inflammatory AAA, and for slightly dense thrombus in non-ruptured aneurysms – very common on non-enhanced images, +/- calcification

High-attenuation Crescent & Disrupted Calcification Signs

- 93-year-old man with 11 x 12 cm juxtarenal AAA
- Patient underwent CT for reasons unrelated to the aorta
- Calcifications in anterior aortic wall look fragmented, and aortic thrombus appears slightly hyperdense, but aneurysm is not rupturing

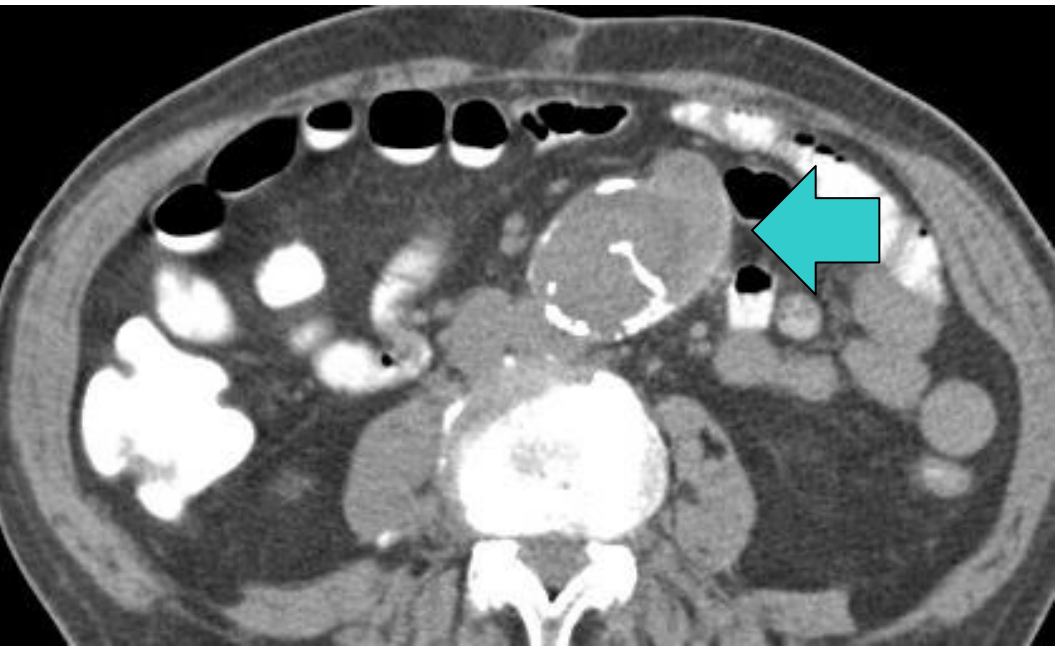


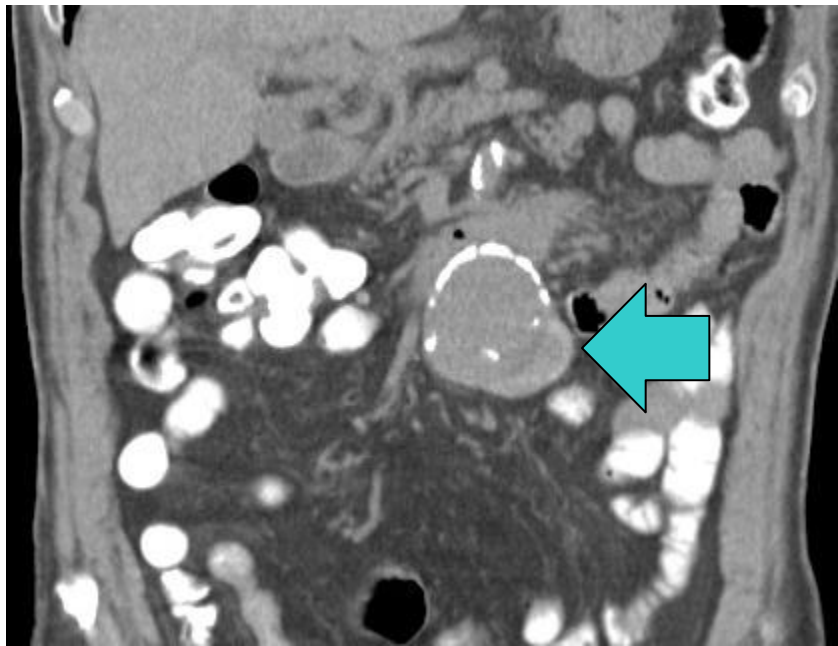
High-attenuation Crescent & Disrupted Calcification Signs

- 47-year-old with known AAA and Marfan's syndrome
- Aneurysm contains areas of irregularly calcified thrombus but no definite acute abnormality; note dural ectasia in lumbar spine

High-attenuation Crescent & Disrupted Calcification Signs

- 85-year-old man with left flank pain
- Bulge in AAA with crescent sign and break in wall calcification, very suspicious for impending rupture, although no edema/bleed
- Patient received a stent graft and did well





Aortic Dissection

- True and false lumen – created by flap of intima with inner layers of media; may be accompanied by acute aortic dilatation
- Abrupt onset (85%) of ripping/tearing pain, usually with radiation to interscapular region/back
- Mimics MI and other acute disorders of the chest, upper abdomen, and spine, and vice versa; need high clinical index of suspicion
- Vast majority of CT examinations for 'rule out dissection' are negative; a minority show an alternative diagnosis – however, some form of cross-sectional imaging is essentially mandatory to establish or exclude the diagnosis
- Spectrum of dissection, hematoma, and penetrating ulcer (Sundt TM et al. Ann Thorac Surg 2007)

Aortic Dissection

- *Stanford type A* – involves the aorta proximal to origin of right brachiocephalic (innominate) artery with or without more distal aorta
- *Stanford type B* – only involves aorta distal to origin of left subclavian artery (and usually begins at this location – a point of high sheer forces)
- **Type A usually needs emergent surgical repair whereas manage type B conservatively unless complications – regardless of whether frank dissection or intramural hematoma (IMH)**
- Acute type B is associated with morbidity and mortality (Estrera AL et al. Ann Thorac Surg 2007)
- CXR is abnormal in 60-90% - particularly watch for new widening of mediastinum – but findings may be subtle, non-specific, or normal

Aortic Dissection

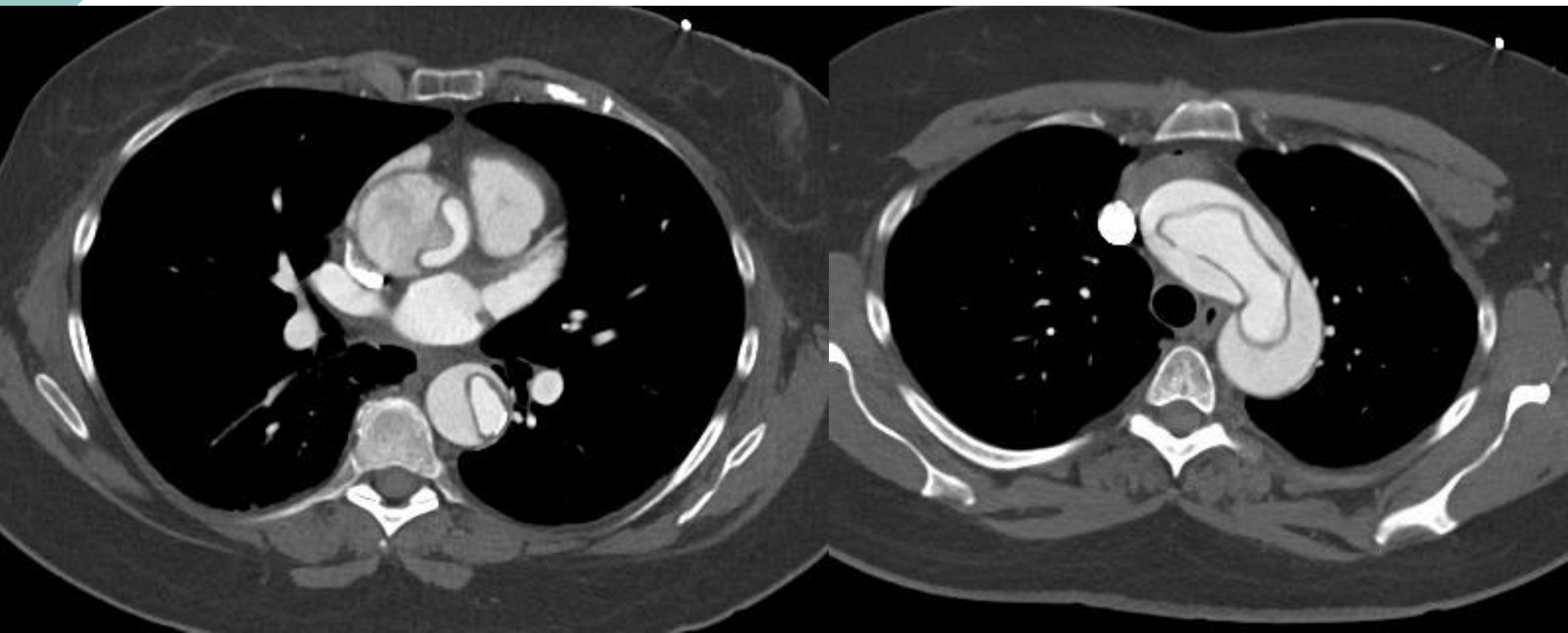
- What if there is dissection involving the aortic arch between the right brachiocephalic artery and the left subclavian artery, with or without involvement of the descending aorta?
- I.E., the flap originates just distal to the left subclavian artery, and propagates retrograde to the aortic arch, but does not involve the ascending aorta?
- Unclear in the past; tendency for radiologists to categorize as type A
- Lempel et al. (Radiology 2014) propose this should be categorized as type "B*", and that these cases should be treated conservatively if possible

Aortic Dissection

- There is frequently some degree of acute dilatation compared with the aorta prior to dissection
- Interval dilatation of the affected aorta within the next few months is also common
- This needs to be monitored for
- Note I have also seen lots of litigation/QA issues regarding aortic dissection and its variants based on imaging/clinical evaluation (and this continues to date)

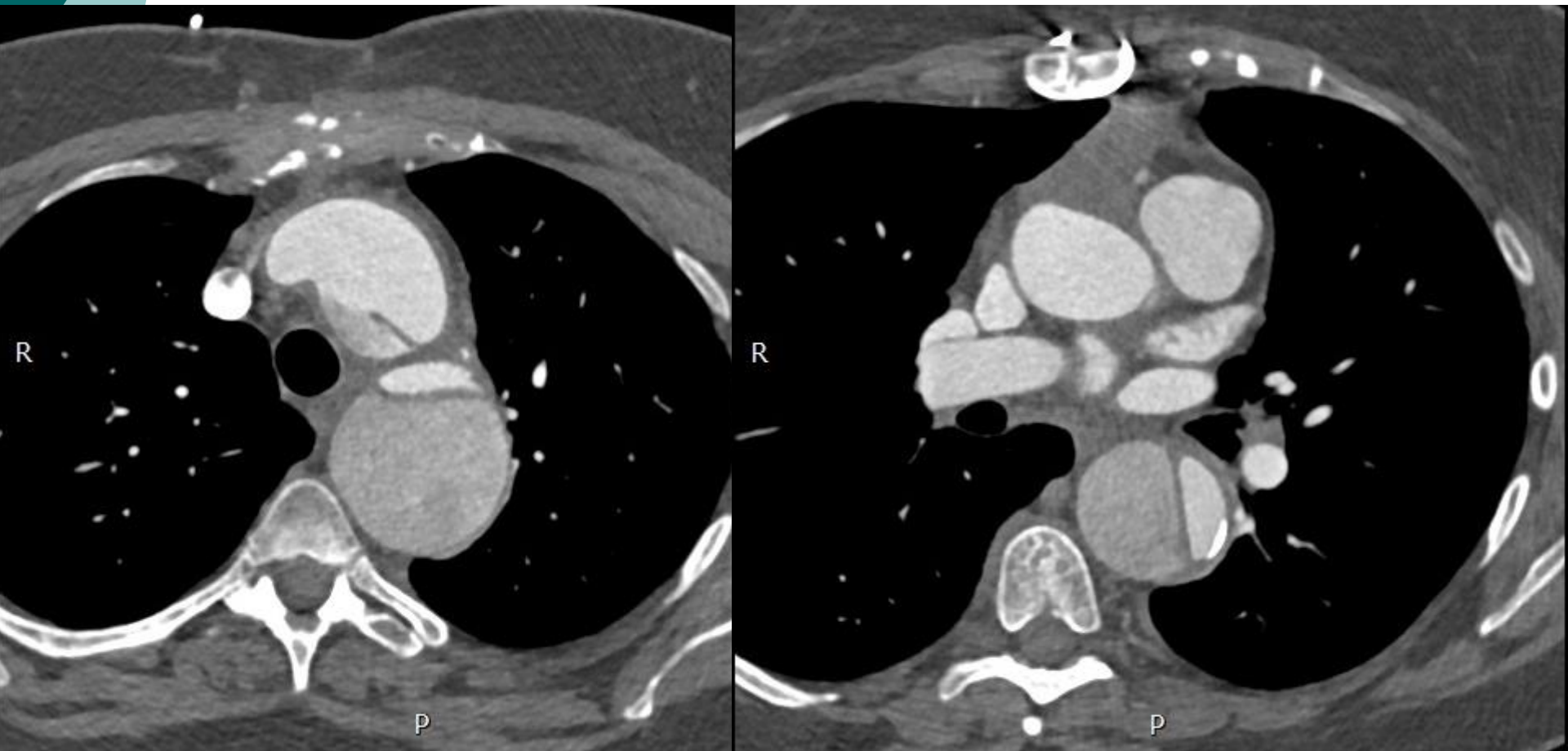
Aortic Dissection + Aneurysm

- 68-year-old woman with type A aortic dissection and associated enlarged aorta
- Initial measurements for distal arch: 3.7 x 3.6 cm; also dilated ascending aorta



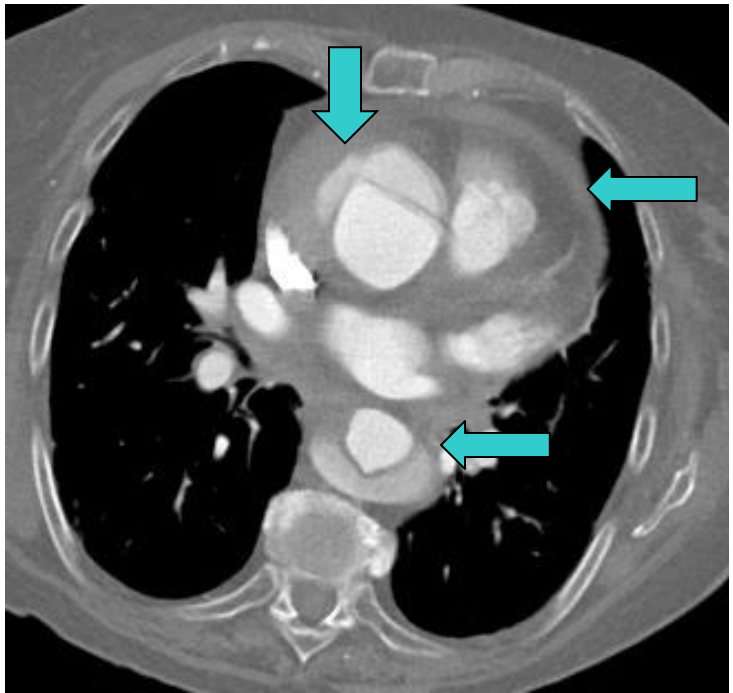
Aortic Dissection + Aneurysm

- Urgent repair of ascending aorta was done
- Follow-up CT 5 months later: 4.9 x 4.9 cm



Aortic Dissection + Aneurysm

- 93-year-old woman with chest pain radiating to the back
- CTA shows acute type A dissection with associated aneurysm, and rupture with associated hemopericardium



Aortic Dissection

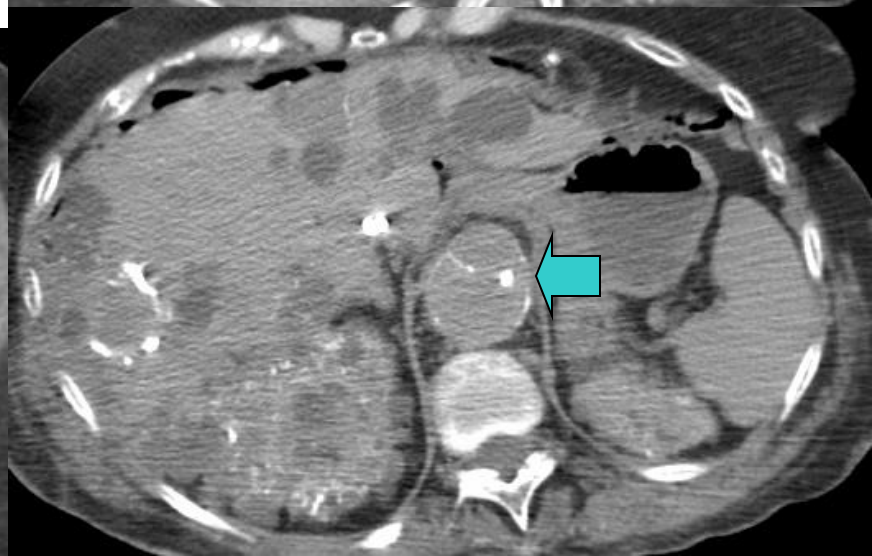
- CT is extremely accurate for aortic dissection (Shiga T et al. Arch Intern Med 2006)
- 373 CT examinations (in 365 patients with suspected acute aortic emergencies, with 23 dissections, 14 IMH, and 20 acute penetrating ulcers): 18% examinations positive, nearly 100% accurate (Hayter RG et al. Radiology 2006)
- Our protocol: 1 to 3 mm arterial-phase MDCT images of entire chest/abdomen +/- pelvis
- My bias: no need for routine initial non-enhanced CT if interpreted by an experienced radiologist; IV contrast should *not* obscure IMH - *and there is no conclusive data to contradict this to my knowledge*
- Single-phase acquisition reduces radiation dose (but could generate virtual C- images with DECT, if obtained and available)

Aortic Dissection

- Determine false lumen (FL) versus true lumen (TL), especially if planning interventions (stent, fenestration, etc.)
- CT finding most reliable for TL is direct continuity with unaffected portion of aorta; also calcification lining the lumen
- Finding most reliable for FL is the "beak sign" (acute angles with wall/flap) and then larger size (LePage MA et al. AJR 2001)
- Occasionally identify "cobwebs" in FL, or complete wrap of FL around TL/multiple flaps (with TL in center; bad prognostic indicator (Sueyoshi E et al. Radiology 2013))
- "Intimomedial rupture" – flap opens up from TL into FL (Kapoor V et al. AJR 2004)

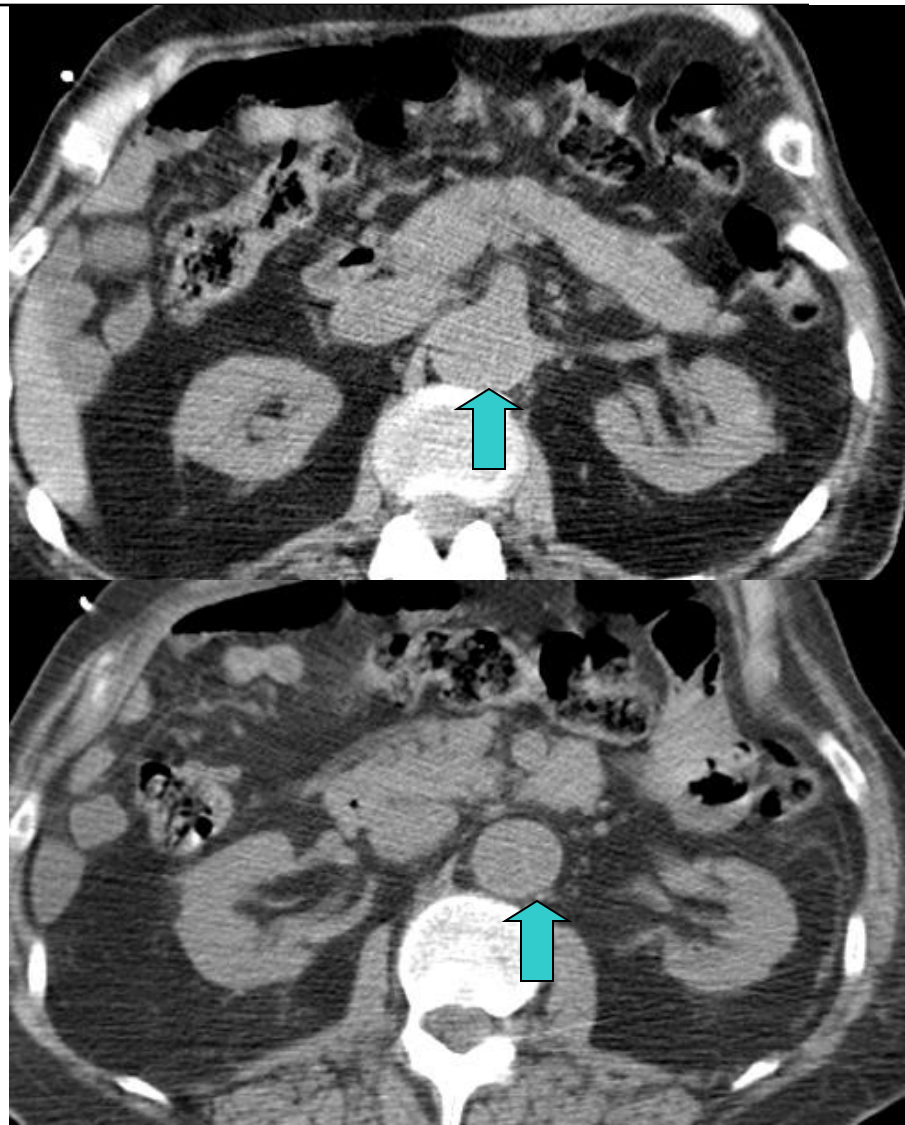
Aortic Dissection – Non-Enhanced CT

- 60-year-old woman with known chronic aortic dissection, & underlying autosomal dominant polycystic kidney disease with liver involvement
- Dissection flap is heavily calcified and is easily identified on non-enhanced CT



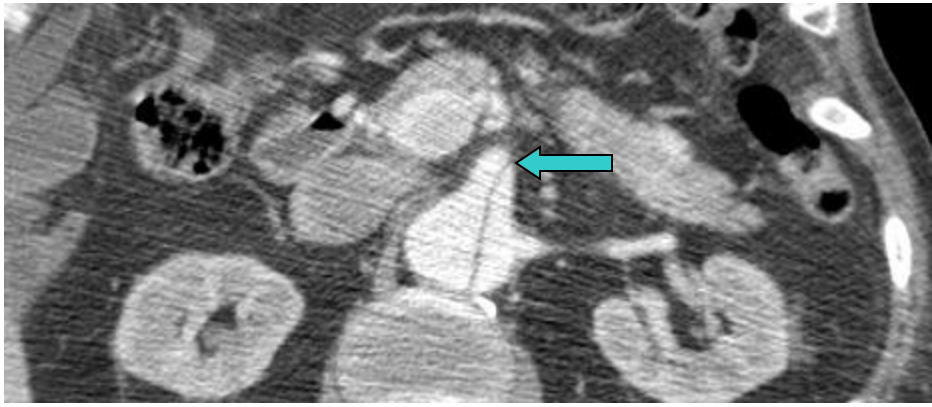
Aortic Dissection – Non-Enhanced Versus Enhanced CT

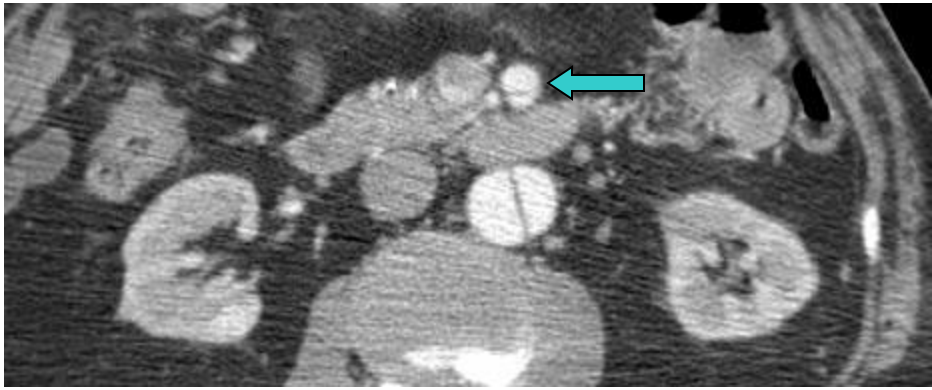
- 77-year-old man with known chronic type B dissection
- Dissection flap is subtle on initial non-enhanced CT
- Generally, IV contrast-enhanced images are needed for accurate diagnosis or exclusion of aortic dissection

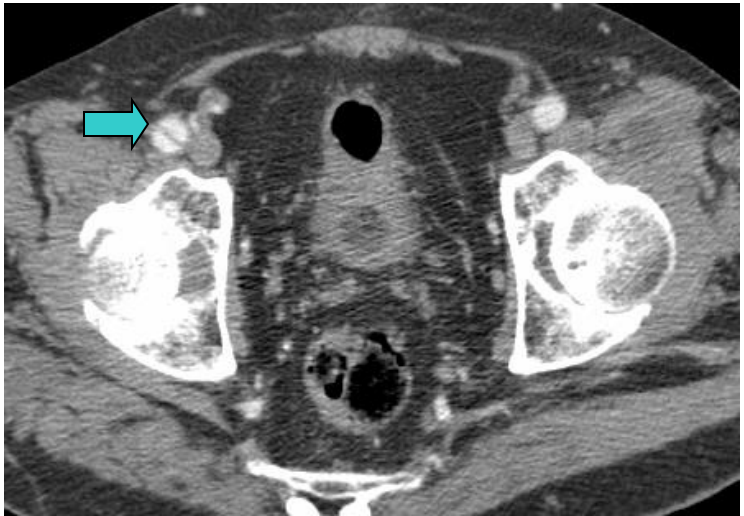


Aortic Dissection – Non-Enhanced Versus Enhanced CT

- Dissection flap is readily seen with IV contrast
- Extends into superior mesenteric artery and right common femoral artery

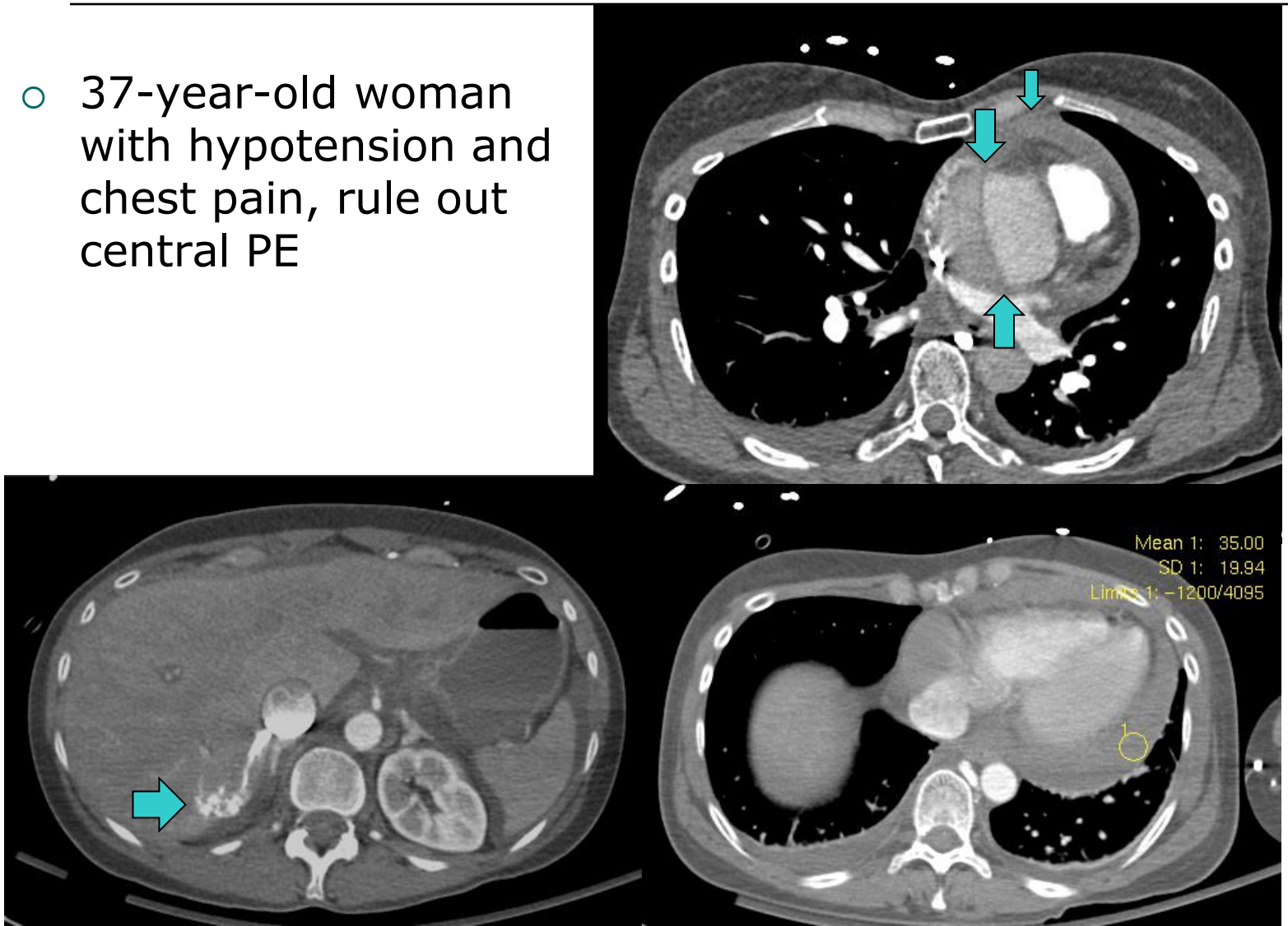






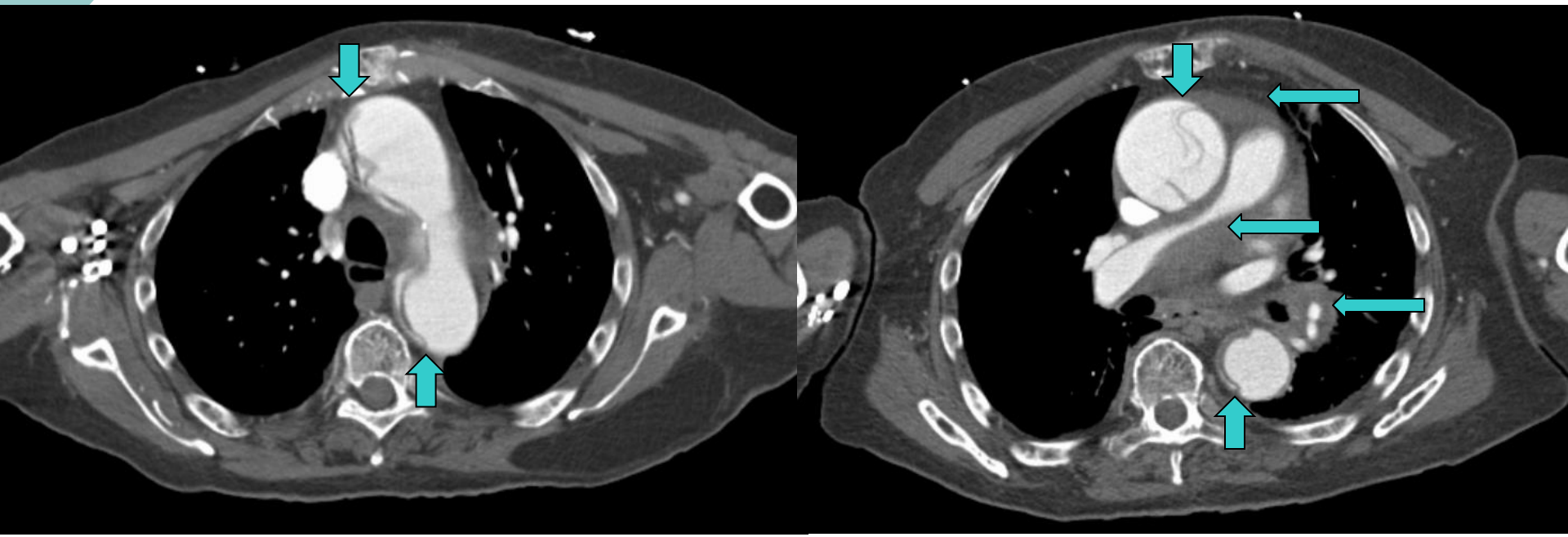
Type A Aortic Dissection with Hemopericardium & Right Heart Failure

- 37-year-old woman with hypotension and chest pain, rule out central PE



Type A Dissection with Rupture into Pericardium/Pulmonary Arterial Interstitium

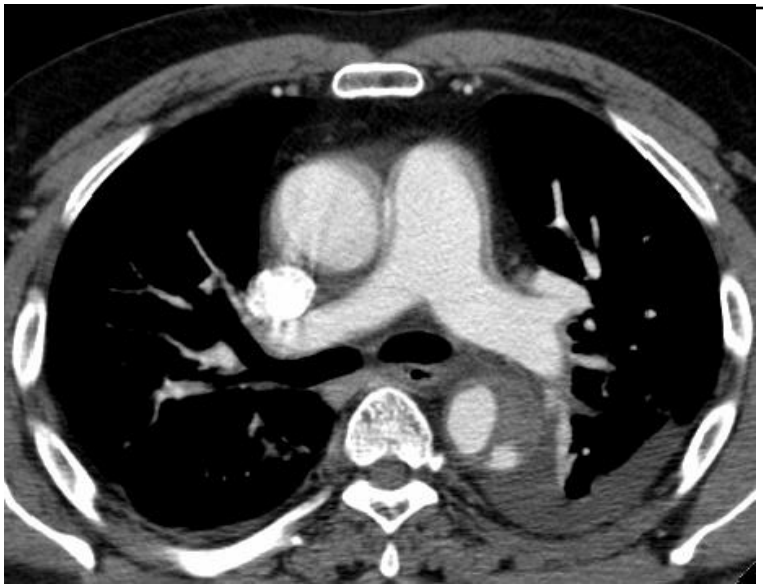
- 90-year-old man with acute chest pain and numbness in the right leg
- **Note hemorrhage around central pulmonary arteries**

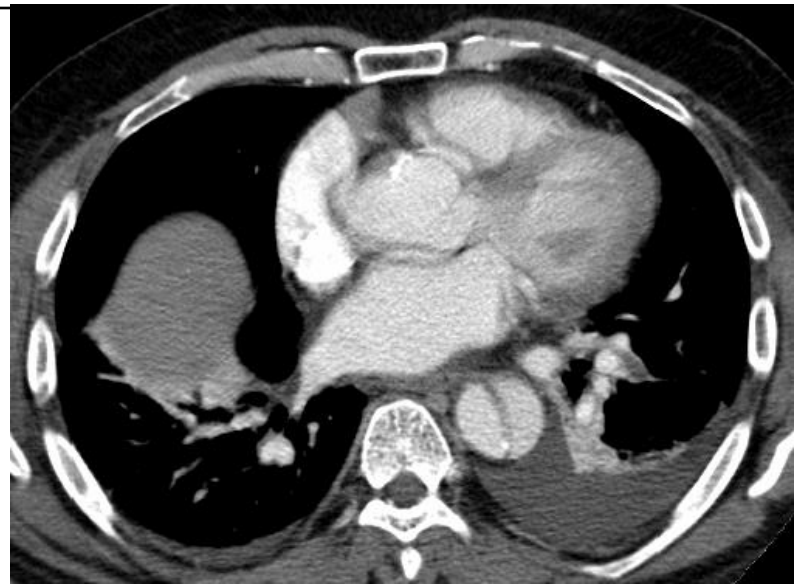


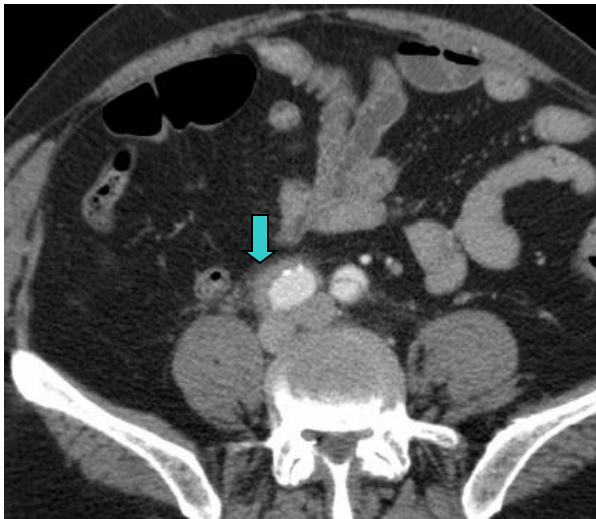
Type B Aortic Dissection

- 78-year-old woman with acute chest and back pain
- CT shows type B dissection with mild aortic dilatation

Type B Aortic Dissection

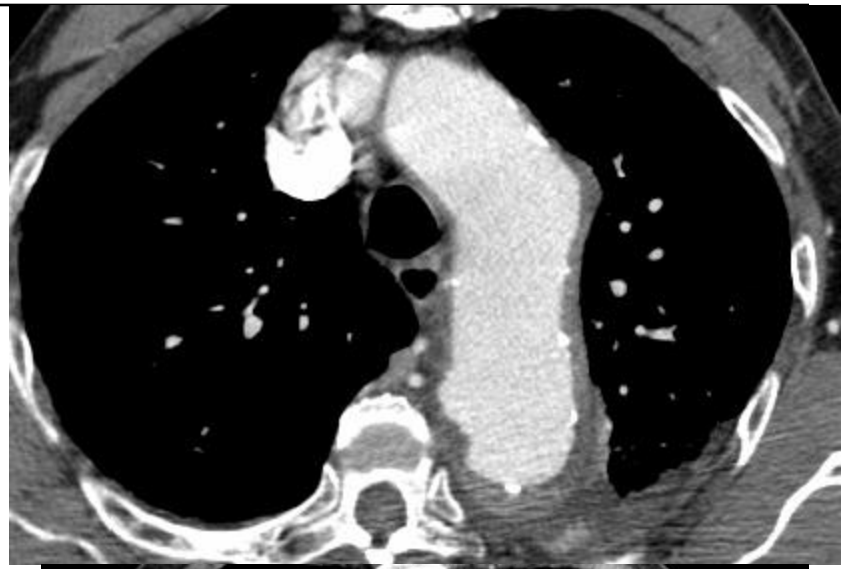


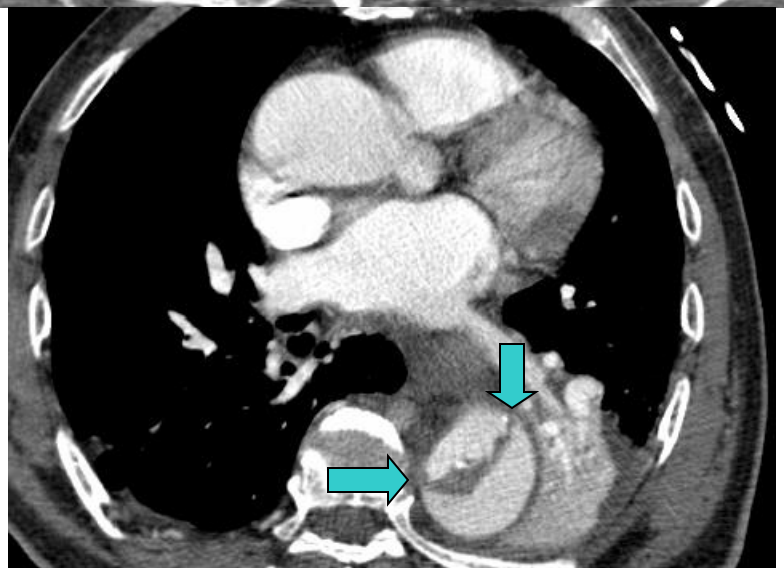




Type B Aortic Dissection

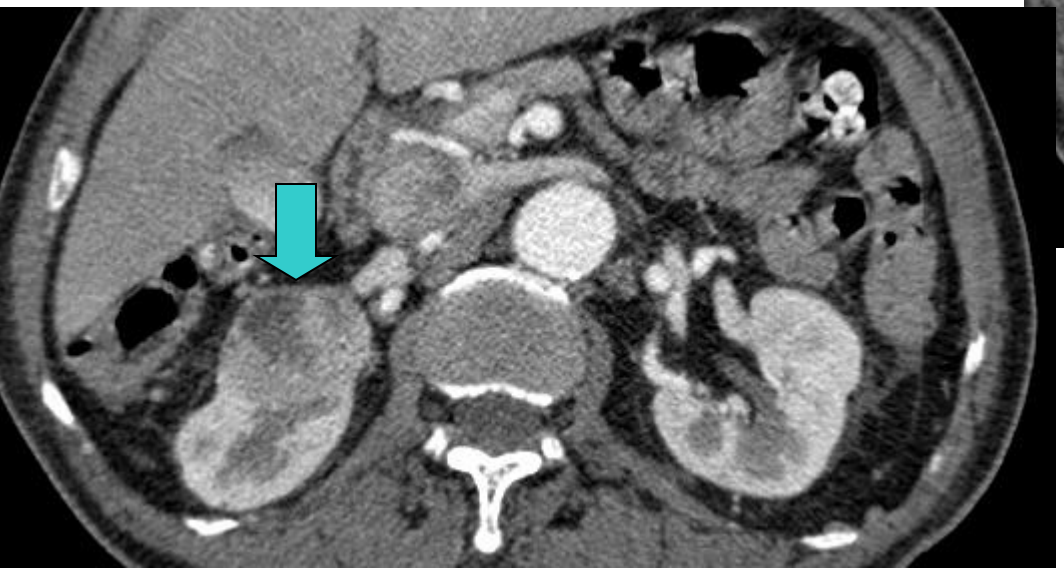
- 82-year-old man with acute type B dissection
- History of AAA repair, & residual lower thoracic/upper abdominal aneurysm
- True lumen is anterior – note calcification, typical “beak sign”, and larger size of false lumen





Type B Aortic Dissection

- (Continued)
- Dissection ends in upper abdomen
- Incidental right renal cell carcinoma



Aortic Intramural Hematoma (IMH)

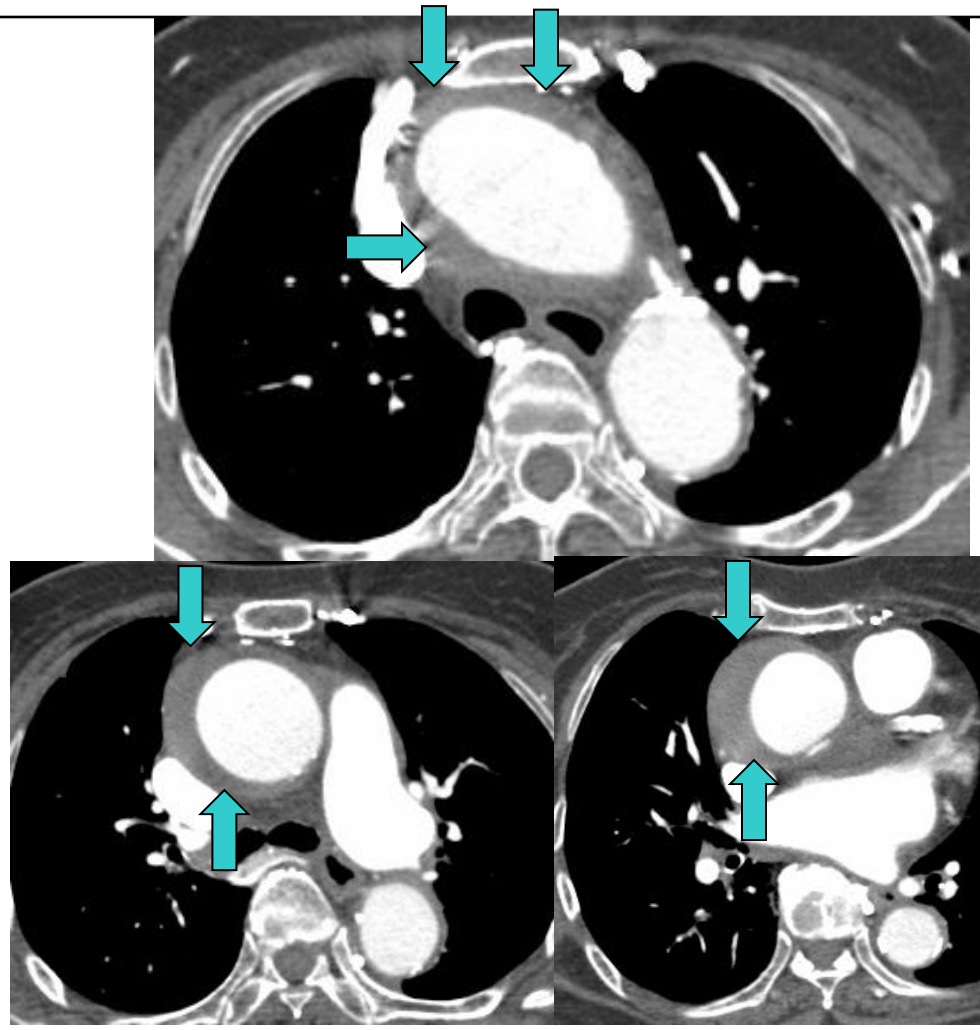
- IMH: A common variant of dissection, which may evolve into a frank dissection &/or aneurysm over time
- No identifiable communication with the aortic lumen on imaging studies
- Believed to be due to spontaneous rupture of the vasa vasorum with subintimal hemorrhage – or may be related to a "penetrating aortic ulcer (PAU)"
- Can then rupture into lumen, producing frank dissection (as opposed to classical initial intimal tear, which then dissects into the media)
- *Similar clinical presentation to dissection, much overlap of these scenarios – a spectrum of disease*

Aortic Intramural Hematoma

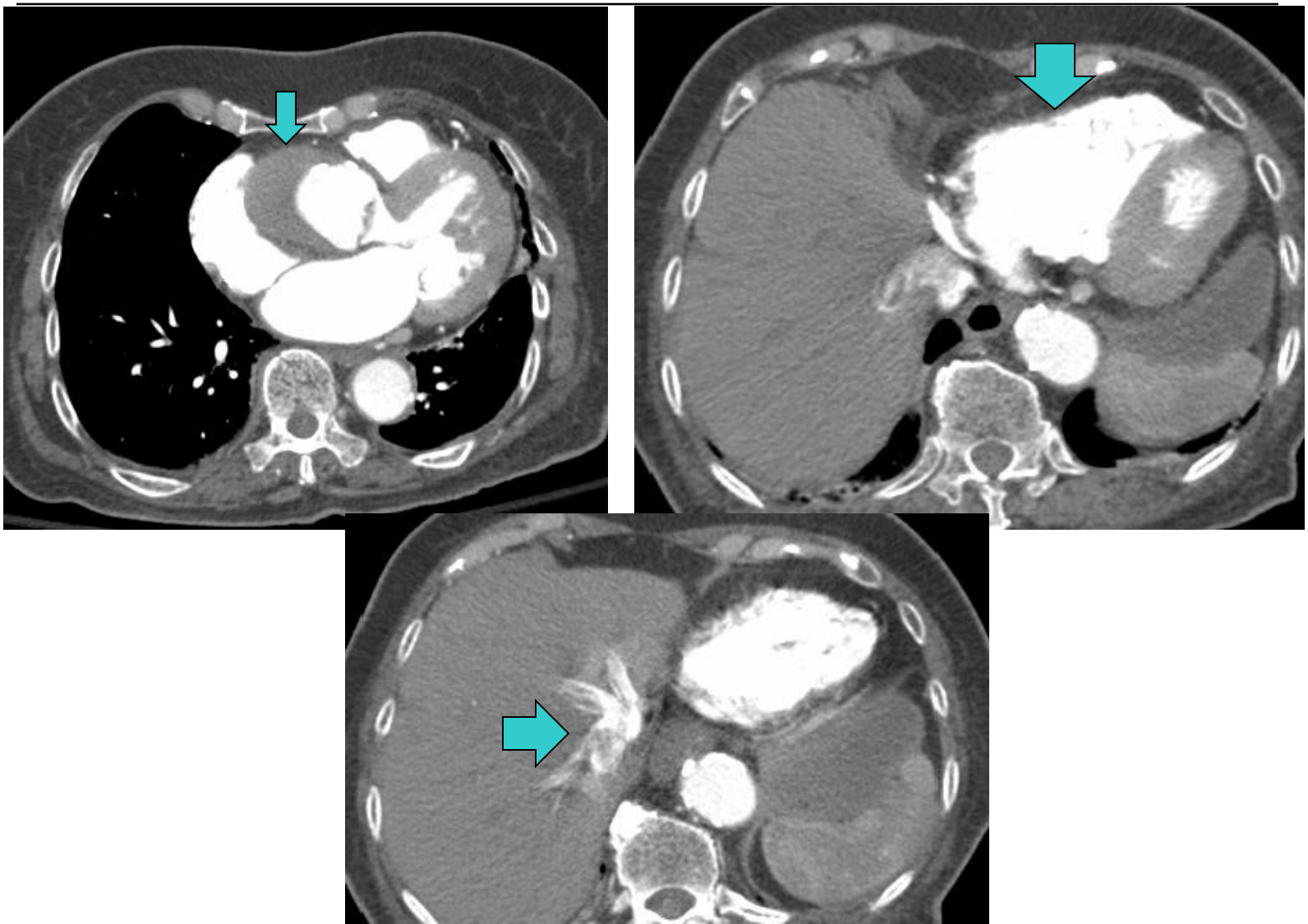
- Some differences – e.g. IMH in slightly older males, & tends to spare the infrarenal aorta (Ganaha F et al. Circulation 2002; Srichai MB et al. Ann Thorac Surg 2004)
- C- CT: crescent of high attenuation in aortic wall; displacement of intimal calcification (vs. chronic plaque with medial calcification)
- C+ CT: no flap, no enhancement of area with hematoma (c/w C- CT, if performed)
- Sometimes difficult to determine if slow flow in false lumen vs. IMH on CT, but should not change management
- **There is again often associated acute aortic dilatation and/or increased aortic size subacutely**

Type A Aortic Intramural Hematoma

- 83-year-old woman with chest pain and hypertension
- CTA - enlarged ascending aorta with type A intramural hematoma
- Also left ventricular hypertrophy; reflux into IVC & hepatic veins, representing right heart failure

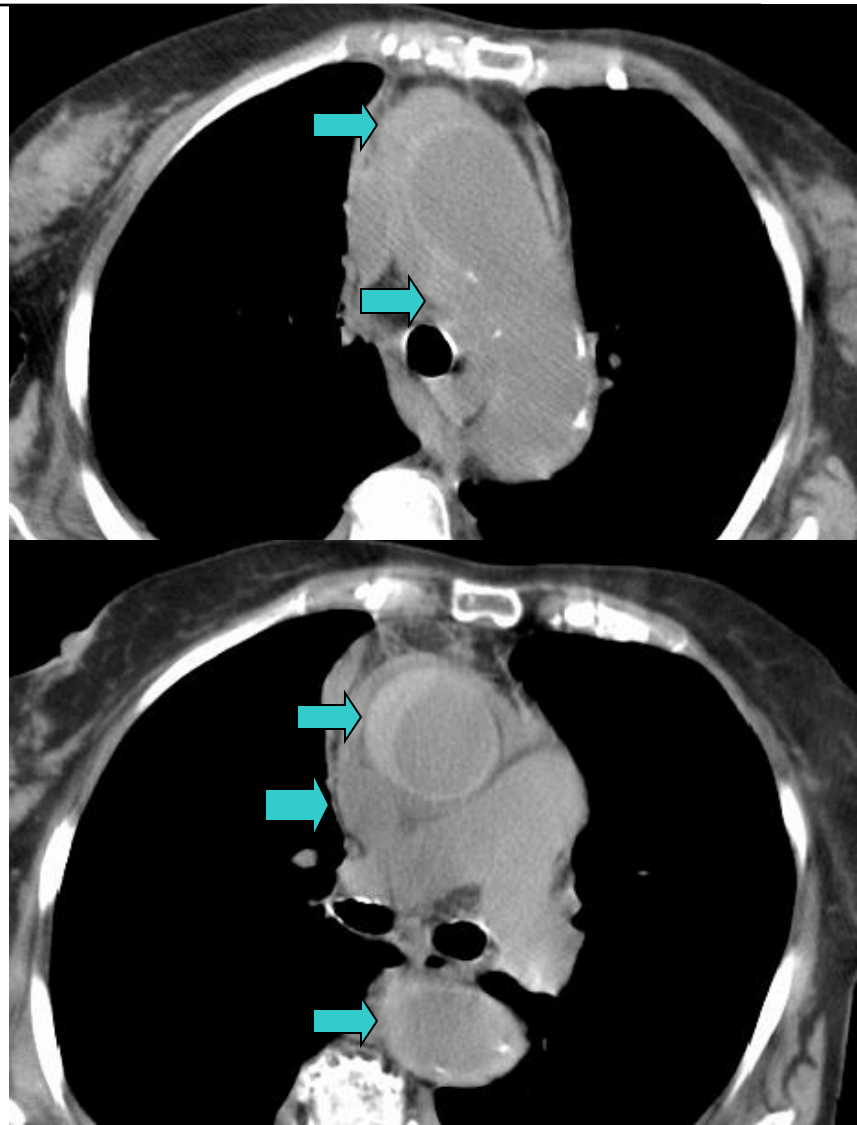


Type A Aortic Intramural Hematoma



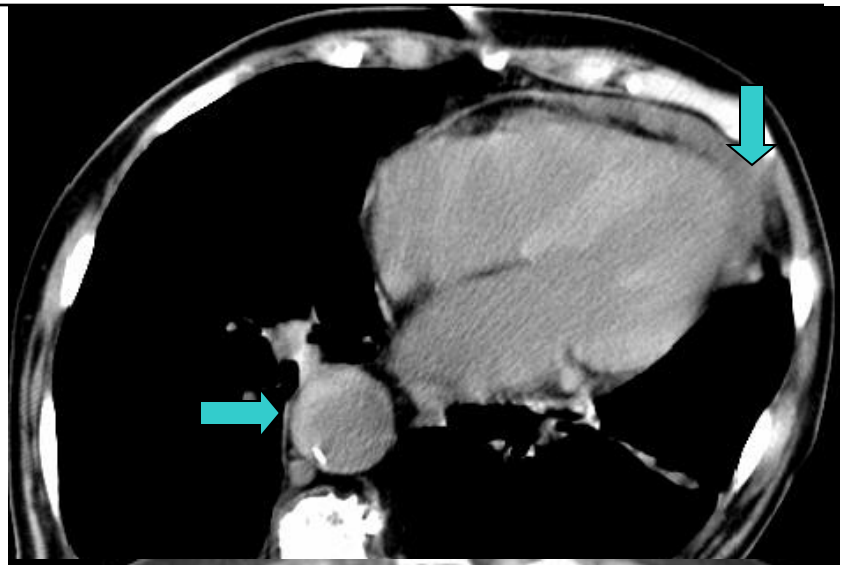
Type A Aortic Intramural Hematoma

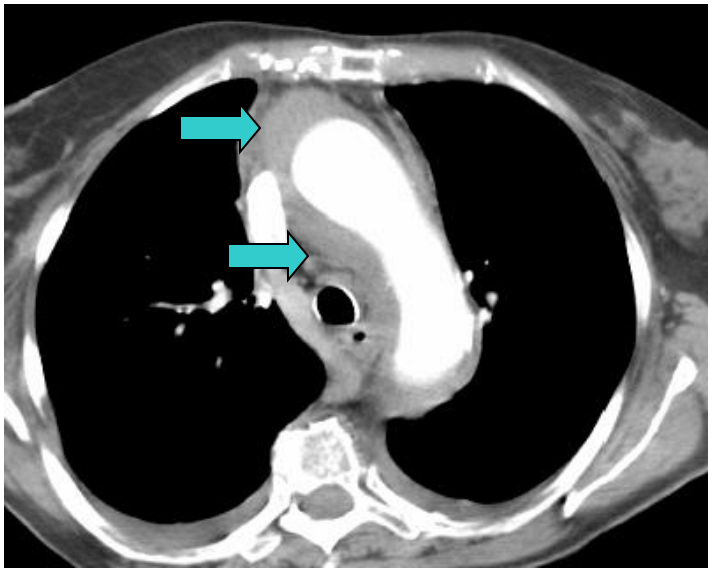
- 85-year-old woman with new mediastinal widening on CXR
- Initial non-enhanced followed by enhanced CT
- Type A IMH is clearly present on both C- and C+ CT images



Type A Aortic Intramural Hematoma

- Note left ventricular hypertrophy
- Pericardial effusion measured water attenuation





Penetrating Aortic Ulcer

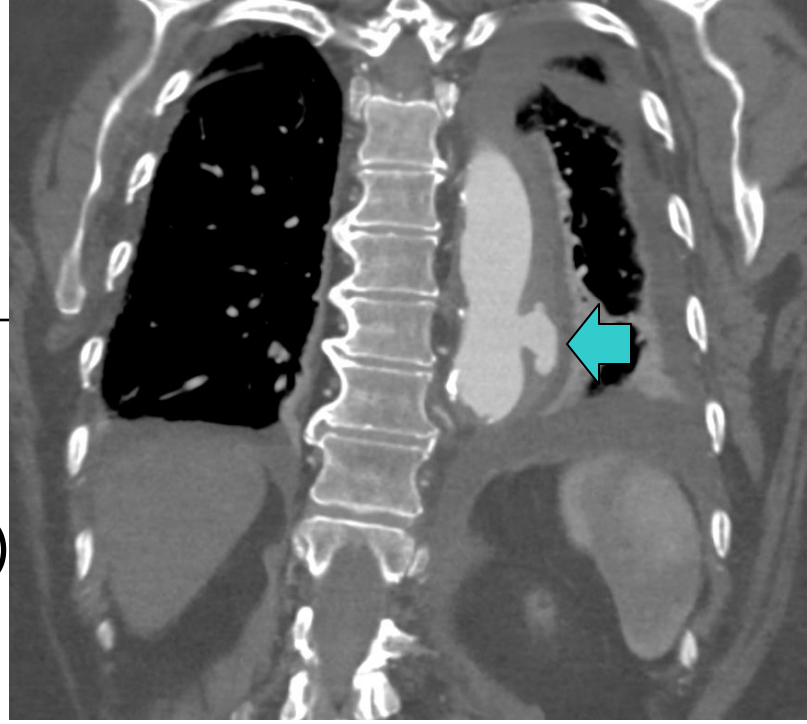
- Atherosclerotic lesion with ulceration that penetrates the internal elastic lamina
- Classically in mid to distal descending thoracic aorta
- Confusing literature, terminology, and non-standardized criteria for penetrating aortic ulcer – e.g., extent of wall involvement – beyond the intima vs. beyond entire wall
- Believed to be the cause of IM hematoma, when identified in association with it on imaging studies
- Some controversy regarding course, exact association with IMH/dissection, prognosis, and treatment
- One large series – in descending thoracic aorta in 61%, 4% presented acutely, 13% underwent repair (Nathan DP et al. J Vasc Surg 2012)

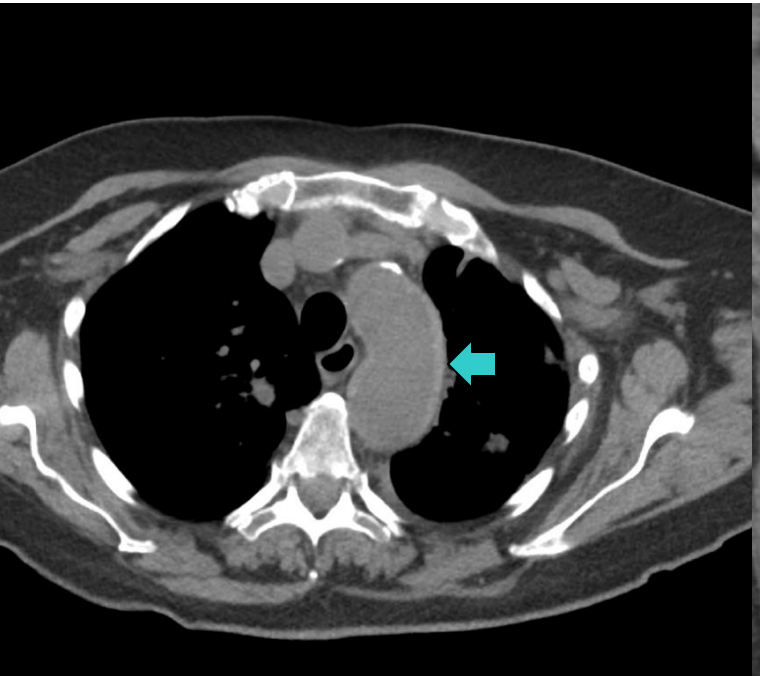
Penetrating Aortic Ulcer

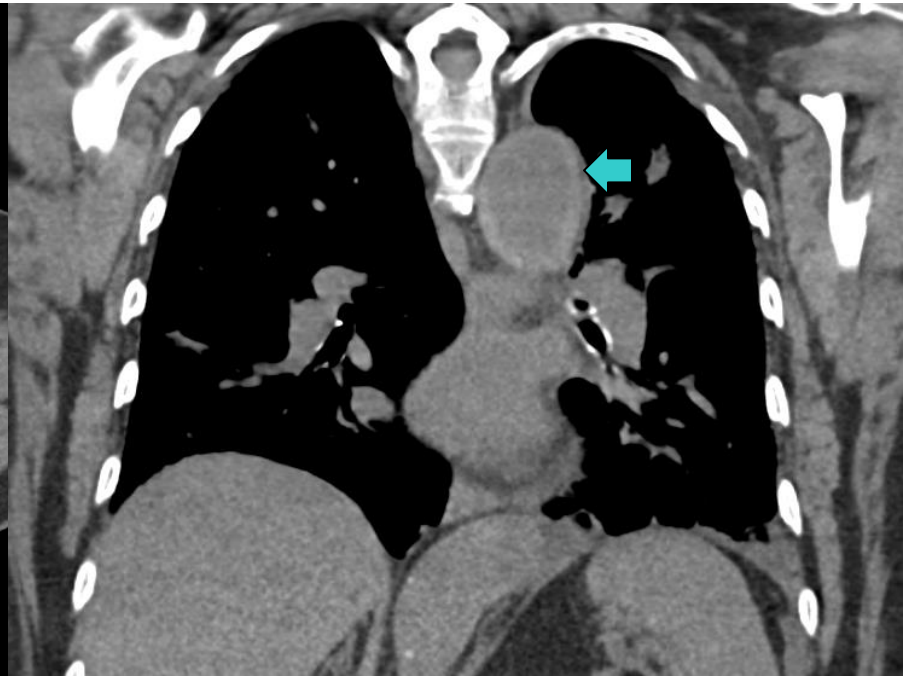
- PAU appears to be a more serious disorder when associated with IMH c/w IMH without PAU (Ganaha F et al. Circulation 2002; Cho KR et al. J Thorac Cardiovasc Surg 2004; Jeudy J et al. Radiol Clin North Am 2006)
- However, most "ulcer-like" lesions identified on CT are asymptomatic, are not associated with IMH, and do not enlarge over time
- Few PAUs are surgically proven to be truly "penetrating" (Quint LE et al. Radiology 2001; Kazerooni EA et al. Radiology 1992)
- Some PAUs appear during follow-up CT of IMH, some progress to aneurysm, and some disappear (Sueyoshi E et al. Radiology 2002)

PAU with type B IMH

- 80-y.o. woman
- Chest & abdominal pain
- (Metastatic lip CA to lungs)
- Initial non-contrast CT
- Follow-up CTA





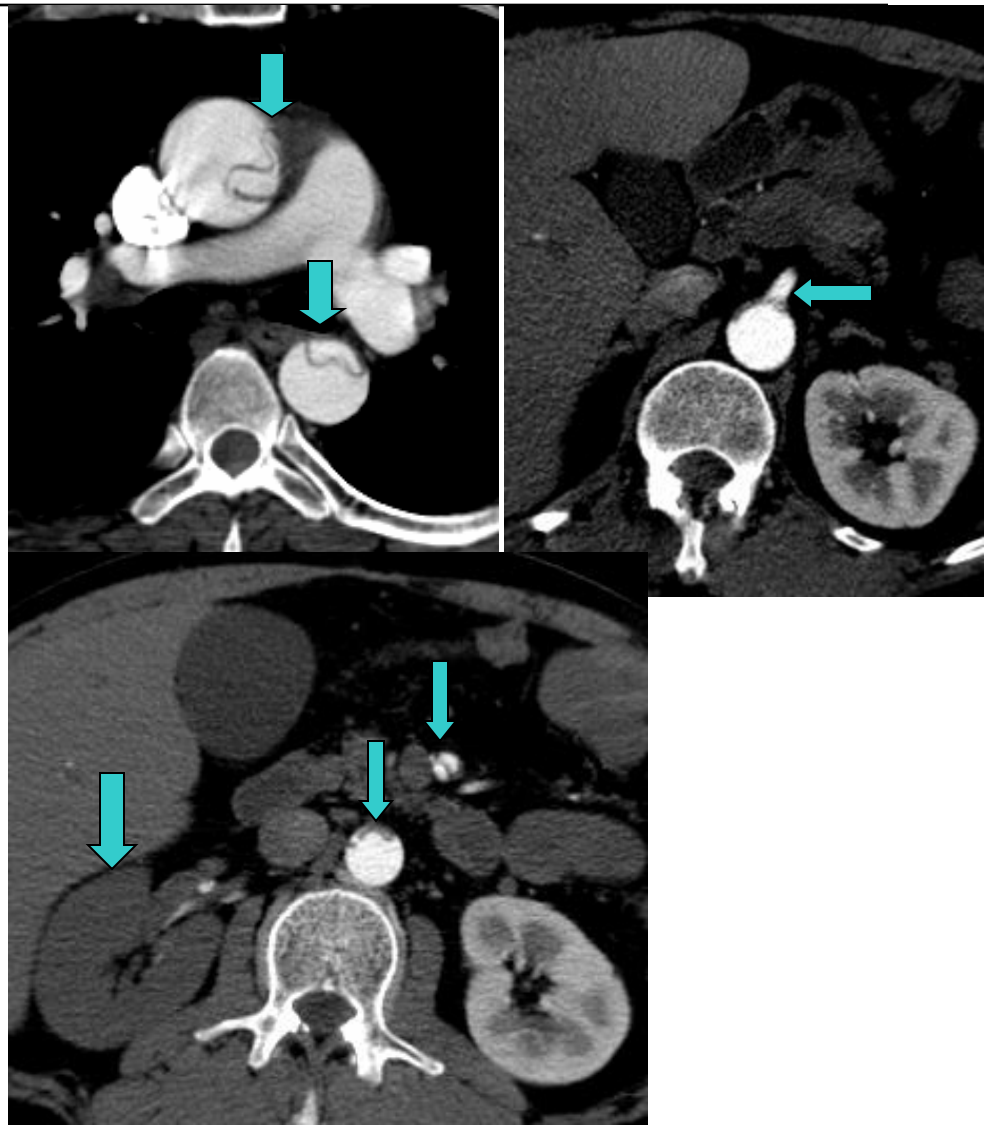


Aortic Dissection - Complications

- Complications of aortic dissection/IMH:
- - aneurysm/pseudoaneurysm formation
- - pericardial (& mediastinal/pulmonary arterial interstitium) hematoma with tamponade/shock
- - coronary arterial or arch branch vessel compromise (and MI or stroke)
- - aortic rupture into left pleural space
- - compromise of abdominal aortic branch vessels (and renal or bowel ischemia/infarction)
- - iliac arterial compromise
- - spinal paralysis
- - aortic rupture into abdomen

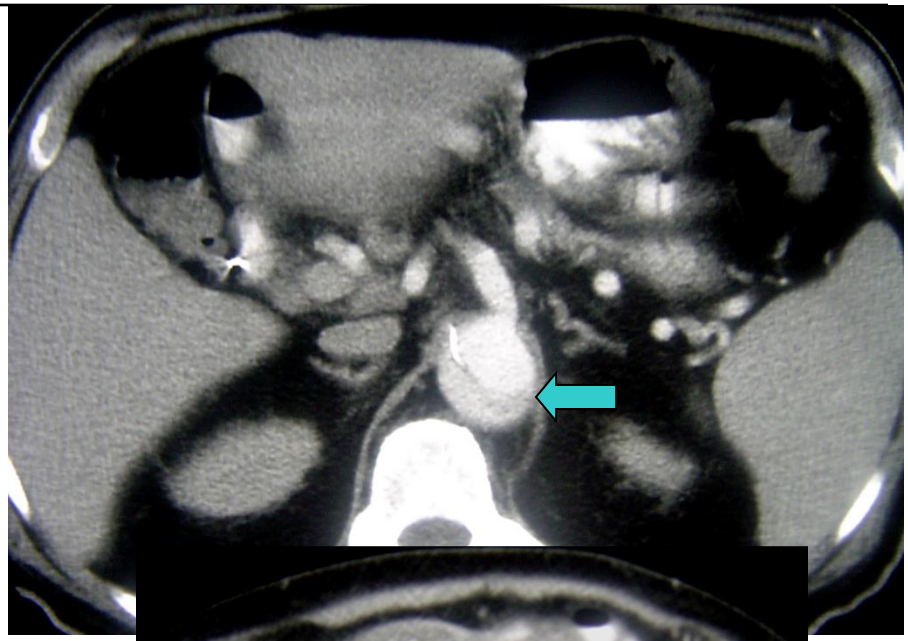
Aortic Dissection - Complications

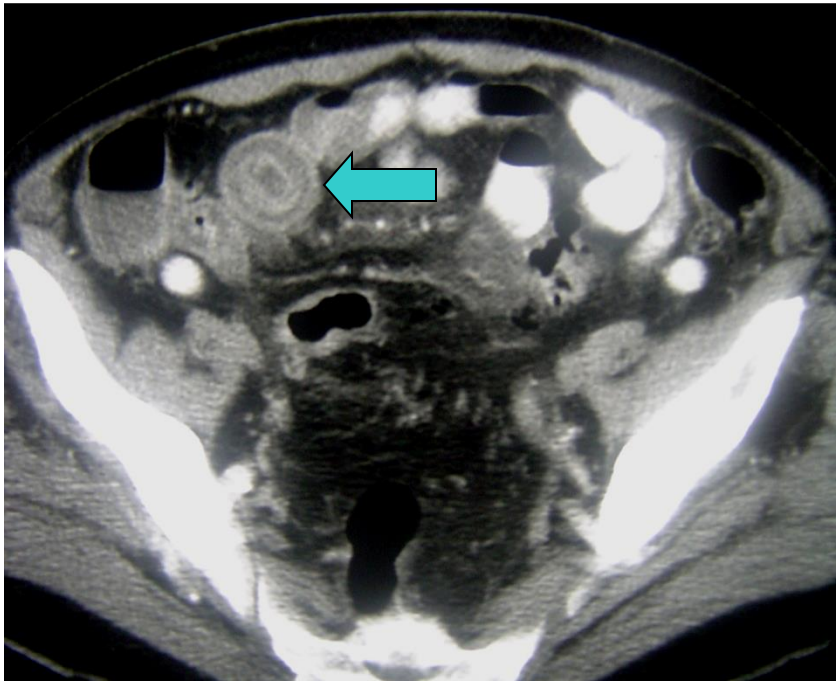
- 42-year-old man with type A dissection
- Dissection flap continues into abdomen; small true lumen supplies right renal artery
- Extension of flap into superior mesenteric artery
- Right kidney is globally poorly perfused

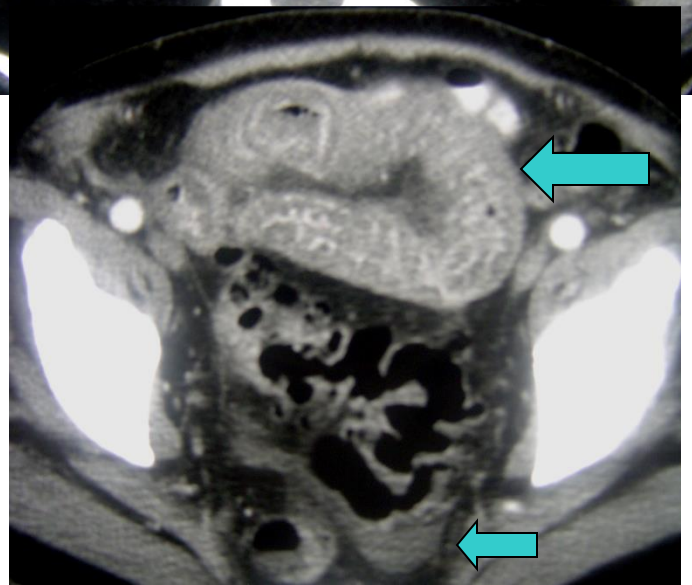


Aortic Dissection - Complications

- 80-year-old man with ischemic small bowel secondary to type B dissection





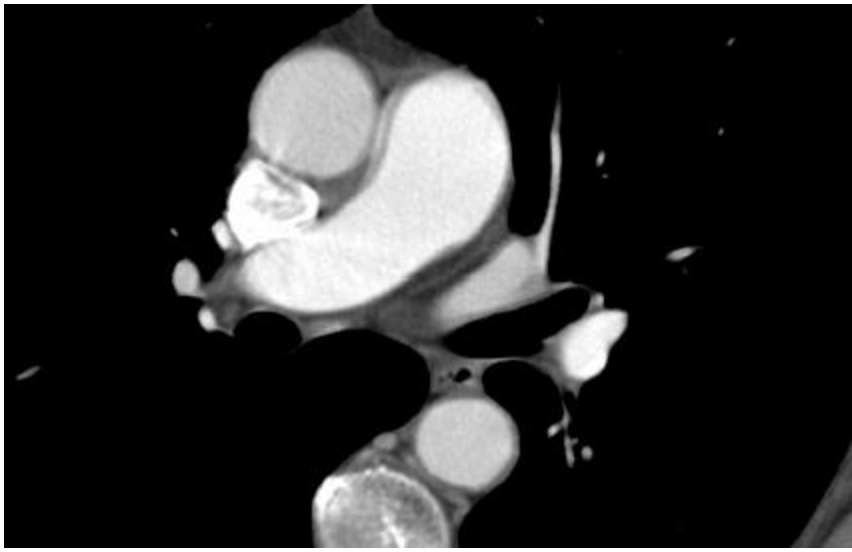


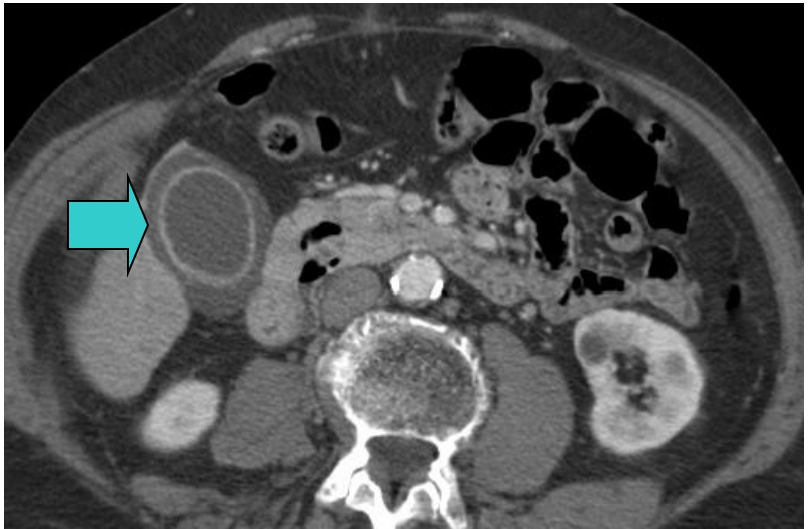
Alternative Diagnoses On CT

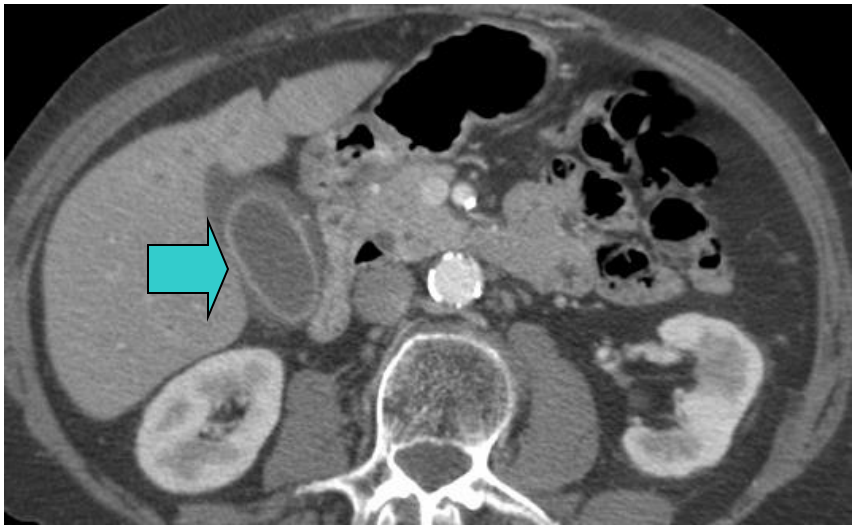
- MGH series: of 373 cases, 48 (13%) had a major alternative diagnosis (Hayter RG et al. Radiology 2006)
- - **Acute cholecystitis or other biliary conditions most commonly (12 cases, 3.2%)**
- - Series included new diagnoses of lung cancer, perforated gastric ulcer, pancreatic cancer, SMA embolus, and mesenteric ischemia
- Do look for PE, although optimized for aorta
- 30% of patients subsequently found to have dissection are initially believed to have another diagnosis (Nienaber CA et al. Circulation 2003)

Alternative Diagnoses On CT

- 72-year-old man with severe chest pain radiating to the back
- Acute cholecystitis is the diagnosis
- **We see this scenario over and over again**; need to scan to mid abd.







Mycotic Aneurysm

- "Mycotic" aortic aneurysm – term coined by Sir William Osler in 1885 – refers to mushroom-like shape of aneurysm, not fungal etiology
- Only 0.7 to 3.4% of all aortic aneurysms
- Now more commonly related to Staphyloccus than Salmonellae (Chan P et al. J Infect 1995); pre-existing conditions, e.g. diabetes, smoking, HTN are common
- Several potential causes: a) direct spread of infection/localized venous spread (e.g. vertebral osteomyelitis); b) septic emboli (endocarditis, IVDA); c) penetrating trauma with infection; d) cryptogenic

Mycotic Aneurysm

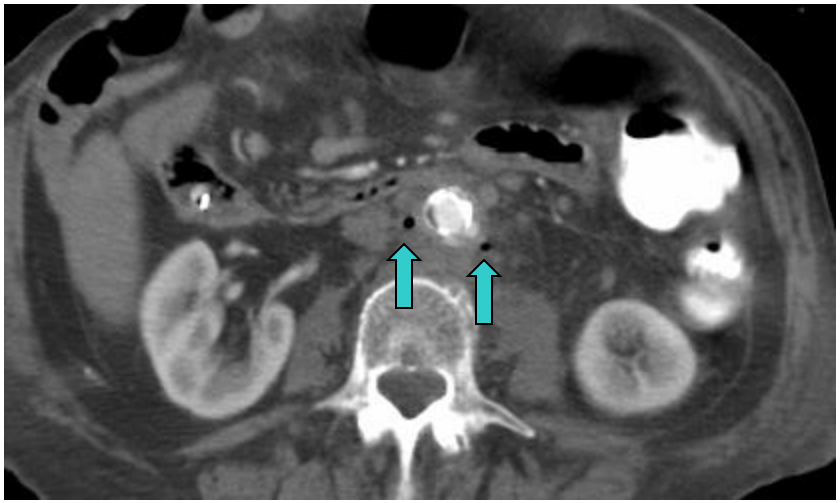
- Location is variable; still commonly infrarenal (super-infection of atherosclerosis) but can be anywhere along aorta
- Variable signs and symptoms – pain, fever, pulsatile mass, leukocytosis; *can be very non-specific*
- Treat with early surgery and antibiotics
- CT is test of choice, with high accuracy (Parellada JA et al. Abdom Imaging 1997; Lai CH et al. World J Surg 2012); ***particularly helpful if prior recent CT examination for comparison***; supplement with nuclear medicine (indium, gallium, PET scans)

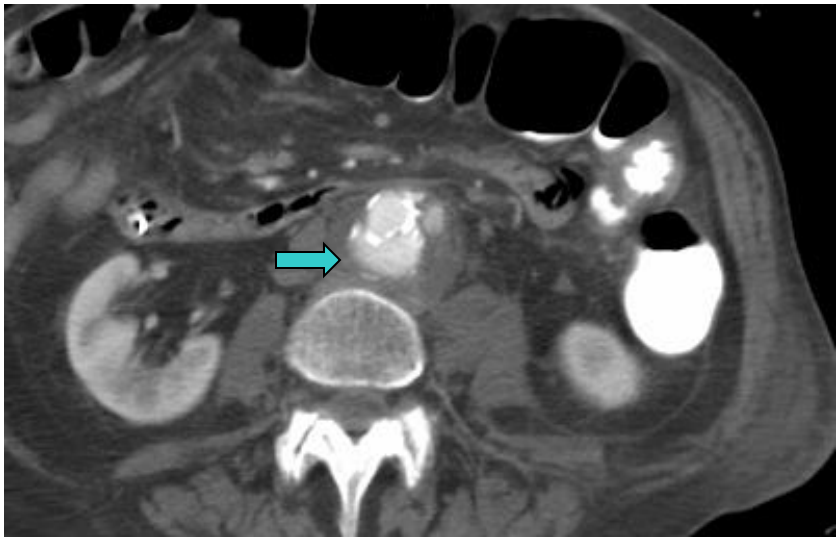
Mycotic Aneurysm

- Mayo Clinic series of 25 patients with CT diagnosis over 25 years (Macedo TA et al. Radiology 2004):
- mean diameter 5.4 cm (range 1-11)
- surrounding soft-tissue edema, fluid, or mass in ½
- only 10 were infrarenal; usually saccular/eccentric
- gas in or adjacent to aneurysm, rapid interval development, absence of wall calcification, and adjacent spinal findings c/w osteomyelitis are highly specific
- Similar findings in 2008 series of 21 patients (Lin MP et al. JCAT)

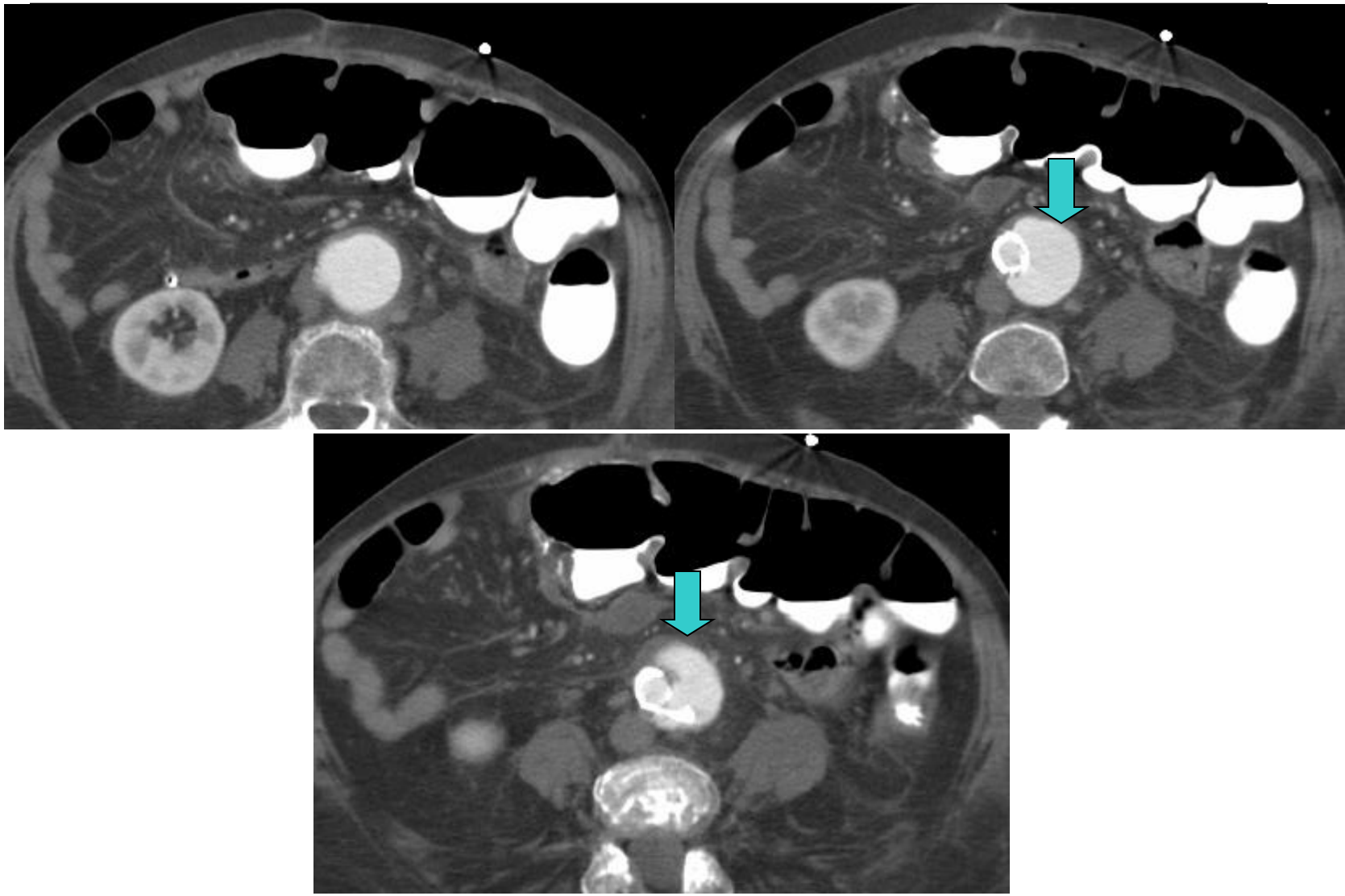
Mycotic Aneurysm

- 89-year-old woman with abdominal pain and fever
- Infrarenal aorta had markedly changed c/w outside recent prior CT
- Gas in and adjacent to aorta, with disruption of the calcified aorta in the craniocaudal dimension and expansion of the aortic lumen



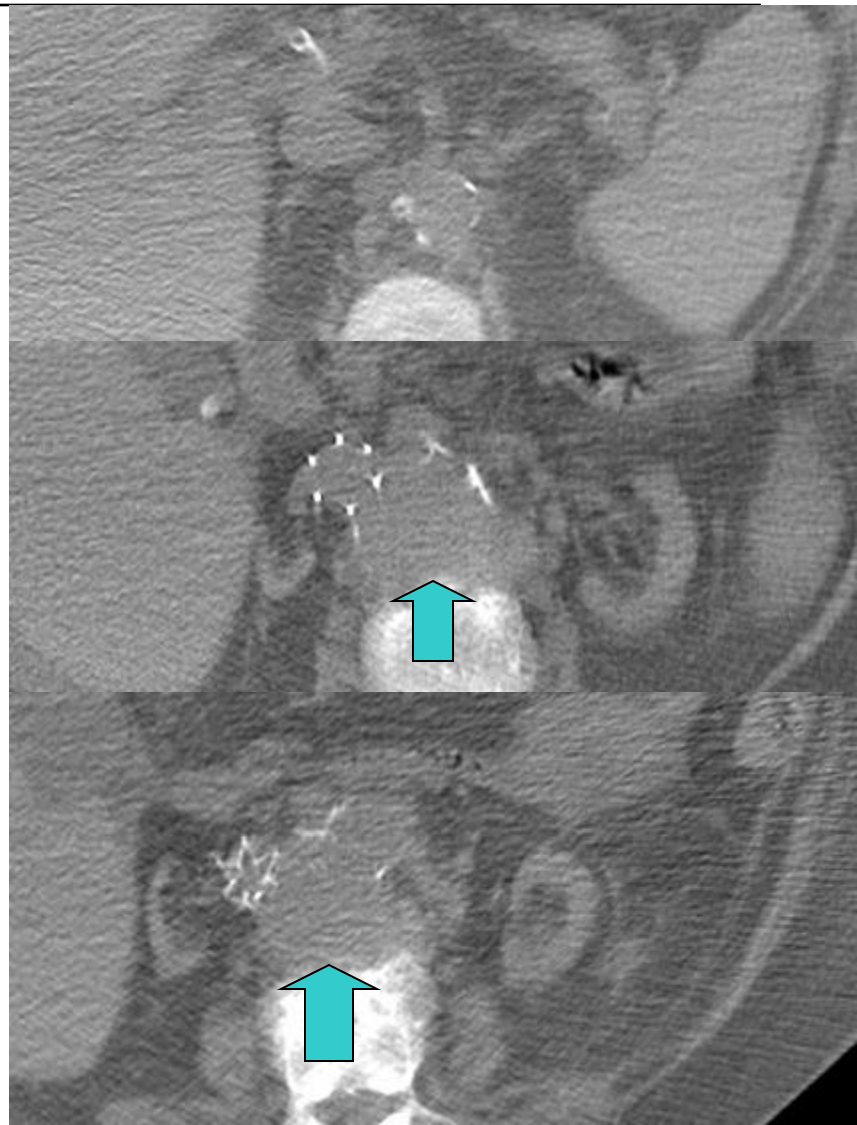


Mycotic Aneurysm



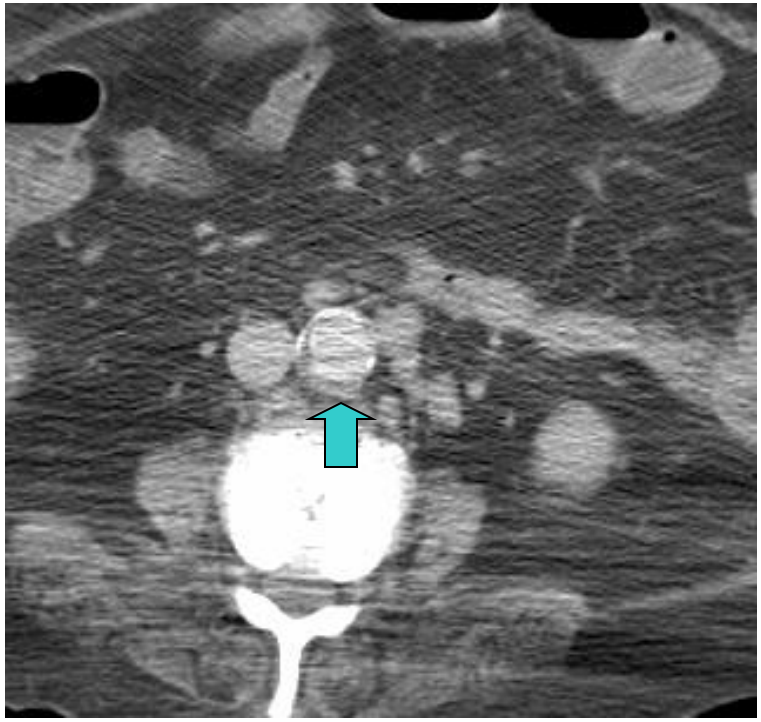
Mycotic Aneurysm

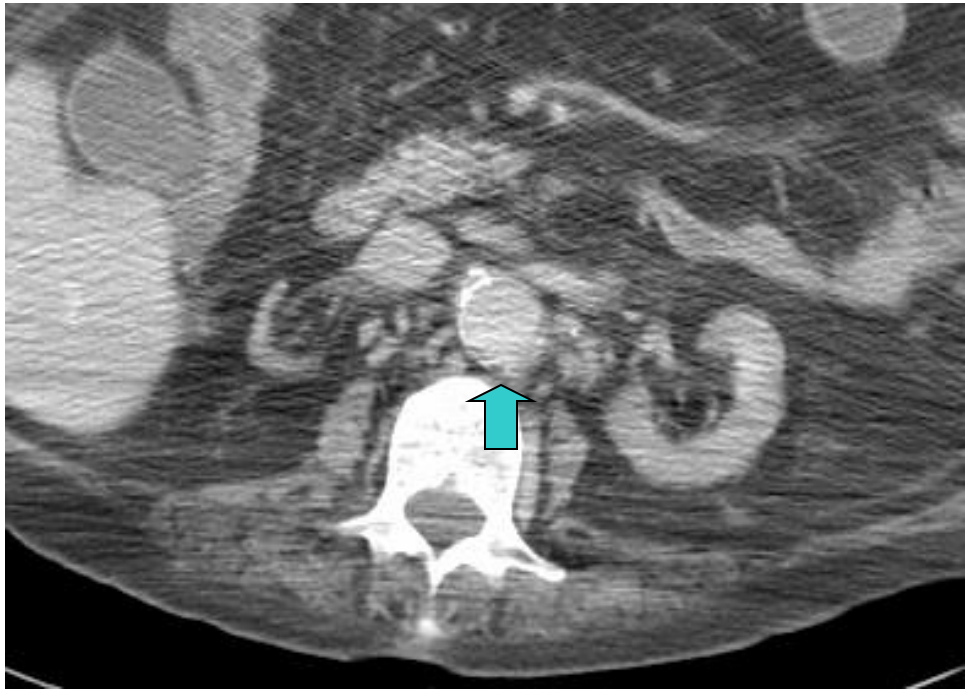
- 84-year-old woman with vomiting; CT without contrast due to renal insufficiency
- Compared with CT from 6 months ago - new 6 x 4.5 cm mycotic aneurysm
- Findings were not obvious on prospective review
- Note loss of posterior aortic wall calcification



Mycotic Aneurysm

- CT images from several months prior



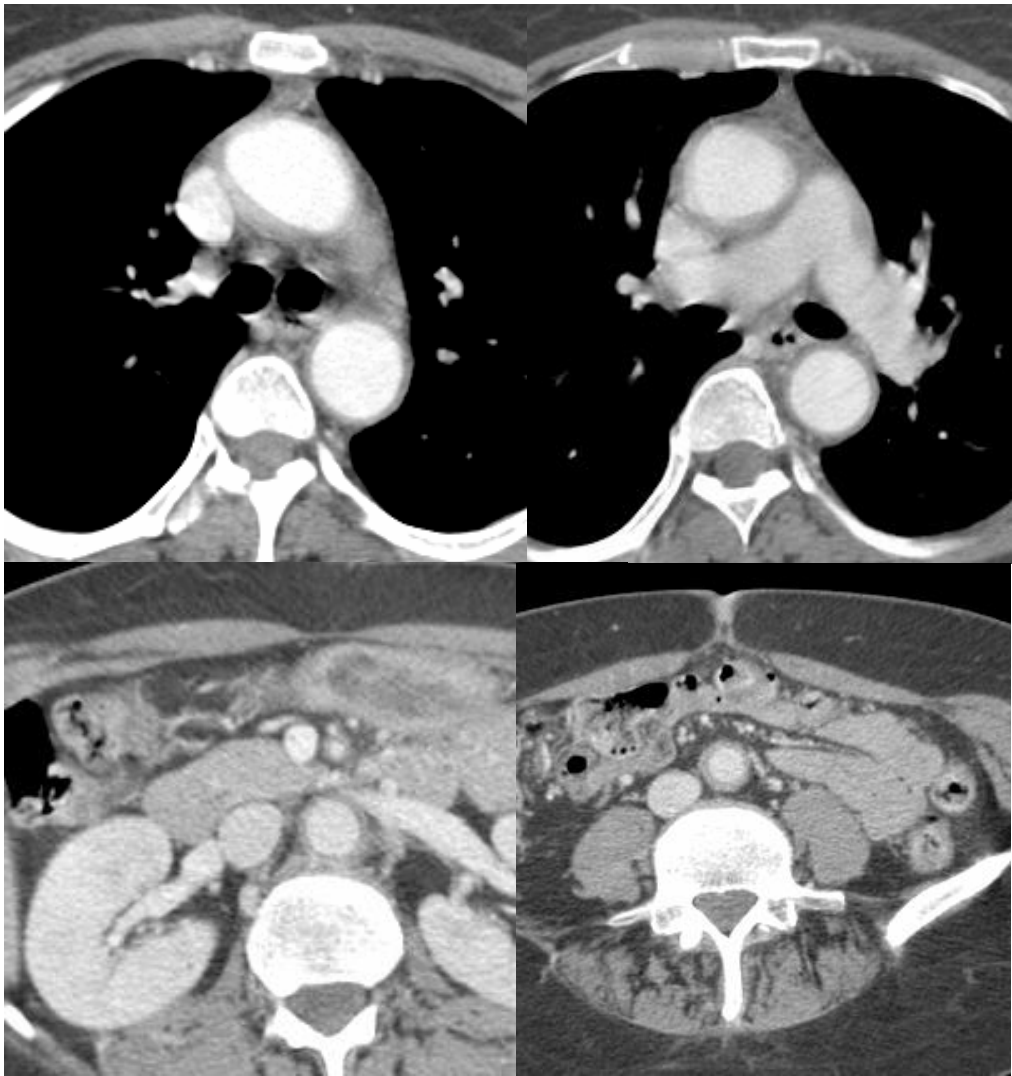


Aortitis

- Subacute disorder; usually young, often Asian, women; highly responsive to steroids; presentation often non-specific
- Prototype for aortitis is Takaysu arteritis, but also see with temporal arteritis and collagen vascular disease
- Perform C-/C+ CT images – but usually the diagnosis is not specifically suspected
- Do not confuse with IM hematoma on C+ - but the latter has a crescentic shape
- CT in early phase: diffuse thoracic aortic/branch thickening; enhancement esp. of outer ring; CT is highly accurate (Yamada I et al. Radiology 1998; Khandelwal N, et al. Eur J Radiol 2011; Zhu FP et al. Br J Radiol 2012)

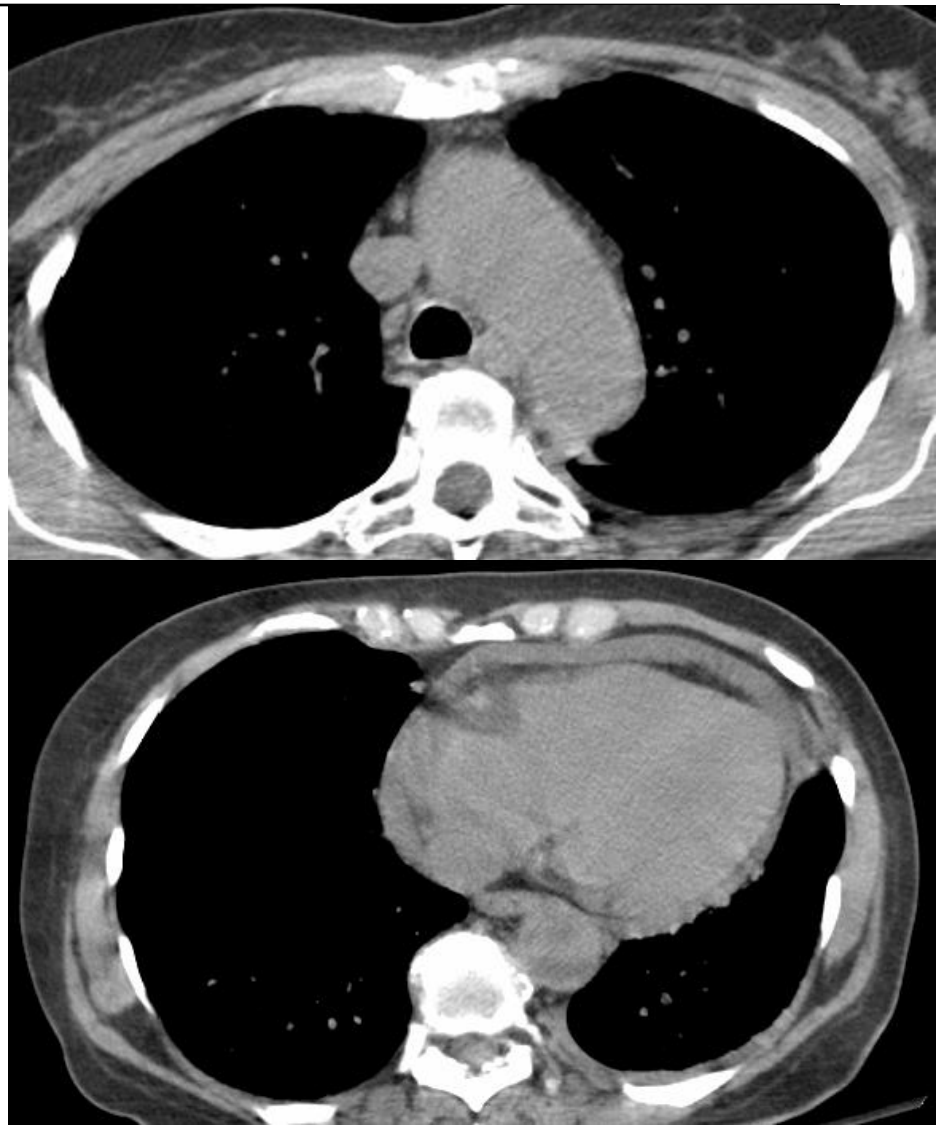
Aortitis

- 55-year-old woman with chest pain
- Smooth diffuse aortic wall thickening consistent with aortitis
- Absence of any aortic wall calcification supports the diagnosis, as opposed to atherosclerosis (although calcification may occur in later-stage aortitis)

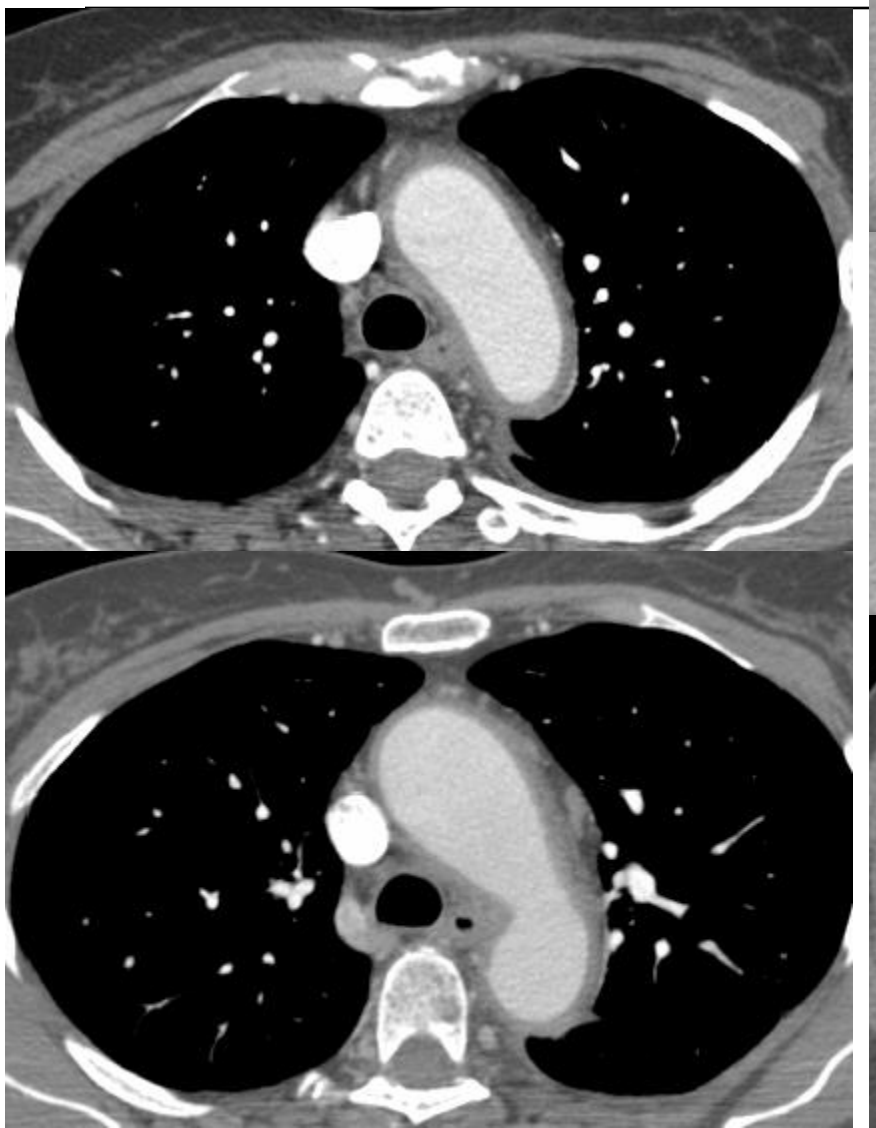


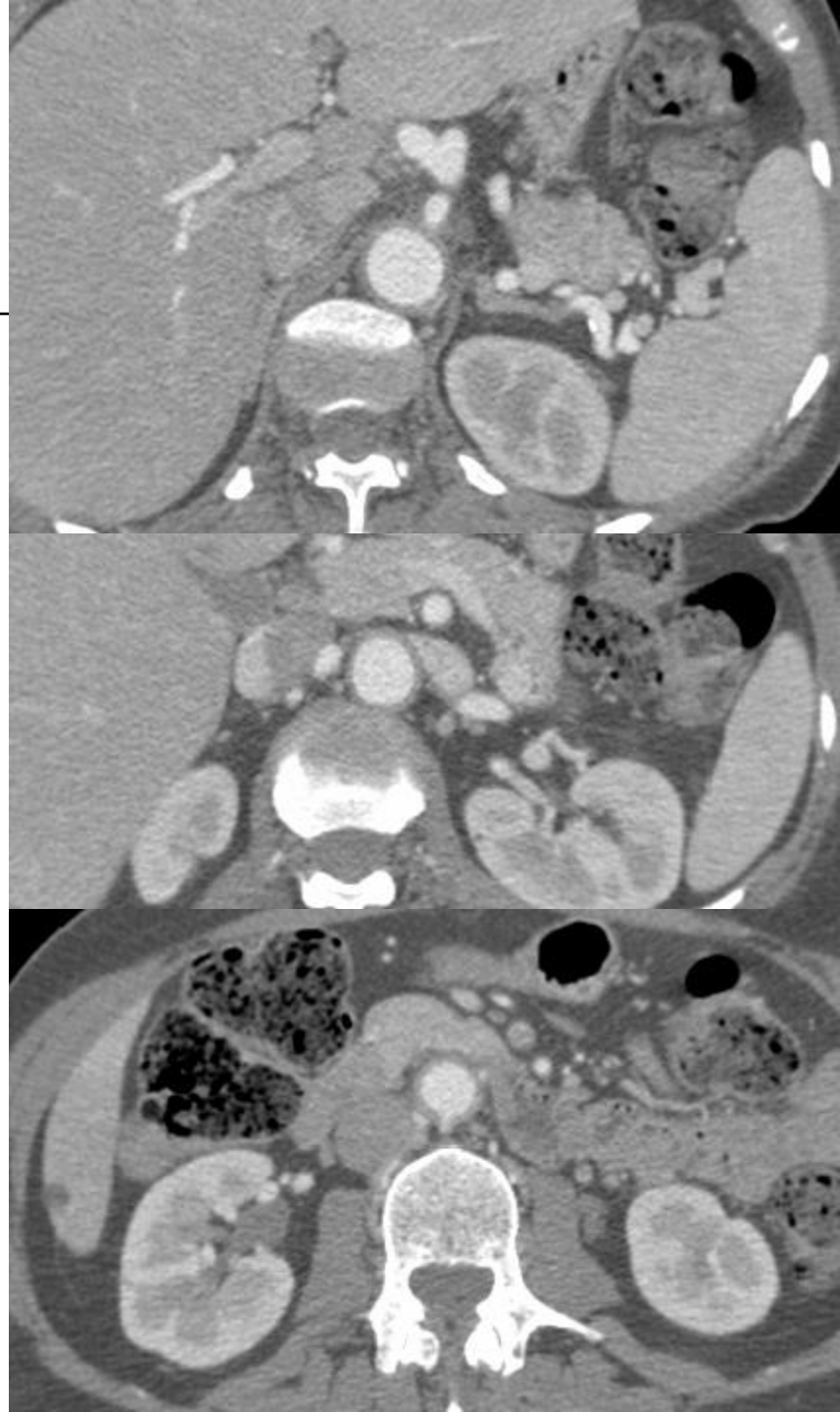
Aortitis

- 61-year-old woman with 4 months of fever, and an elevated ESR; normotensive, no chest or back pain
- C- CT shows pericardial & pleural effusions, mildly dilated aorta, & subtle aortic wall thickening (slightly hyperdense, but less than expected with IM hematoma, and is circumferential)
- C+ CT shows aortic wall thickening and enhancement



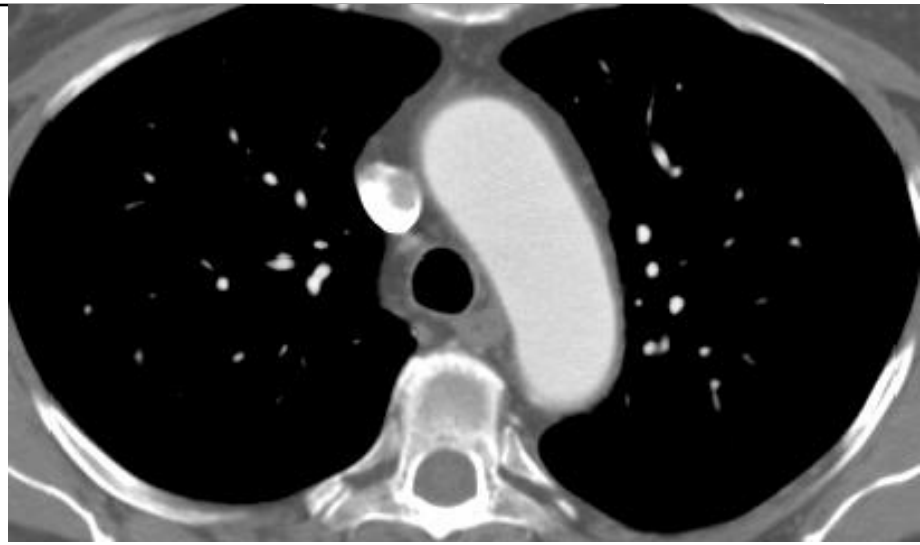
Aortitis

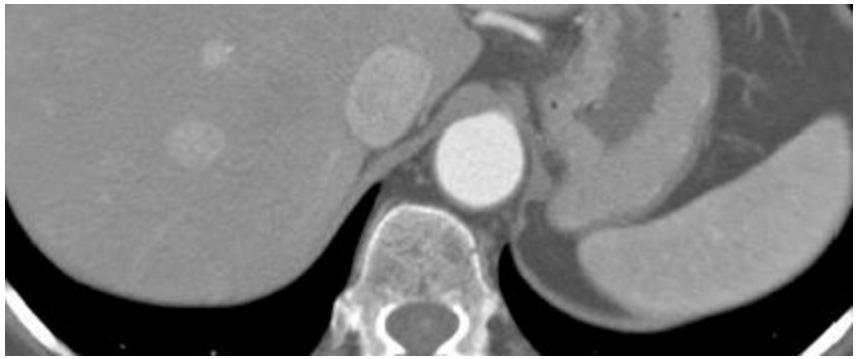


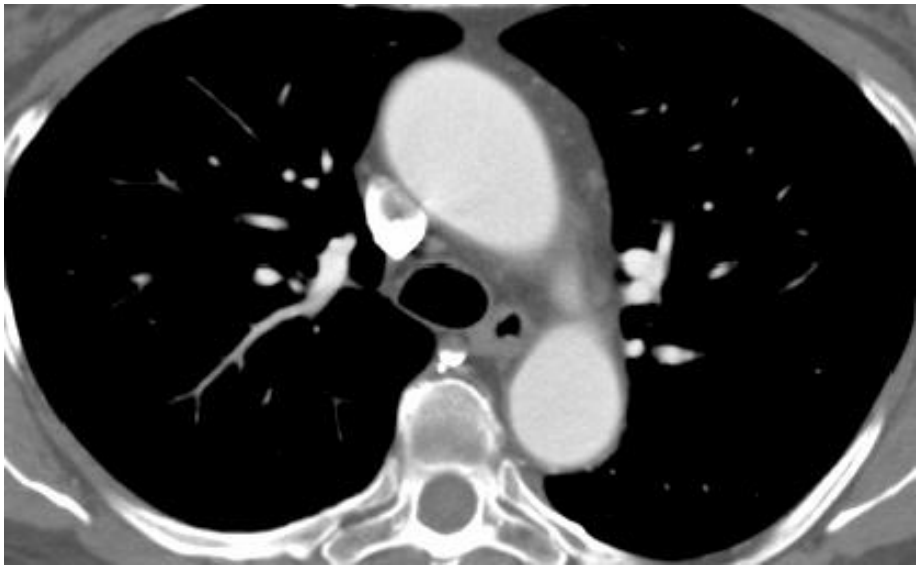


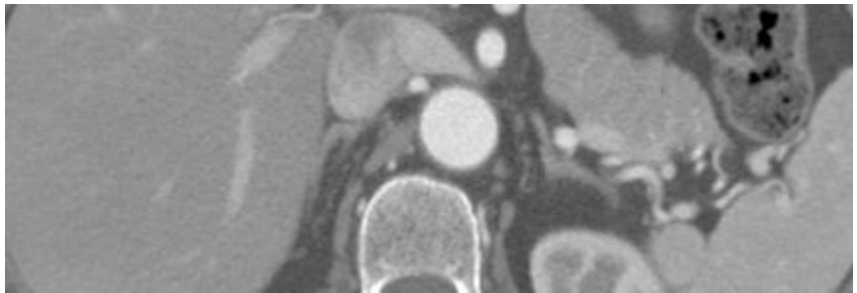
Aortitis

- Follow-up CT several weeks later, following steroid therapy
- Near-complete resolution









Graft Infection/Aortoenteric Fistula

- Expect residual changes within the first 2 months following aortic repair; difficult to diagnose infection based on CT alone
- Look for new hematoma, peri-aortic inflammatory changes, gas, or pseudoaneurysm (Low RN et al. Radiology 1990); supplement with nuclear medicine examinations and aspiration
- Aortoenteric fistula (AEF) is rare, almost always is associated with graft infection, is difficult to diagnose (even with serial/multiple imaging studies in some patients) and manage, and has a high mortality rate

Aortoenteric Fistula due to Aneurysm

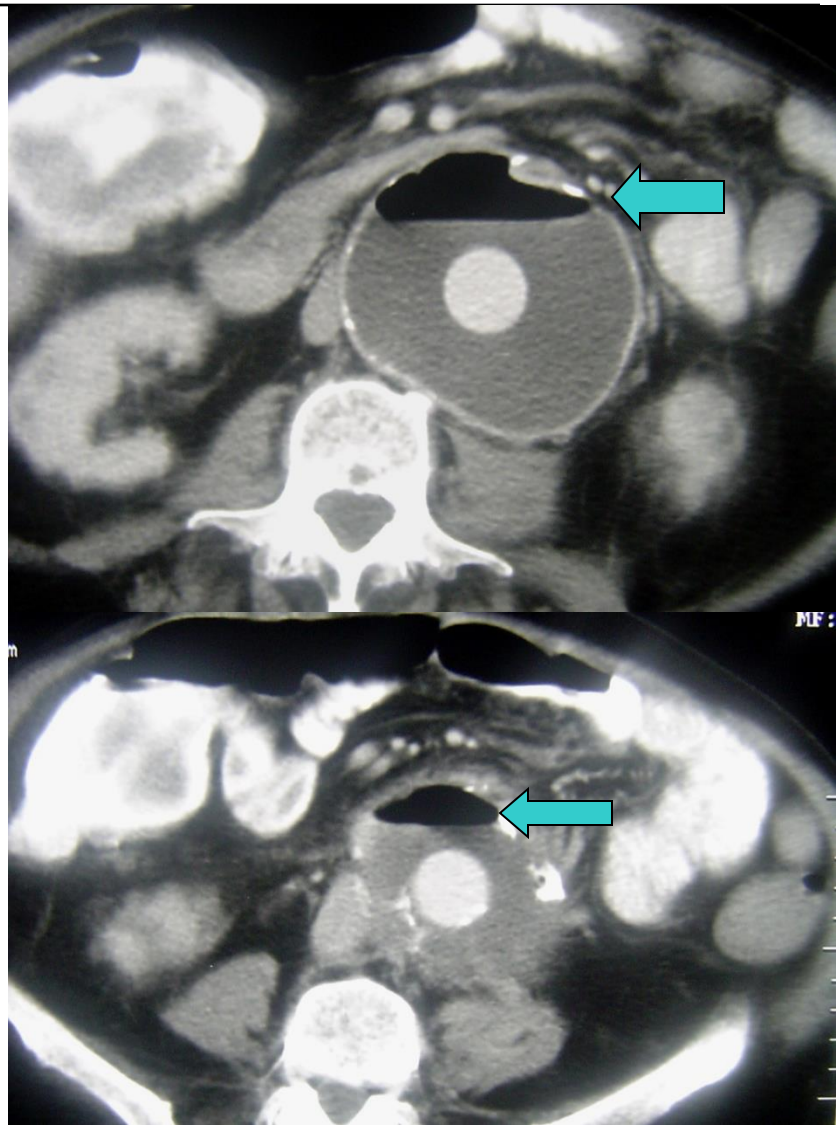
- Aortoenteric fistula (AEF) due to an untreated abdominal aortic aneurysm is very rare, although it has been reported
- I have never seen this in practice
- Do see AEF following open or endovascular repair, although also relatively rare (approximately 1%)
- Strongly associated with concurrent infection

Graft Infection/Aortoenteric Fistula

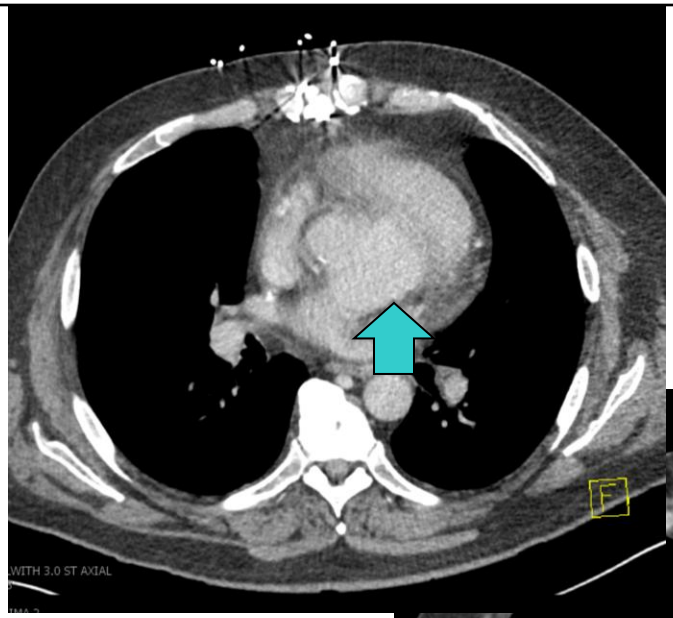
- Need high clinical index of suspicion; watch for sentinel upper/lower GI bleed
- Endoscopy and CT are principal diagnostic tests (Busuttil S et al. Semin Vasc Surg 2001)
- CT findings of AEF overlap with graft infection: periaortic inflammatory changes, hematoma, and gas; bowel wall thickening/hematoma; and rarely active arterial contrast extravasation (Perks FJ et al. JCAT 2004; Mylona S et al. Abdom Imaging 2007)

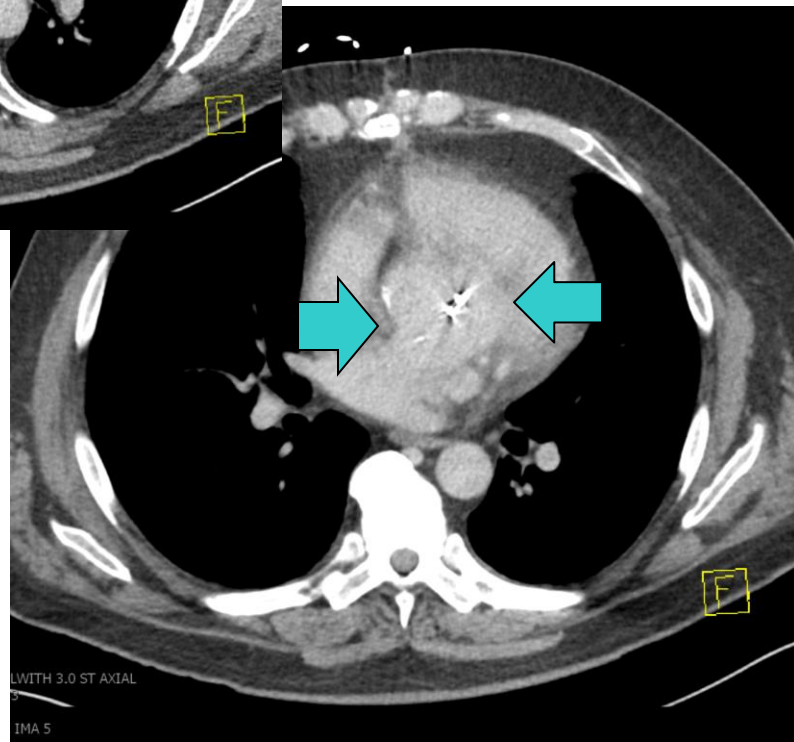
Aortic Graft Infection

- 80-year-old man, one month following AAA repair, now with Clostridium sepsis
- Extensive gas around the graft, representing gas-forming infection
- (Case courtesy Philip Beuchert, MD)

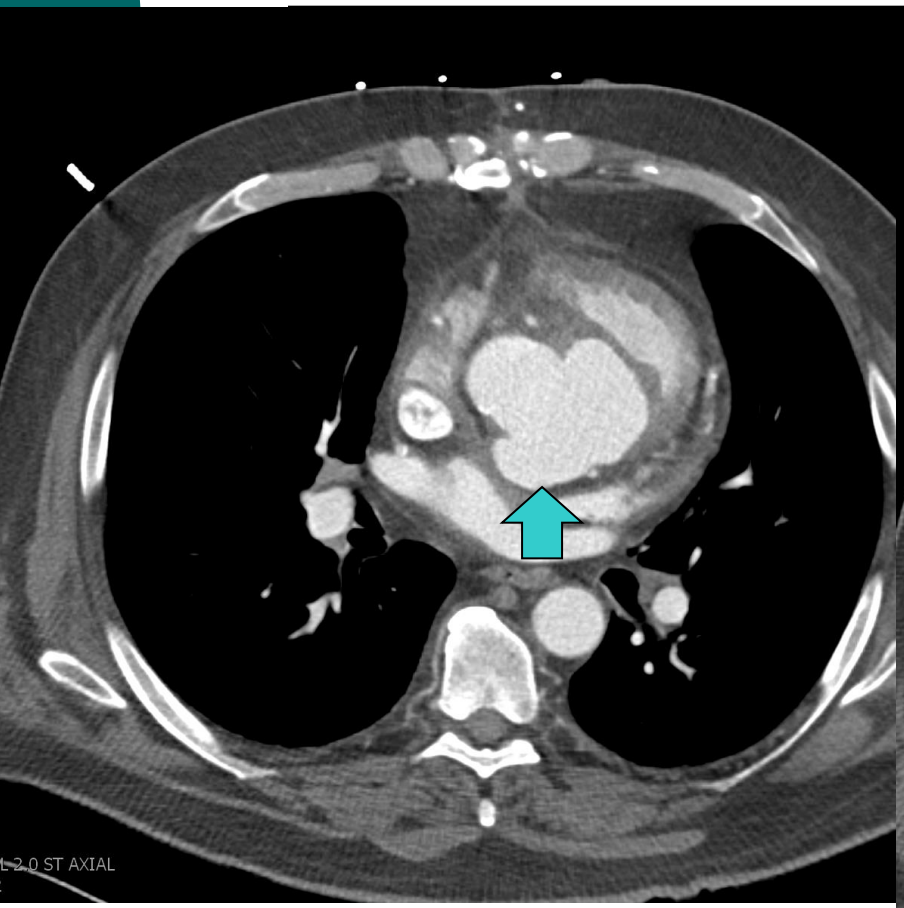


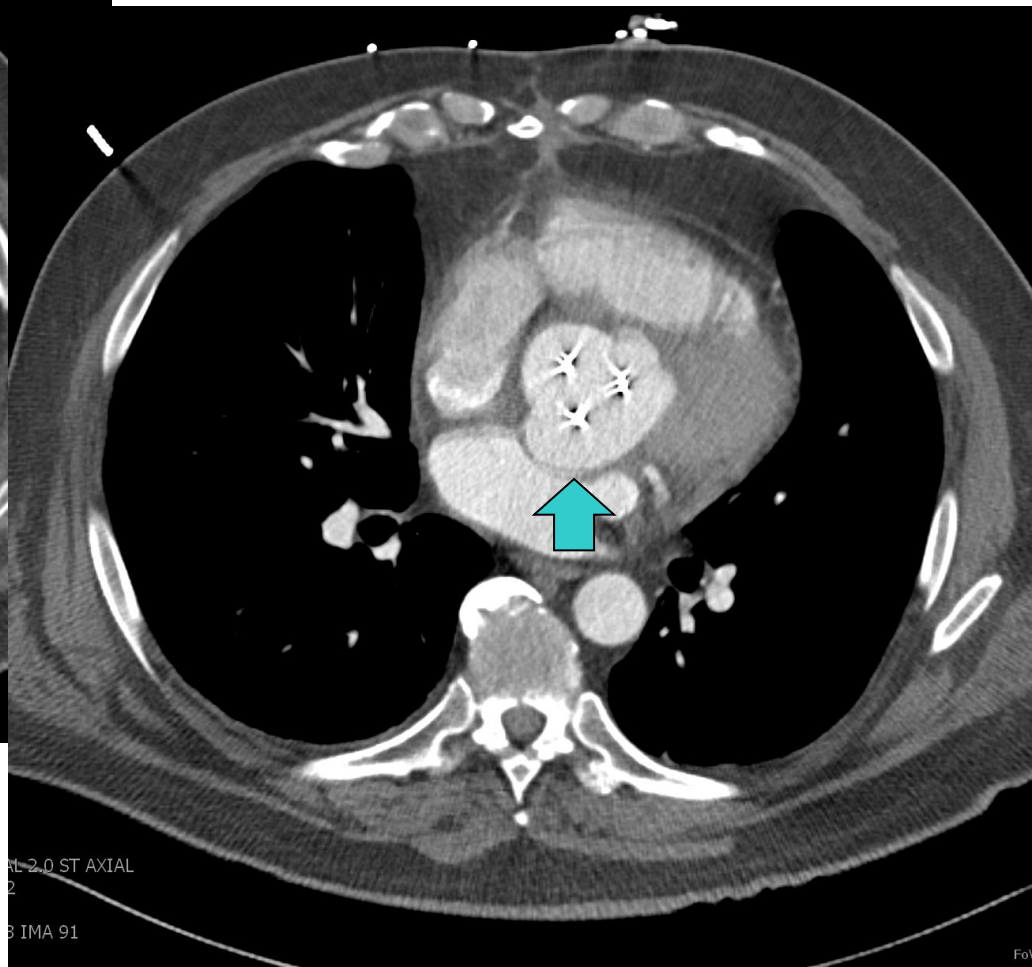
55-year-old man with recent aortic valve replacement, chest pain, fever, splenic infarcts – July 2022 CTA (lt.), then top of September 10, 2022 CT A/P (cent./rt.)





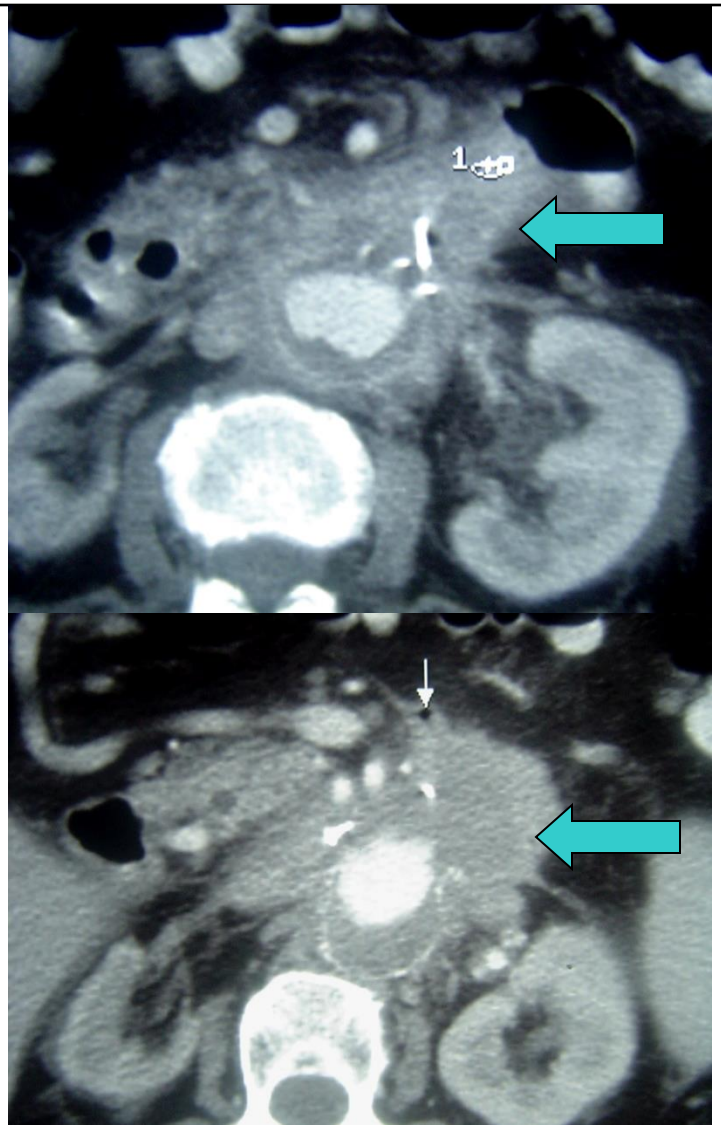
Case continued – CTA Sept 14, 2022





Aortoenteric Fistula

- 68-year-old woman with prior AAA repair, intermittent GI bleeding, and aortoenteric fistula based on CT; then proved at surgery
- Note extraluminal gas and hematoma around aorta and duodenum

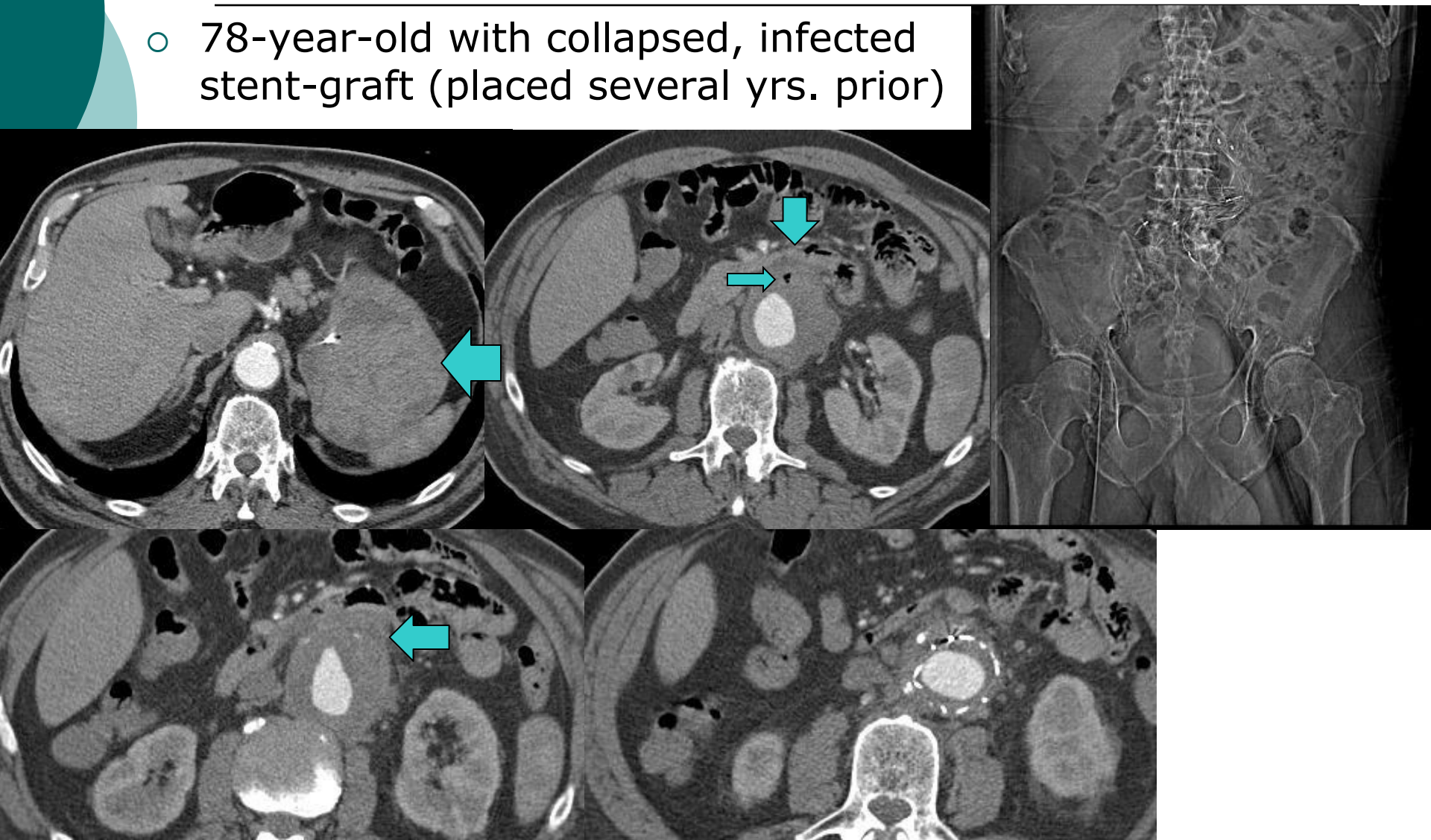


Stent-Graft Complications On CT

- Most common complication/finding on CT -endoleak
- Other complications: stent-graft displacement, occlusion, branch vessel occlusion, graft kinking, and (rarely) fistula/infection (Sharif MA et al. J Vasc Surg 2007; Bergqvist D et al. JVIR 2008; Laser A et al. J Vasc Surg 2011; Christensen JD, et al. Semin Roentgenol 2009)
- However, gas within the aneurysm sac on CT in the early post-operative period – even in a patient with fever and leukocytosis – usually does *not* indicate infection (Velazquez O et al. Am J Surg 1999)

Aorto-enteric fistula – Stent-graft

- 78-year-old with collapsed, infected stent-graft (placed several yrs. prior)



SAM QUESTION 1

- Which statement is true regarding the crescent sign and aortic aneurysm on CT?
- A) It is only rarely present if there is no rupture or impending rupture
- B) It is diagnostic of rupture/impending rupture
- C) Can be seen in symptomatic & asymptomatic aneurysms, but is more concerning if new &/or in conjunction with disrupted wall calcification
- D) It has no diagnostic relevance

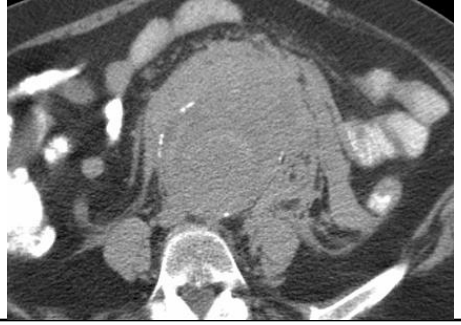
SAM QUESTION 2

- What is a type “B*” aortic dissection?
- A) The flap originates just distal to the left SCL & propagates retrograde not involving the ascending aorta
- B) An IMH variant starting just distal to the left SCL & propagates slightly distally
- C) Involves the ascending aorta but not the aortic root or valve
- D) Starts at the right brachiocephalic artery & propagates retrograde

SAM QUESTION 3

- Which statement on mycotic aneurysms of the aorta is correct?
- A) They are often of fungal or Salmonella origin
- B) They represent approximately 10% of all aortic aneurysms
- C) They are only believed to be caused by hematogenous dissemination of infection
- D) They are most often infrarenal, but can occur anywhere along the aorta

Conclusion



- MDCT is the test of choice for imaging suspected aortic emergencies, including ruptured aneurysm and dissection/intramural hematoma
- Radiologists need to be familiar with the common and unusual manifestations of acute aortic disease on MDCT, as well as the appropriate technical considerations and potential pitfalls

See Gardner JB et al. Semin CT MR US 2014