Annual Scientific Meeting
October 16-18

ESCR 2008
EUROPEAN SOCIETY OF CARDIAC RADIOLOGY
Porto / PORTUGAL

Acute Aortic Syndromes – a systematic review on MD-CT

e-Poster: 102

Congress: ESCR 2008

Type: Poster

Topic: ESCR 2008

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MeSH:

Aorta [A07.231.114.056]

Keywords: Aortic dissection, Intramural hematoma, Acute Aortic Syndromes, Penetrating atherosclerotic aortic ulcer

1. Purpose

.....Purpose.....

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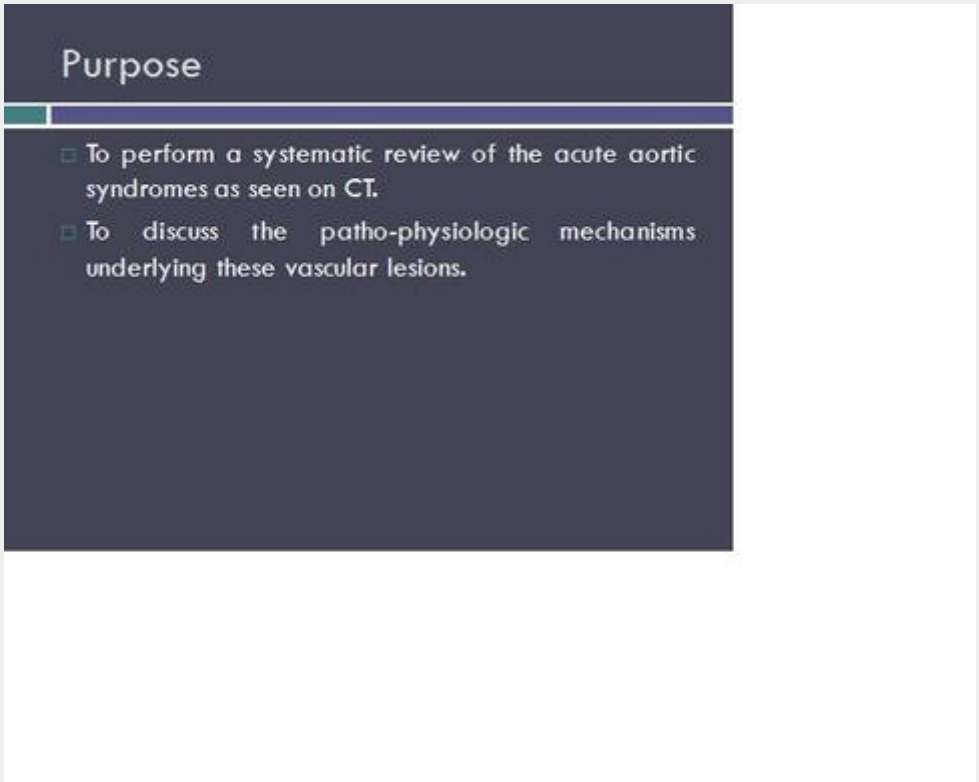

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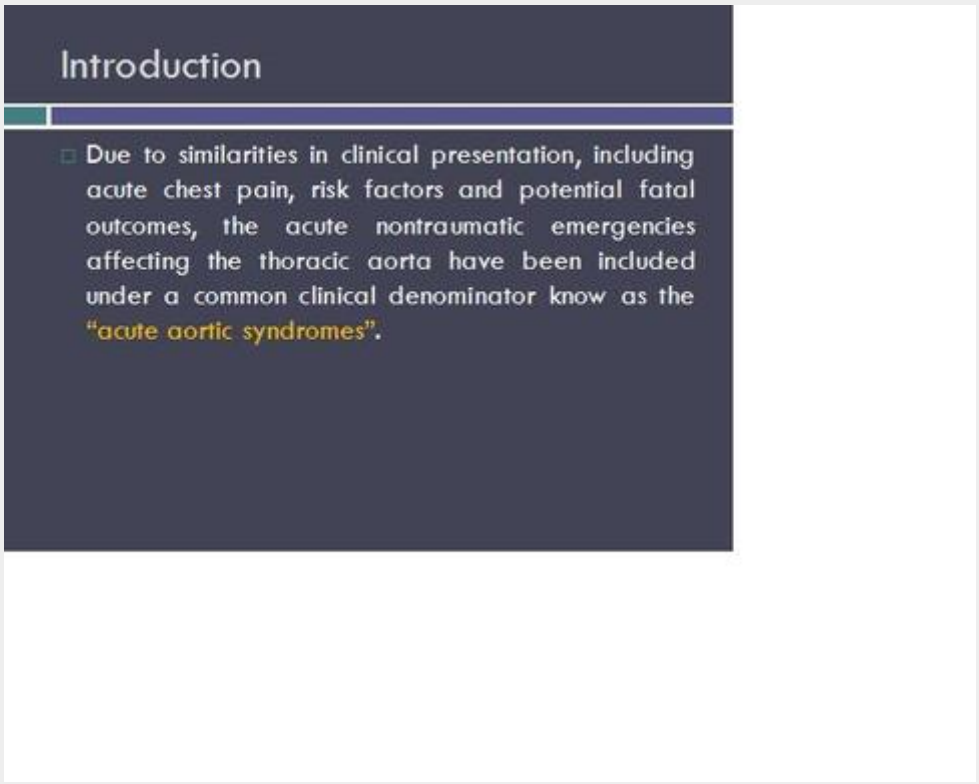
Introduction
Due to similarities in clinical presentation, including acute chest pain, risk factors and potential fatal outcomes, the acute nontraumatic emergencies affecting the thoracic aorta have been included under a common clinical denominator know as the "acute aortic syndromes".

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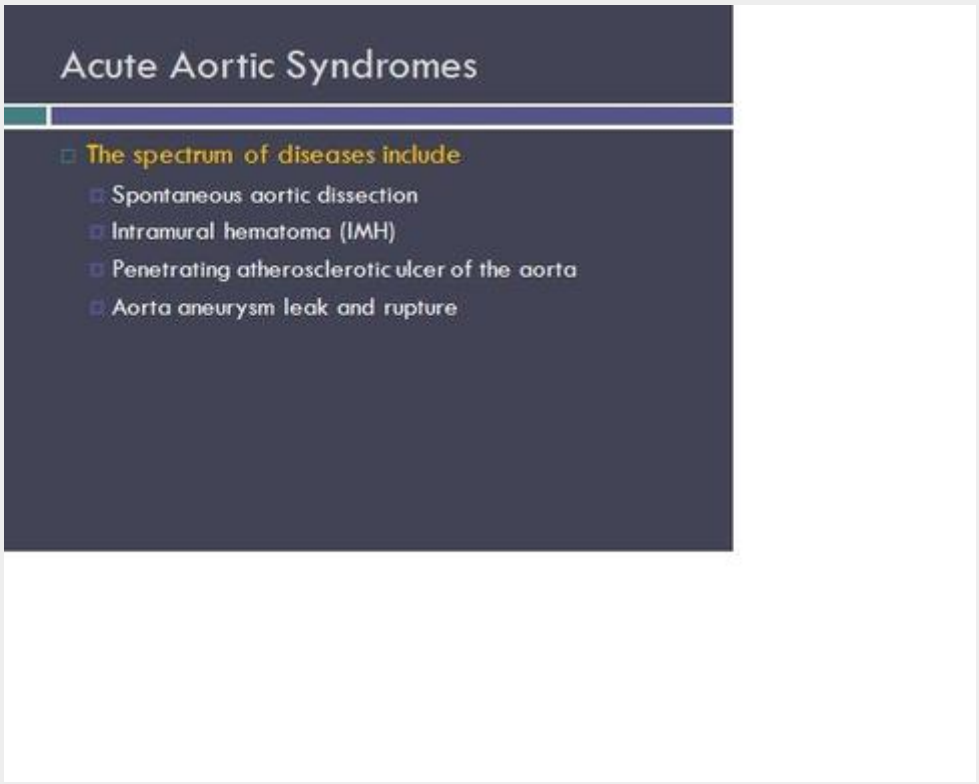

2. Methods and Materials

.....Methods and Materials.....

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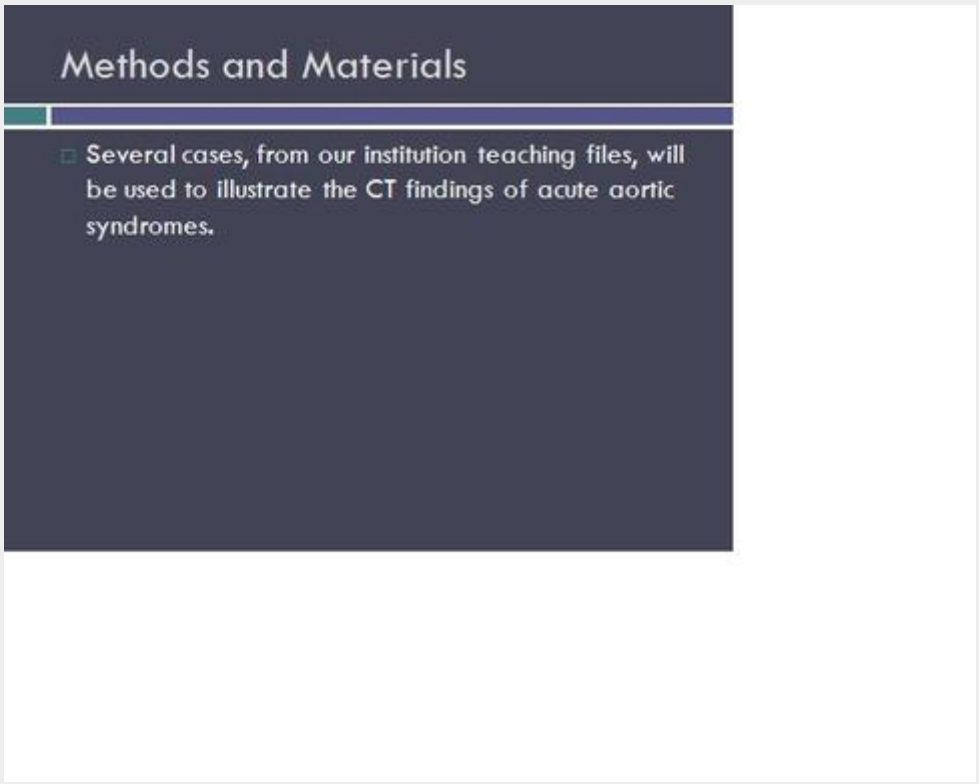

3. Results

.....Results.....

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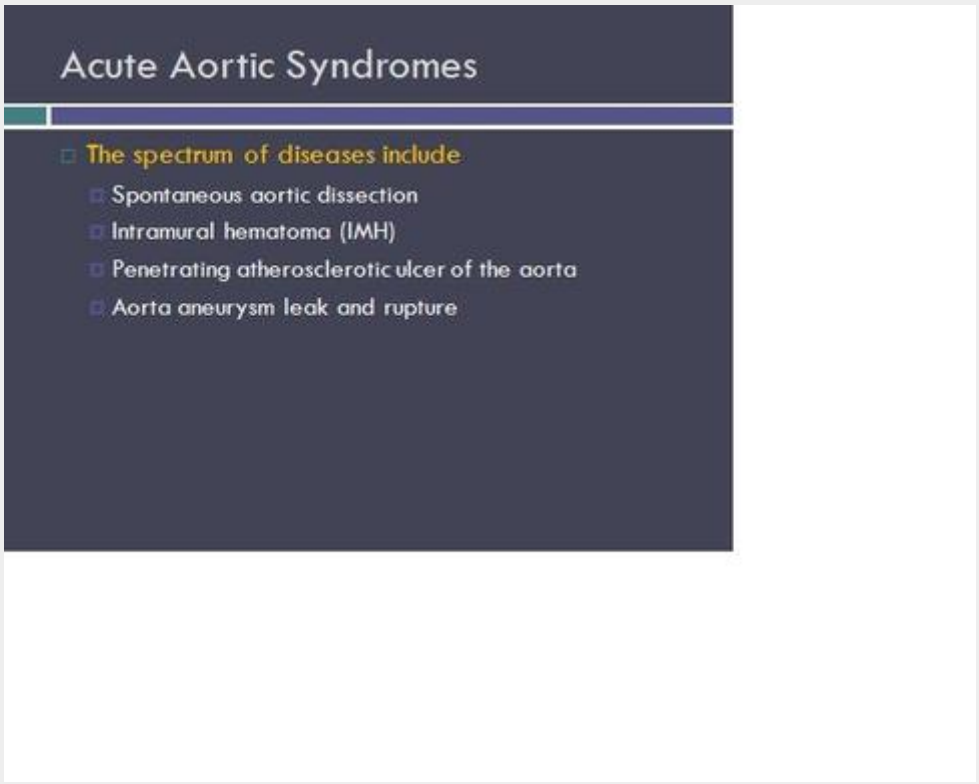
Acute Aortic Syndromes
The spectrum of diseases include
Spontaneous aortic dissection
Intramural hematoma (IMH)
Penetrating atherosclerotic ulcer of the aorta
Aorta aneurysm leak and rupture

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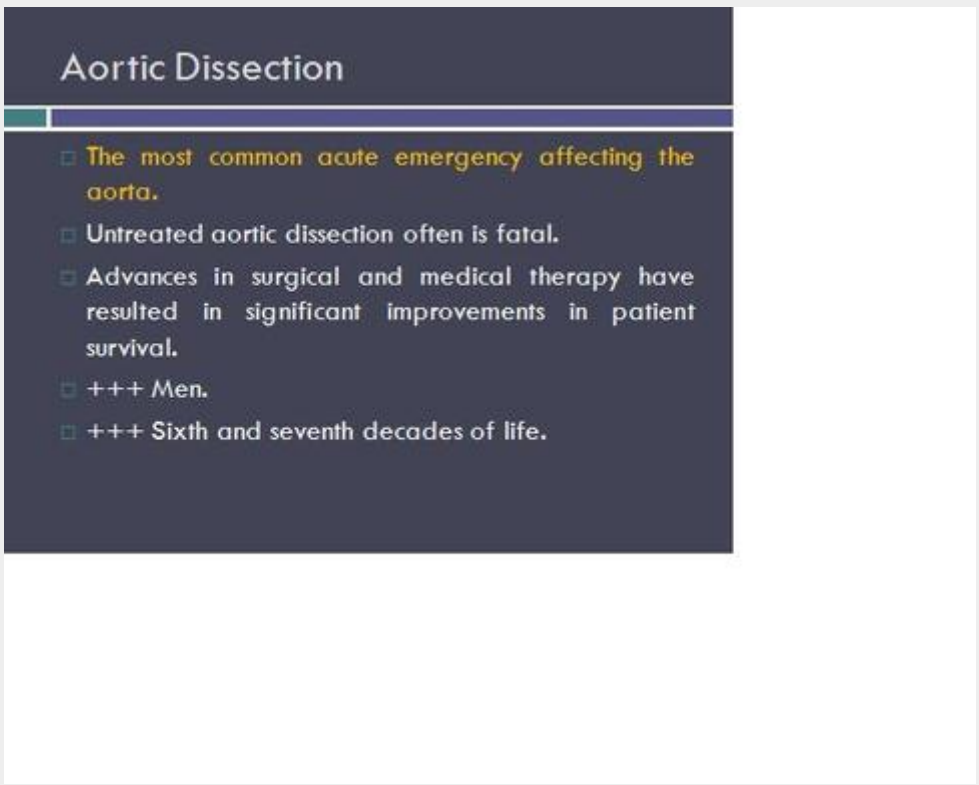
Aortic Dissection
The most common acute emergency affecting the aorta.
Untreated aortic dissection often is fatal.
Advances in surgical and medical therapy have resulted in significant improvements in patient survival.
+++ Men.
+++ Sixth and seventh decades of life.

6.jpg


Aortic Dissection – Clinical Findings
Most patients (95%) present with acute onset of a sharp, tearing, intractable chest or back pain.
Minority may present with primary symptoms other than chest pain.
Congestive heart failure (acute aortic valve incompetence, Myocardial infarction, pericardial tamponade).
Abdominal pain (renal or mesenteric ischemia).
Stroke or syncope (compression or occlusion of major aortic branches in the neck).

7.jpg


Aortic Dissection – Clinical Findings
The most common predisposing condition is hypertension, that is present in up to 90% of patients.
Other important predisposing factors:
Inherited connective tissue disorders (Marfan and Ehlers-Danlos syndrome).
Cystic medial degeneration.
Annuloaortic ectasia.
Bicuspid aortic valve and aortitis.
Cocaine and amphetamine abuse.
May be iatrogenic sites of aortic cannulation; bypass grafting; cross-clamping; catheterization.

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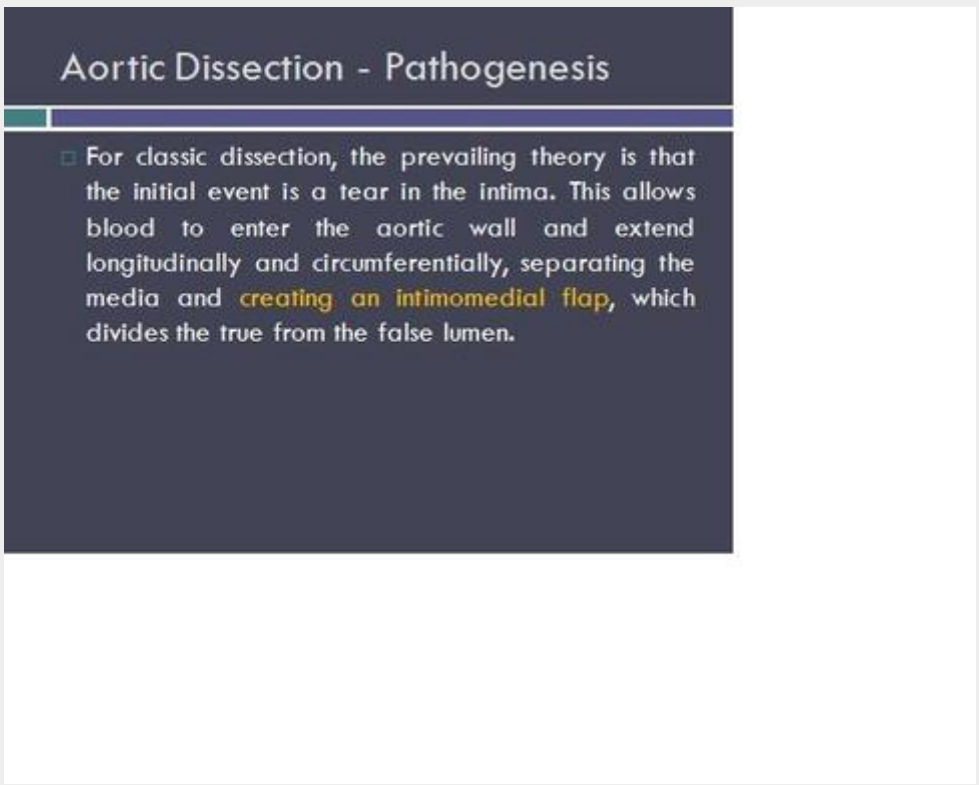
Aortic Dissection - Pathogenesis
For classic dissection, the prevailing theory is that the initial event is a tear in the intima. This allows blood to enter the aortic wall and extend longitudinally and circumferentially, separating the media and creating an intimomedial flap, which divides the true from the false lumen.

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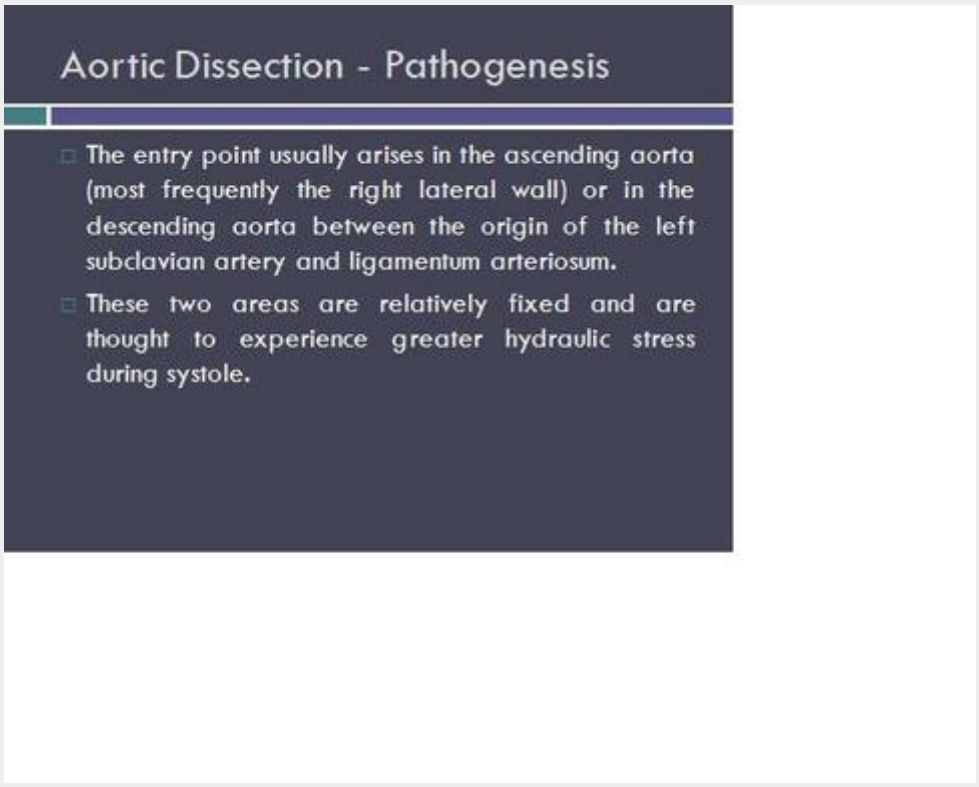
Aortic Dissection - Pathogenesis
The entry point usually arises in the ascending aorta (most frequently the right lateral wall) or in the descending aorta between the origin of the left subclavian artery and ligamentum arteriosum.
These two areas are relatively fixed and are thought to experience greater hydraulic stress during systole.

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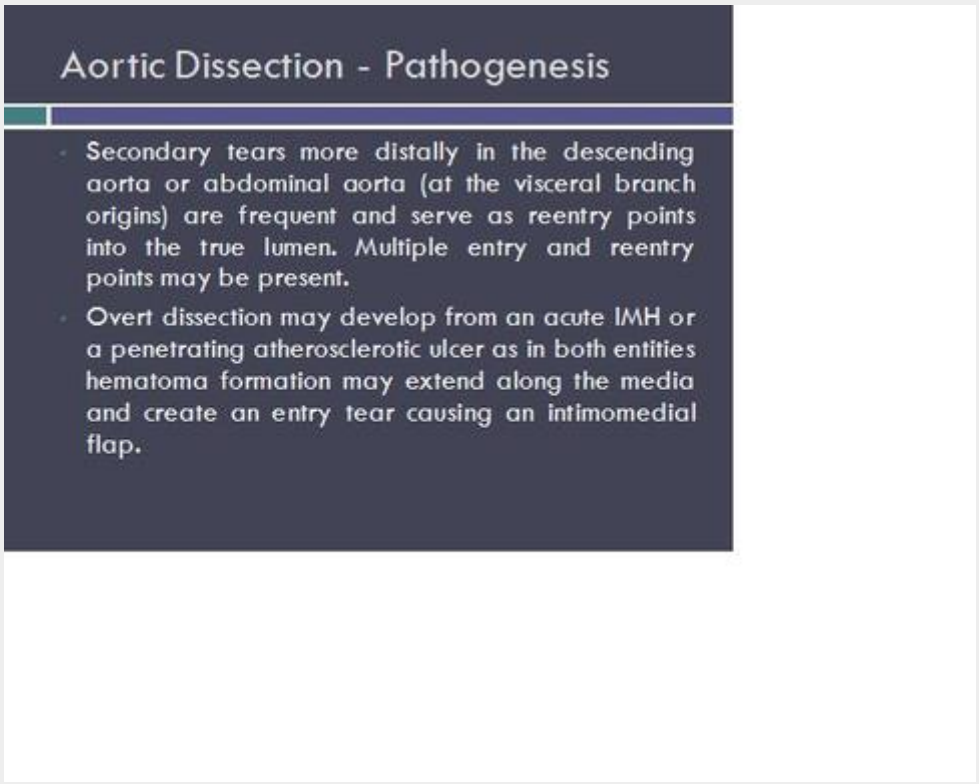
Aortic Dissection - Pathogenesis
Secondary tears more distally in the descending aorta or abdominal aorta (at the visceral branch origins) are frequent and serve as reentry points into the true lumen. Multiple entry and reentry points may be present.
Overt dissection may develop from an acute IMH or a penetrating atherosclerotic ulcer as in both entities hematoma formation may extend along the media and create an entry tear causing an intimomedial flap.

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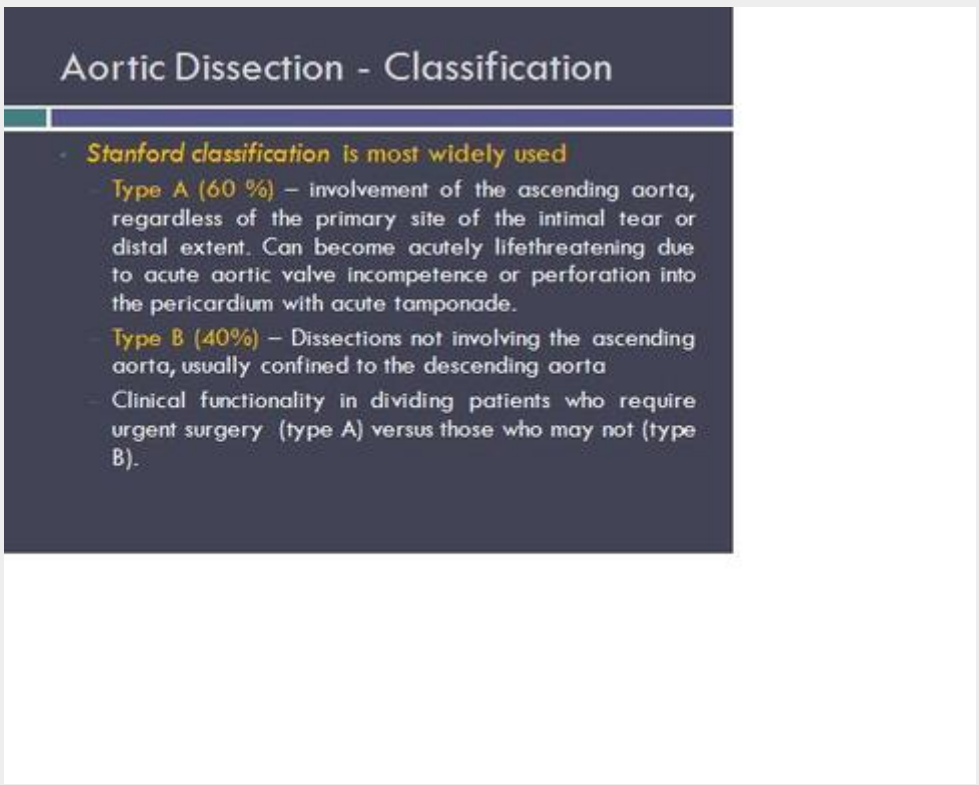
Aortic Dissection - Classification
Stanford classification is most widely used
Type A (60 %) – involvement of the ascending aorta, regardless of the primary site of the intimal tear or distal extent. Can become acutely lifethreatening due to acute aortic valve incompetence or perforation into the pericardium with acute tamponade.
Type B (40%) – Dissections not involving the ascending aorta, usually confined to the descending aorta
Clinical functionality in dividing patients who require urgent surgery (type A) versus those who may not (type B).

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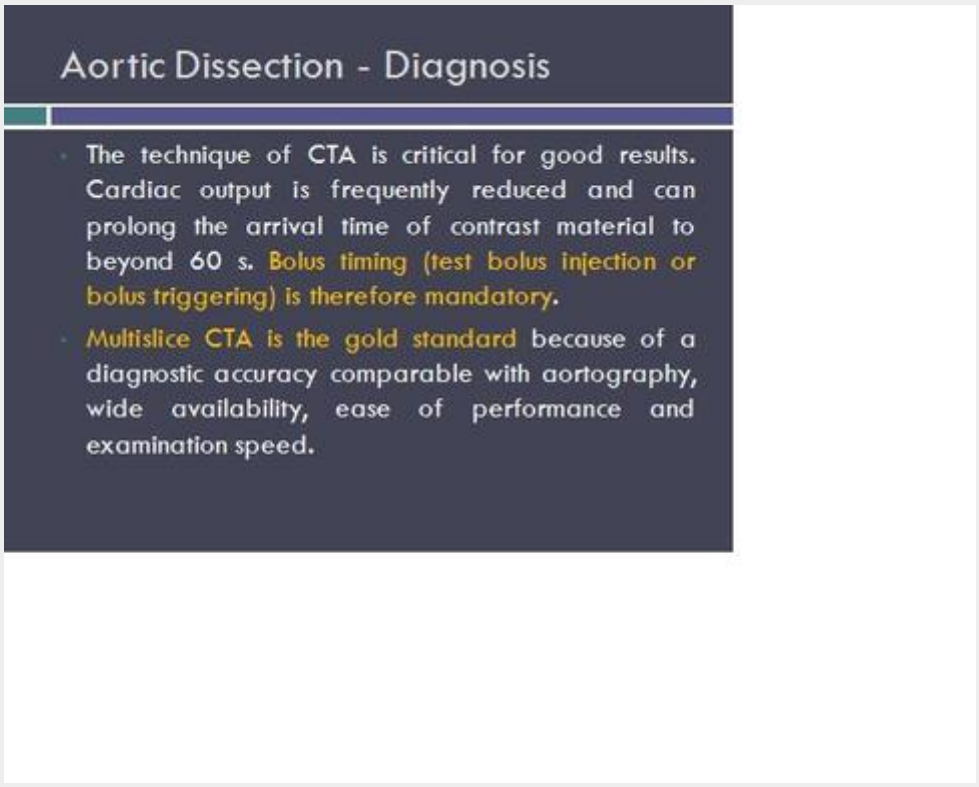
Aortic Dissection - Diagnosis
The technique of CTA is critical for good results. Cardiac output is frequently reduced and can prolong the arrival time of contrast material to beyond 60 s. Bolus timing (test bolus injection or bolus triggering) is therefore mandatory.
Multislice CTA is the gold standard because of a diagnostic accuracy comparable with aortography, wide availability, ease of performance and examination speed.

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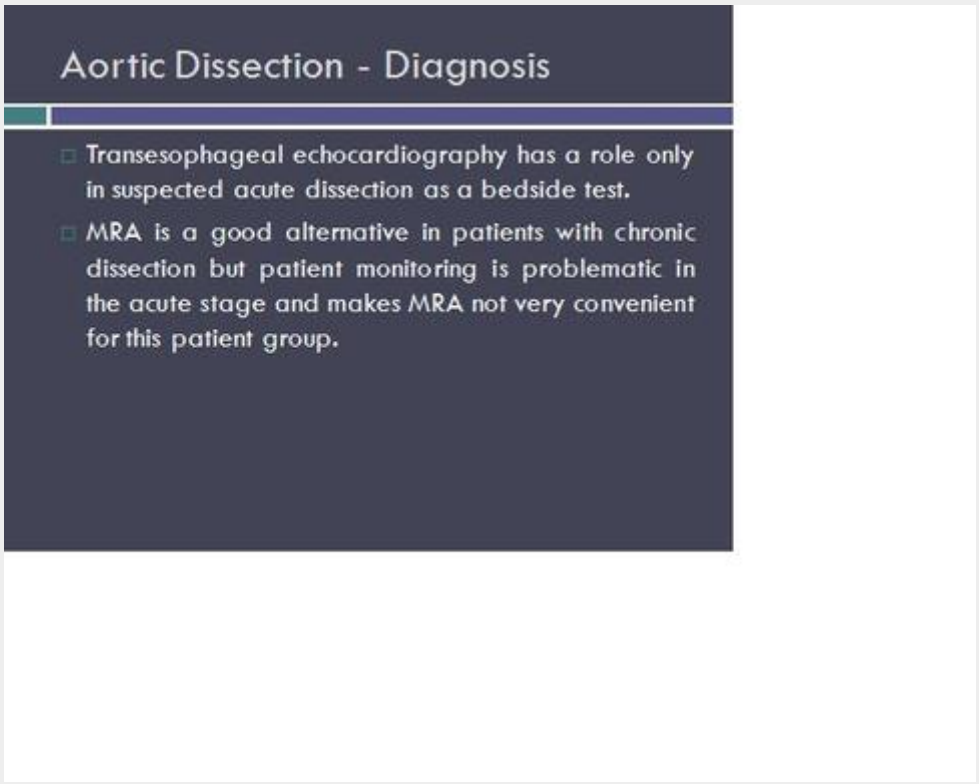
Aortic Dissection - Diagnosis
Transesophageal echocardiography has a role only in suspected acute dissection as a bedside test.
MRA is a good alternative in patients with chronic dissection but patient monitoring is problematic in the acute stage and makes MRA not very convenient for this patient group.

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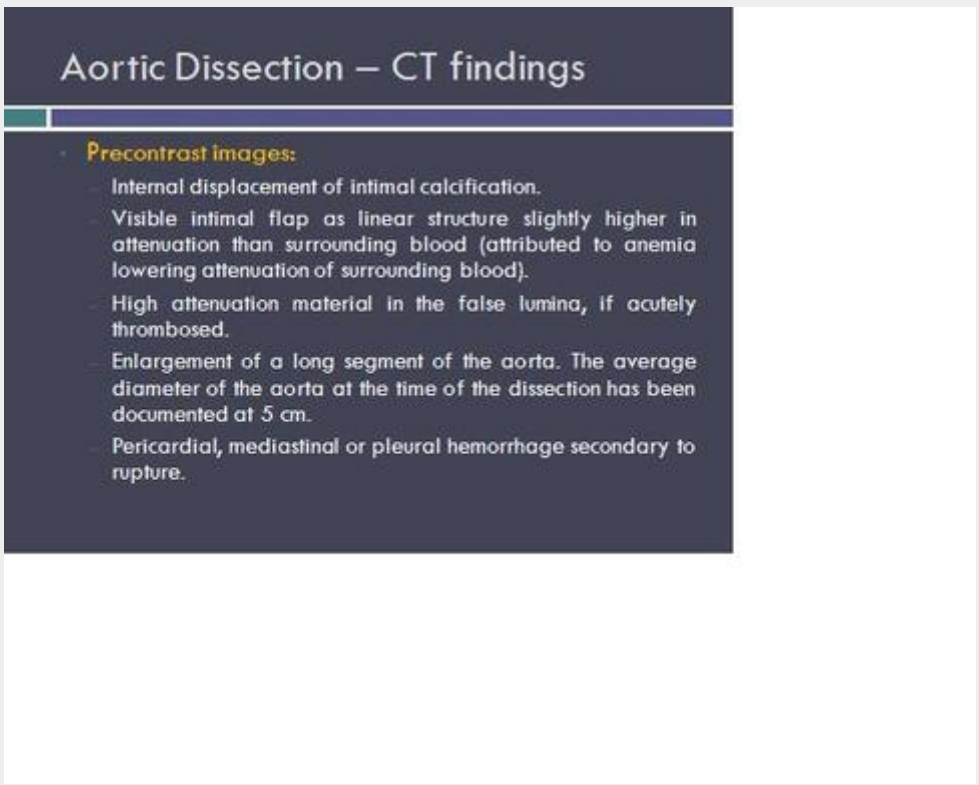
Aortic Dissection – CT findings
Precontrast images:
Internal displacement of intimal calcification.
Visible intimal flap as linear structure slightly higher in attenuation than surrounding blood (attributed to anemia lowering attenuation of surrounding blood).
High attenuation material in the false lumina, if acutely thrombosed.
Enlargement of a long segment of the aorta. The average diameter of the aorta at the time of the dissection has been documented at 5 cm.
Pericardial, mediastinal or pleural hemorrhage secondary to rupture.

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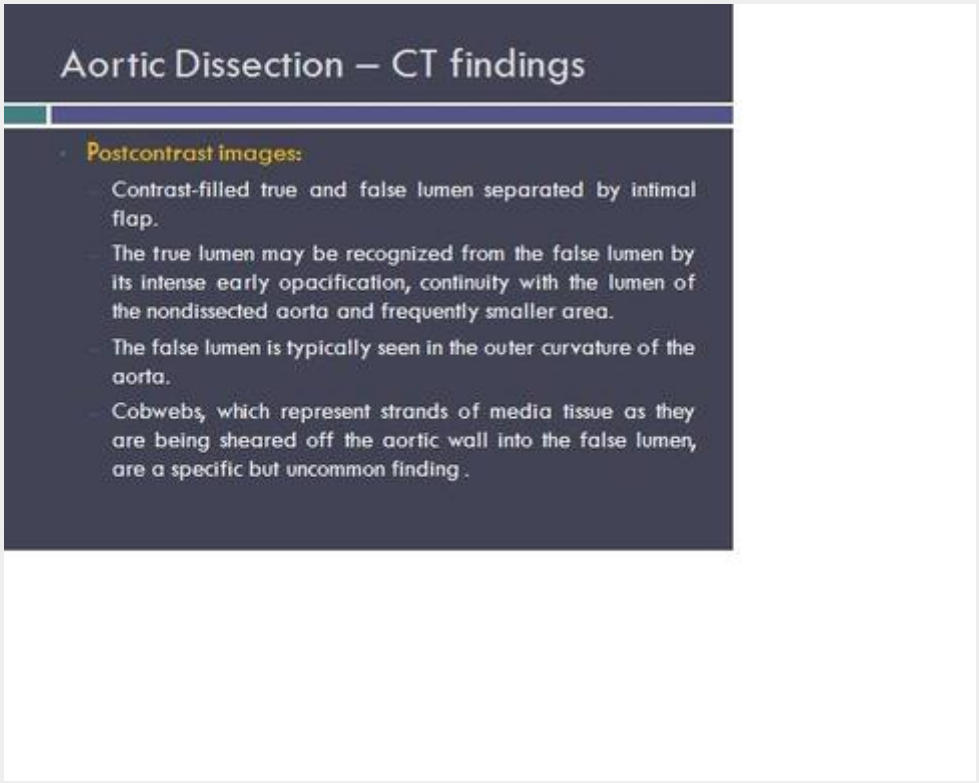
Aortic Dissection – CT findings
Postcontrast images:
Contrast-filled true and false lumen separated by intimal flap.
The true lumen may be recognized from the false lumen by its intense early opacification, continuity with the lumen of the nondissected aorta and frequently smaller area.
The false lumen is typically seen in the outer curvature of the aorta.
Cobwebs, which represent strands of media tissue as they are being sheared off the aortic wall into the false lumen, are a specific but uncommon finding .

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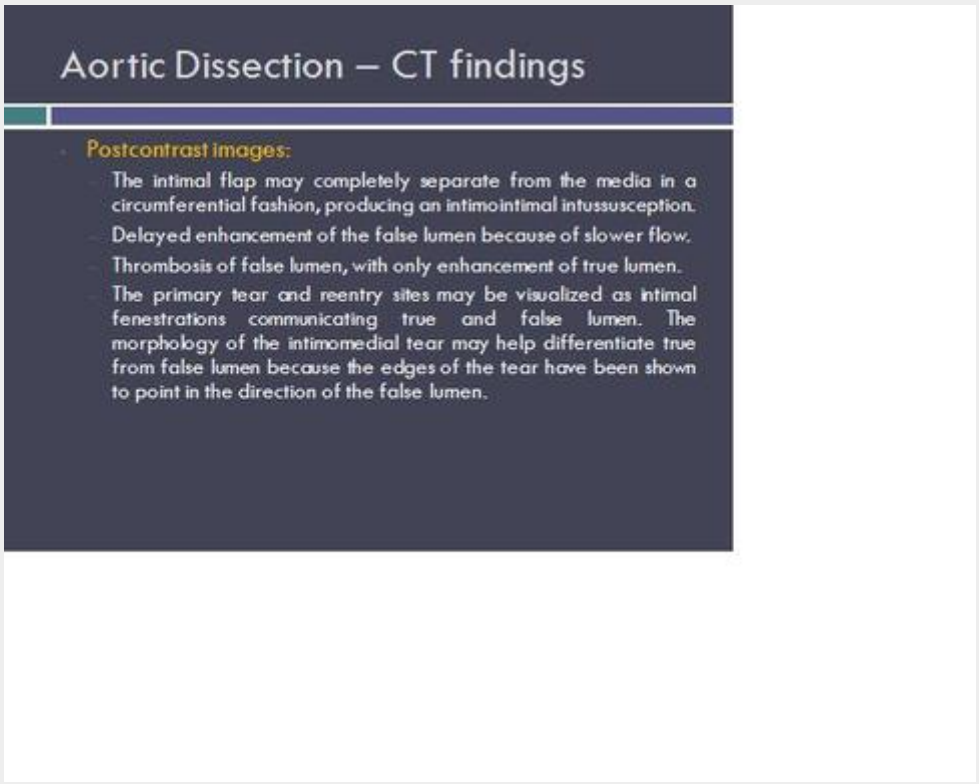
Aortic Dissection – CT findings
Postcontrast images:
The intimal flap may completely separate from the media in a circumferential fashion, producing an intimointimal intussusception.
Delayed enhancement of the false lumen because of slower flow.
Thrombosis of false lumen, with only enhancement of true lumen.
The primary tear and reentry sites may be visualized as intimal fenestrations communicating true and false lumen. The morphology of the intimomedial tear may help differentiate true from false lumen because the edges of the tear have been shown to point in the direction of the false lumen.

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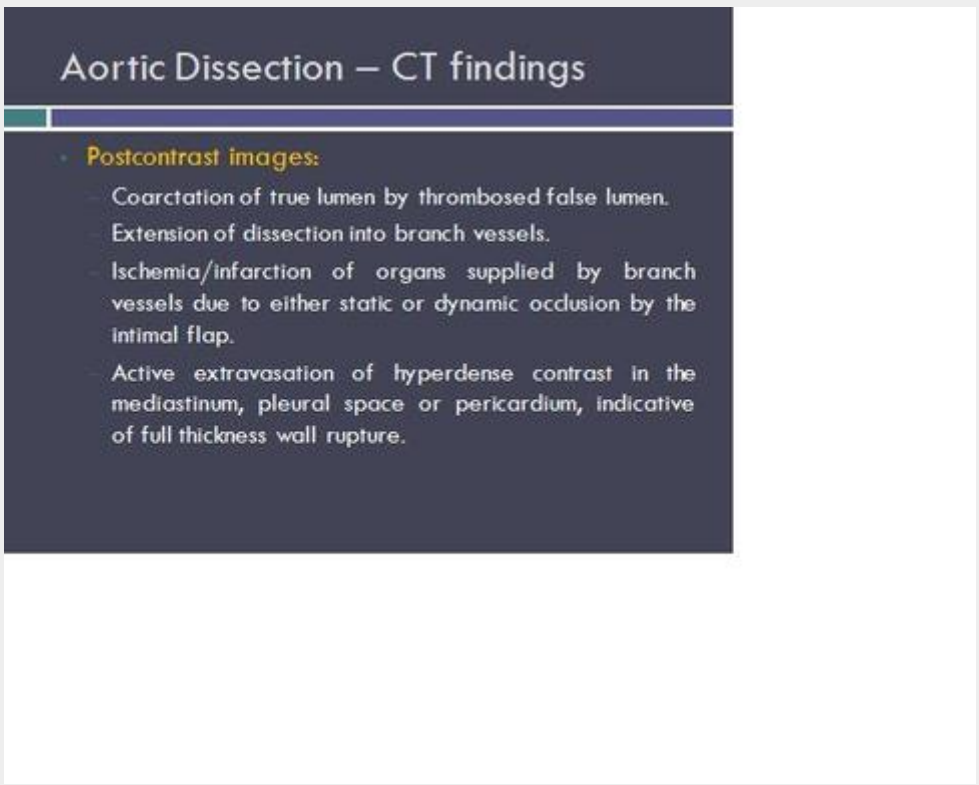
Aortic Dissection – CT findings
Postcontrast images:
Coarctation of true lumen by thrombosed false lumen.
Extension of dissection into branch vessels.
Ischemia/infarction of organs supplied by branch vessels due to either static or dynamic occlusion by the intimal flap.
Active extravasation of hyperdense contrast in the mediastinum, pleural space or pericardium, indicative of full thickness wall rupture.

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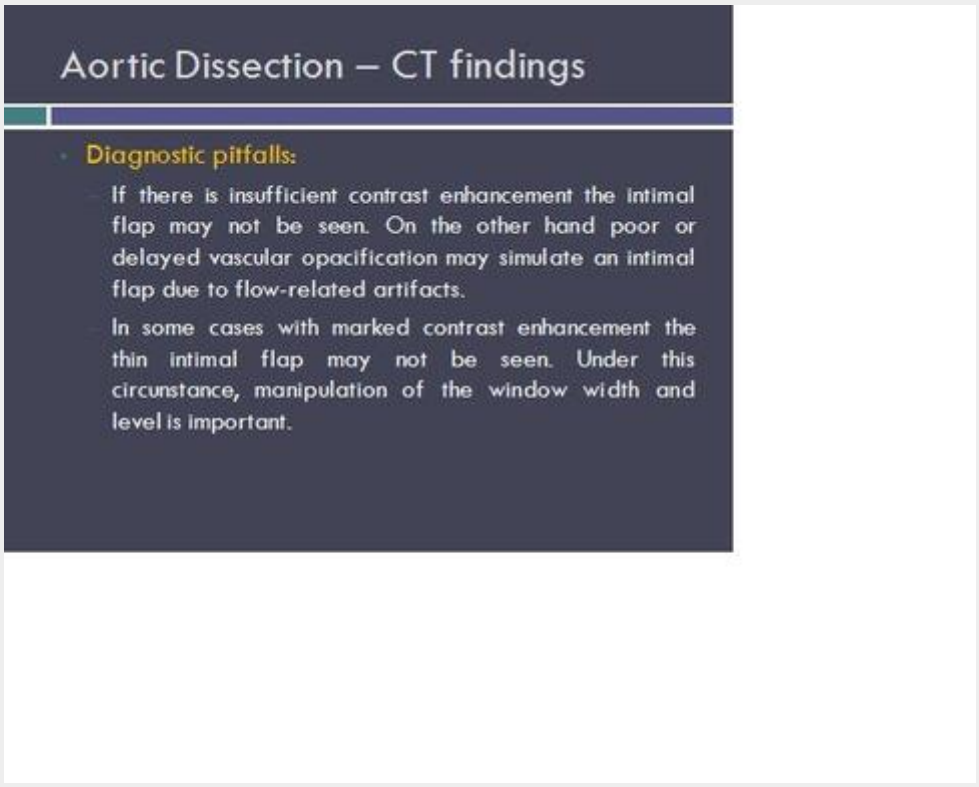
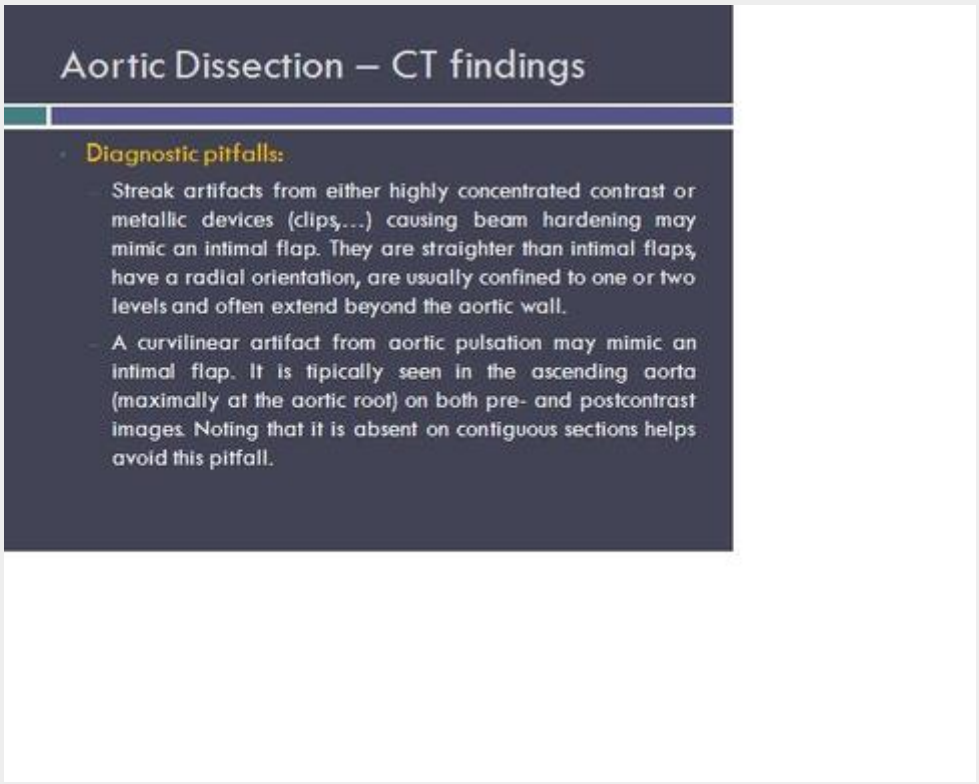

Aortic Dissection – CT findings
Diagnostic pitfalls:
If there is insufficient contrast enhancement the intimal flap may not be seen. On the other hand poor or delayed vascular opacification may simulate an intimal flap due to flow-related artifacts.
In some cases with marked contrast enhancement the thin intimal flap may not be seen. Under this circunstance, manipulation of the window width and level is important.

19.jpg


Aortic Dissection – CT findings
Diagnostic pitfalls:
Streak artifacts from either highly concentrated contrast or metallic devices (clips,…) causing beam hardening may mimic an intimal flap. They are straighter than intimal flaps, have a radial orientation, are usually confined to one or two levels and often extend beyond the aortic wall.
A curvilinear artifact from aortic pulsation may mimic an intimal flap. It is tipically seen in the ascending aorta (maximally at the aortic root) on both pre- and postcontrast images. Noting that it is absent on contiguous sections helps avoid this pitfall.

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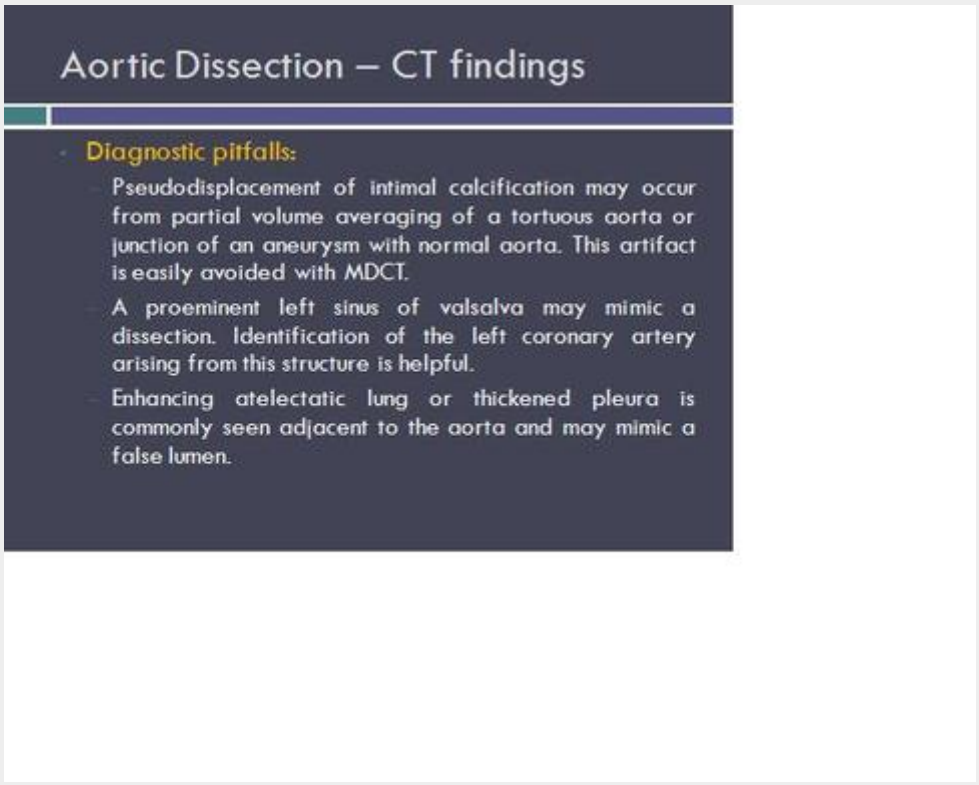
Aortic Dissection – CT findings
Diagnostic pitfalls:
Pseudodisplacement of intimal calcification may occur from partial volume averaging of a tortuous aorta or junction of an aneurysm with normal aorta. This artifact is easily avoided with MDCT.
A proeminent left sinus of valsalva may mimic a dissection. Identification of the left coronary artery arising from this structure is helpful.
Enhancing atelectatic lung or thickened pleura is commonly seen adjacent to the aorta and may mimic a false lumen.

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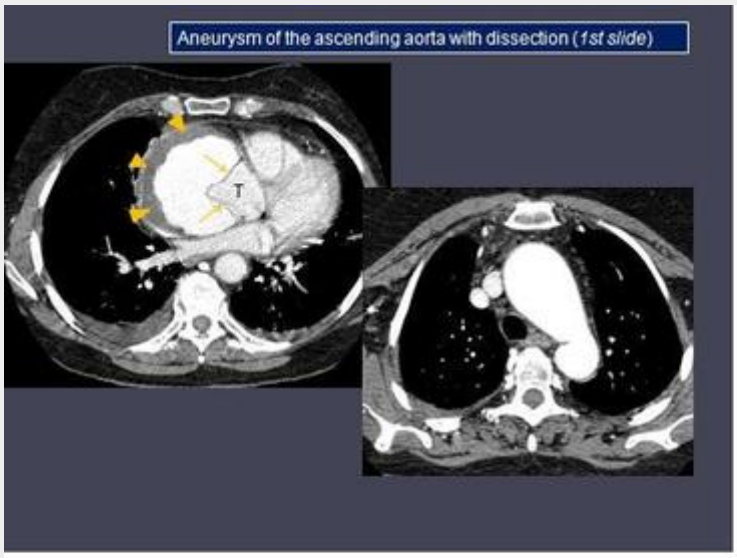

Aneurysm of the ascending aorta with dissection – Type A aortic dissection. An intimal flap (arrow) is present only in ascending aorta (beginning at aortic root and ending before the aortic arch), separating the smaller true (T) from the larger false lumina. There is excentric partial thrombosis of the false lumen (arrowheads).

22.jpg

Aneurysm of the ascending aorta with dissection – Type A aortic dissection. An intimal flap (arrow) is present only in ascending aorta (beginning at aortic root and ending before the aortic arch), separating the smaller true (T) from the larger false lumina. There is excentric partial thrombosis of the false lumen (arrowheads).

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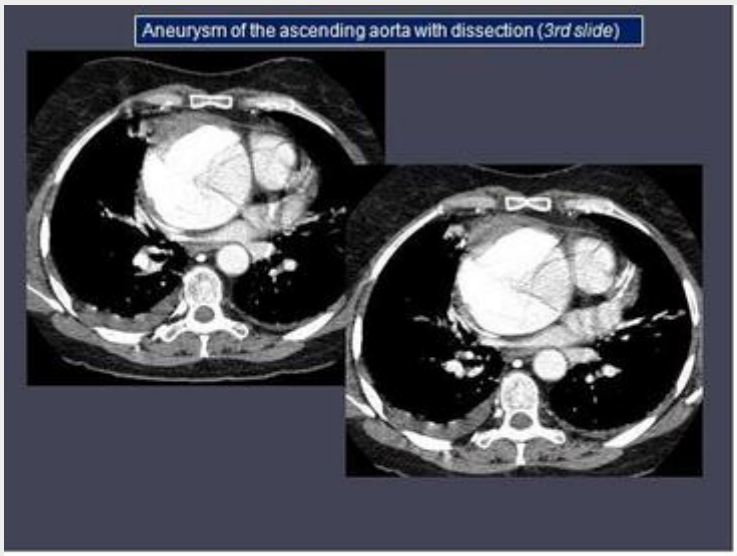


Pulsation effects in acute type-A dissection. Rapidly moving membranes in ascending aorta lead to multiple contours and may make identification of intimal flap difficult. This is usually seen only in acute dissections because the thickness of the intimal flap increases in chronic dissection.

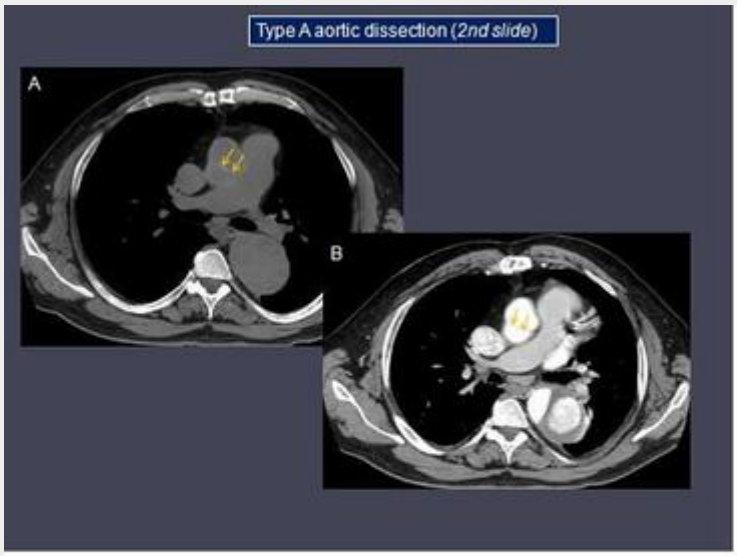
24.jpg

Volumous left-sided hemorrhagic pleural effusion (CT attenuation of 62 HU) secondary to rupture of an ascending aorta dissection (not shown). There is also a small pleural effusion on the right side.

25.jpg

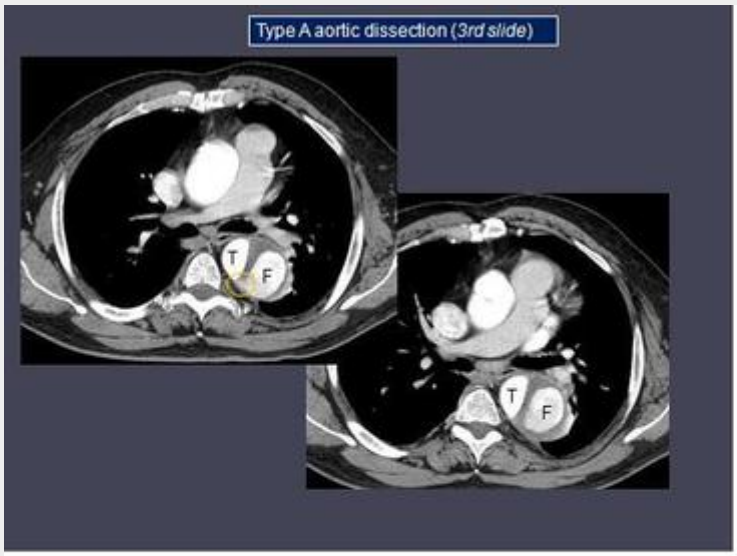
Type A aortic dissection, that stops just before the aortic bifurcation (arrow).

26.jpg



Type A aortic dissection, that stops just before the aortic bifurcation. A. Precontrast image. Visible intimal flap (arrows) as linear structure slightly higher in attenuation than surrounding blood (anemia? Microcalcifications within flap?). B. After CIV the intimal flap (arrows) is easily seen.

27.jpg



The beak sign (circle) identifies the false lumen (F) and refers to the cross-sectional manifestation of the propagating wedge hematoma in the false channel as it cleaves a space and separates the intima. The true lumen (T) may be recognized from the false lumen by its intense early opacification.

28.jpg

True lumen coarctation. There is thrombosis (THR) of the false lumen with compression and stenosis of the true lumen (arrows).

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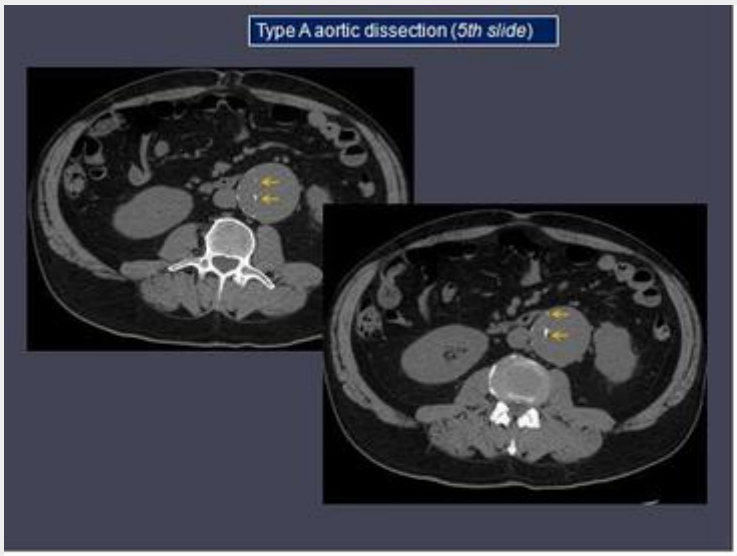

Type A aortic dissection, that stops just before the aortic bifurcation. Noncontrast scan demonstrates displaced intimal calcifications (arrows), signaling the presence of an intimal flap.

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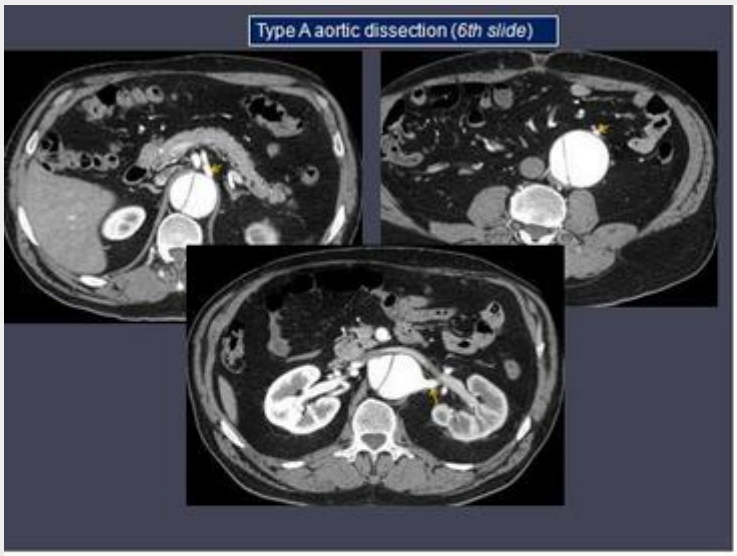

Type A aortic dissection, that stops just before the aortic bifurcation. Splenic, left renal and mesenteric inferior arteries (arrows) have origin in the false lumen. Note that there is less enhancement of the left kidney compared to the contralateral, suggestive of renal ischemia.

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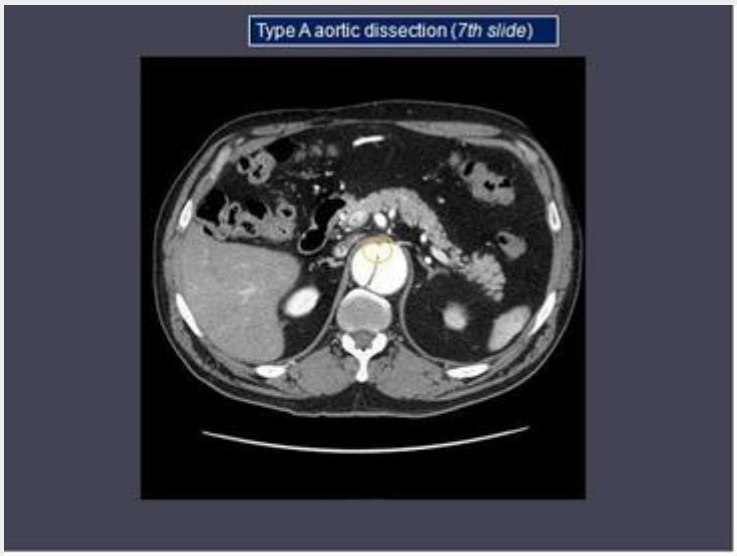

Type A aortic dissection, that stops just before the aortic bifurcation. Intimal tear (reentry site) visualized as intimal fenestration (circle) communicating true and false lumen.

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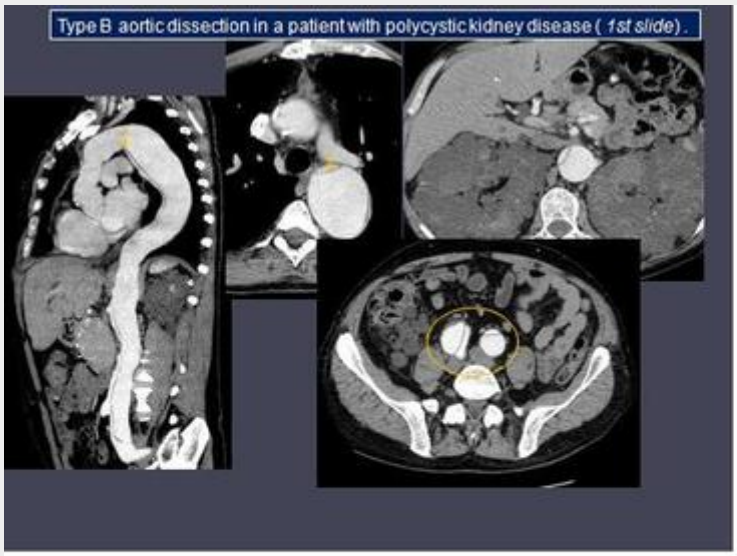
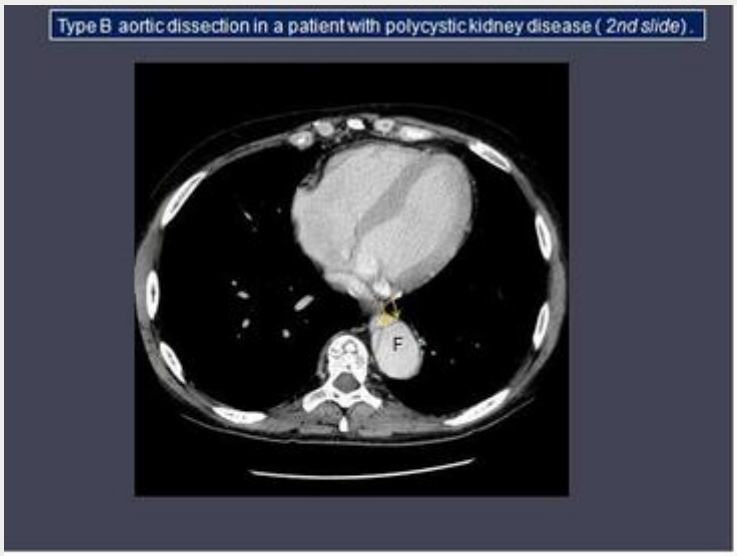


Type B aortic dissection in a patient with polycystic kidney disease. The dissection begins in distal half of aortic arch (arrow) and extends to both common iliac arteries (circle). There are no signs of thrombosis in any of the lumens (true and false).

33.jpg



Type B aortic dissection in a patient with polycystic kidney disease. Aortic cobwebs (arrows) are strands of tissue from the aortic media that indicate the false channel (F).

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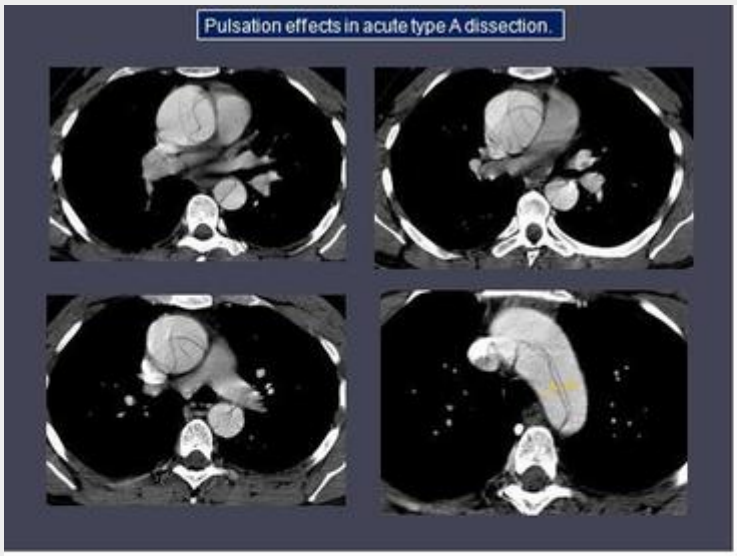

Pulsation effects in acute type A dissection. Rapidly moving membranes in ascending aorta lead to multiple contours and may make identification of intimal flap difficult. Pulsation in the aortic arch leads to double contours of the flap (arrows).

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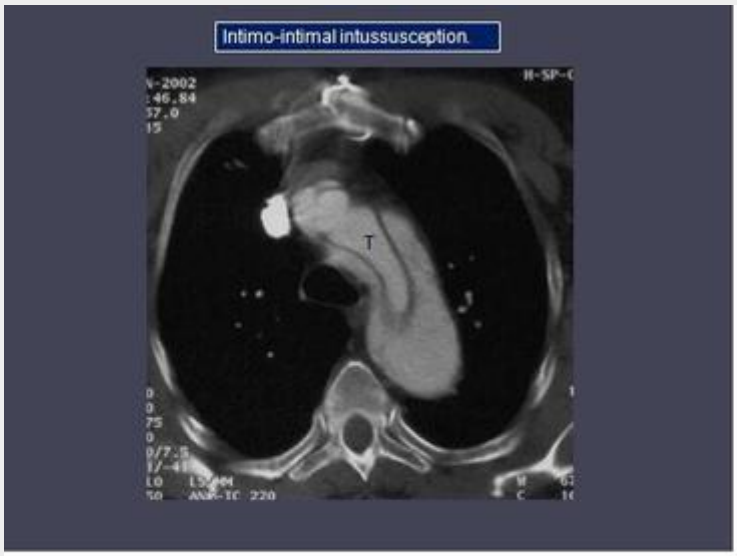
Calcification of the aortic wall acts like glue and may induce atypical shapes of the dissecting membrane.

36.jpg



Intimo-intimal intussusception. CT demonstrates aortic dissection with complete separation of the intimomedial flap from the aortic wall. The inner lumen is invariably the true lumen (T).

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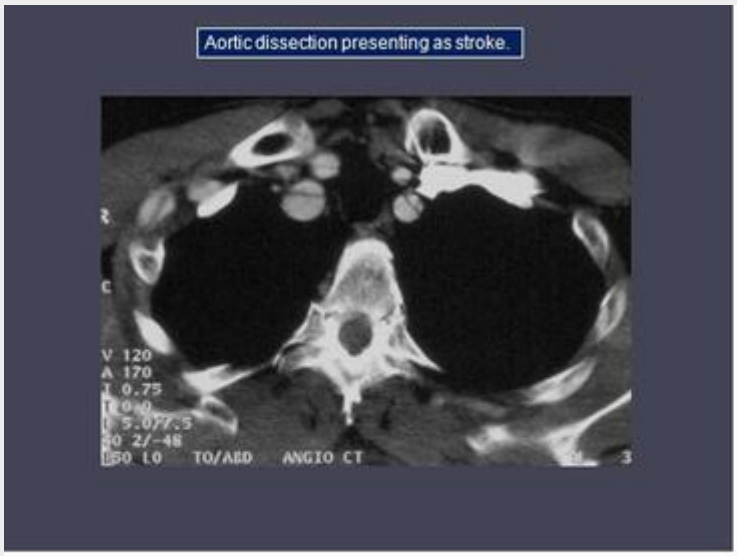

Patient with chest pain followed by stroke. There was a aortic dissection (not shown) that extended into the major aortic branches in the neck.

38.jpg

Thrombosis of false lumen (arrows) with exclusive enhancement of true lumen (T).

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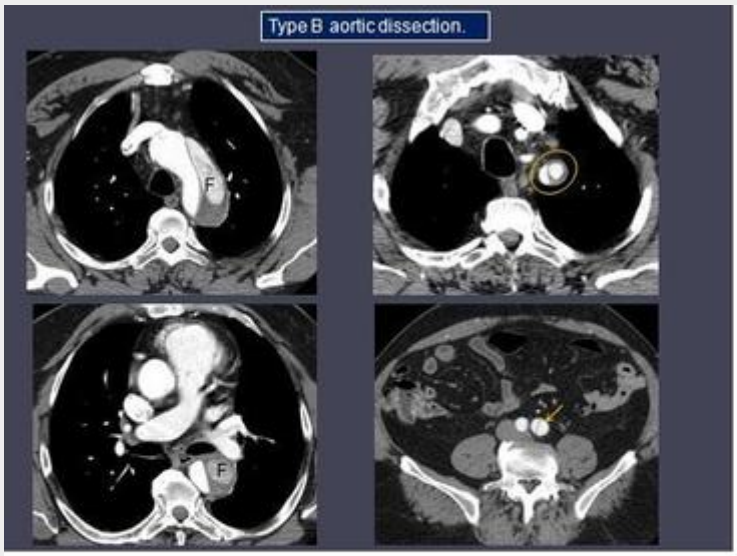

Type B aortic dissection. The dissection begins in the aortic arch and envolves also the left subclavian artery (circle). The false lumen (F) is typically seen in the outer curvature of aorta, has delayed enhancement (slower flow) and has a greater area. The dissection extends into the left iliac artery (arrow). Note partial thrombosis in the false lumen.

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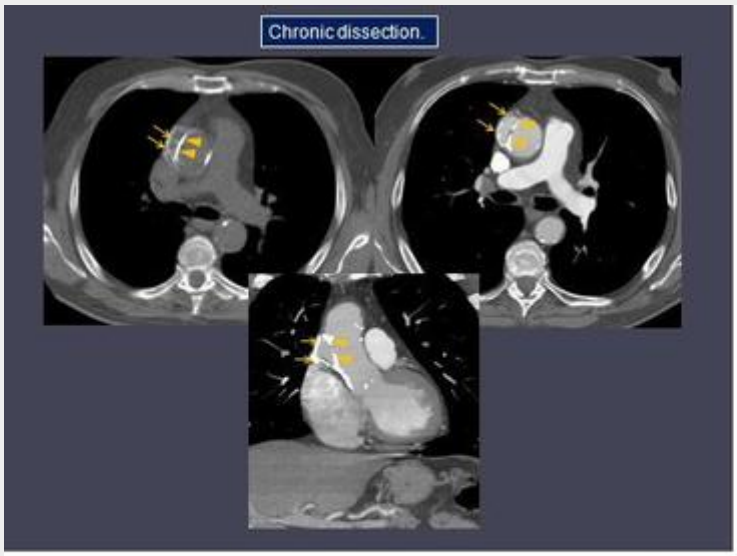

Chronic dissection – This patient had acute chest pain, however CT demonstrated wall calcifications in the false channel (arrows) indicative of a chronic process and aortic dissection could be excluded as the cause of acute chest pain. Intima (arrowheads).

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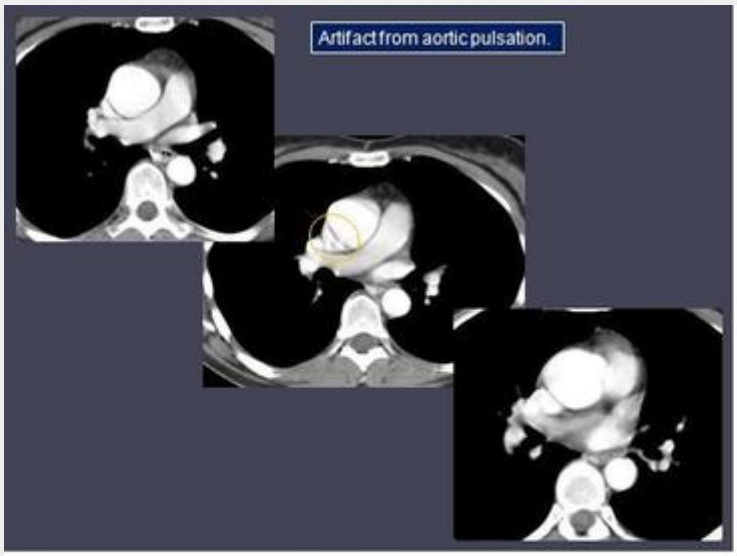
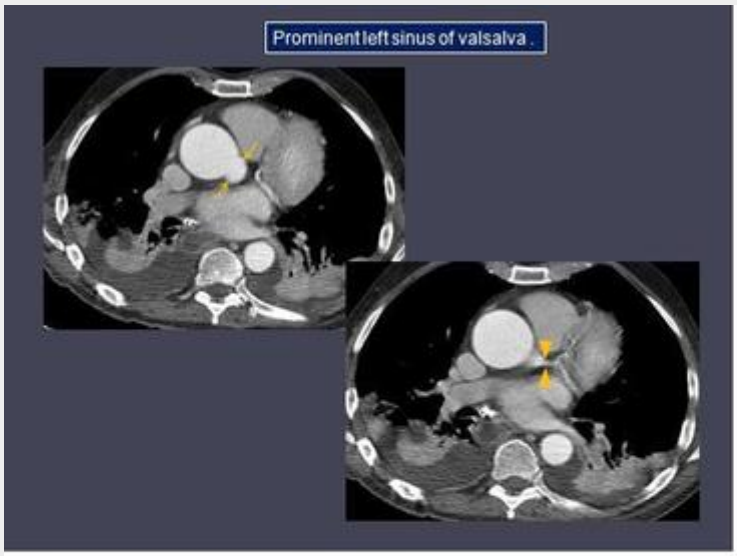


Curvilinear artifact from aortic pulsation mimetizing intimal flap (circle). It is tipically seen in the ascending aorta. Note that it is absent on contiguous sections which helps to avoid this common pitfall.

42.jpg



A prominent left sinus of valsalva (arrows) may mimic a dissection or a penetrating ulcer. Identification of the left coronary artery (arrowheads) arising from this structure is the key to avoid this pitfall.

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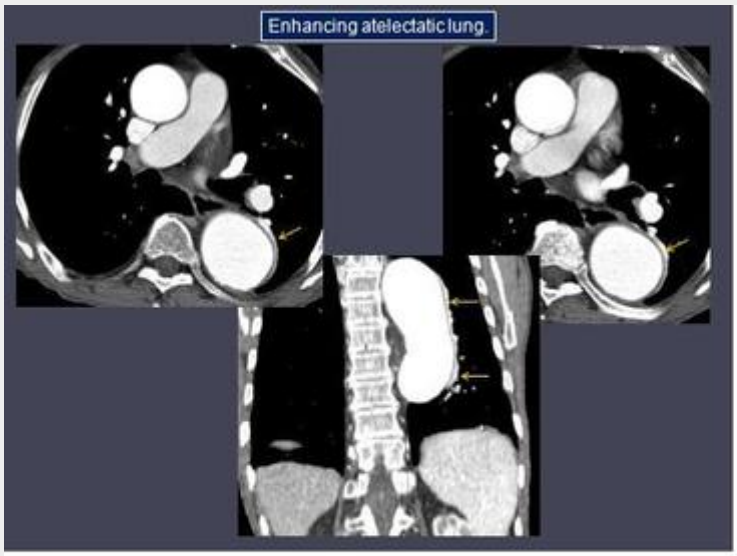

Enhancing atelectatic lung (arrows) is commonly seen adjacent to the aorta and may mimic a false lumen.

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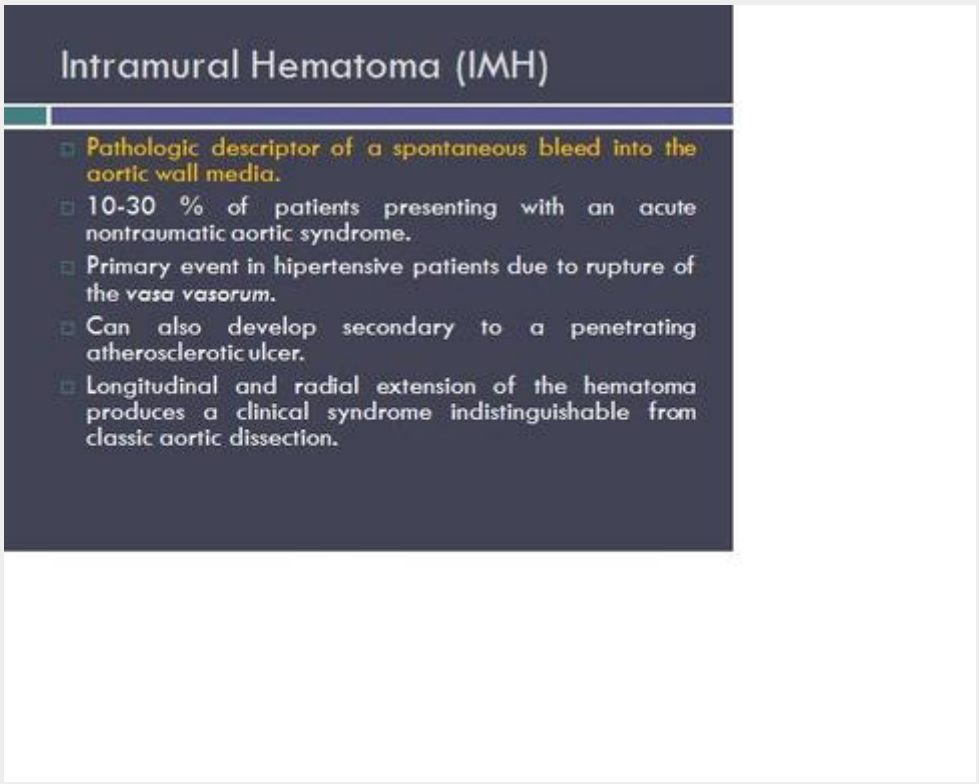
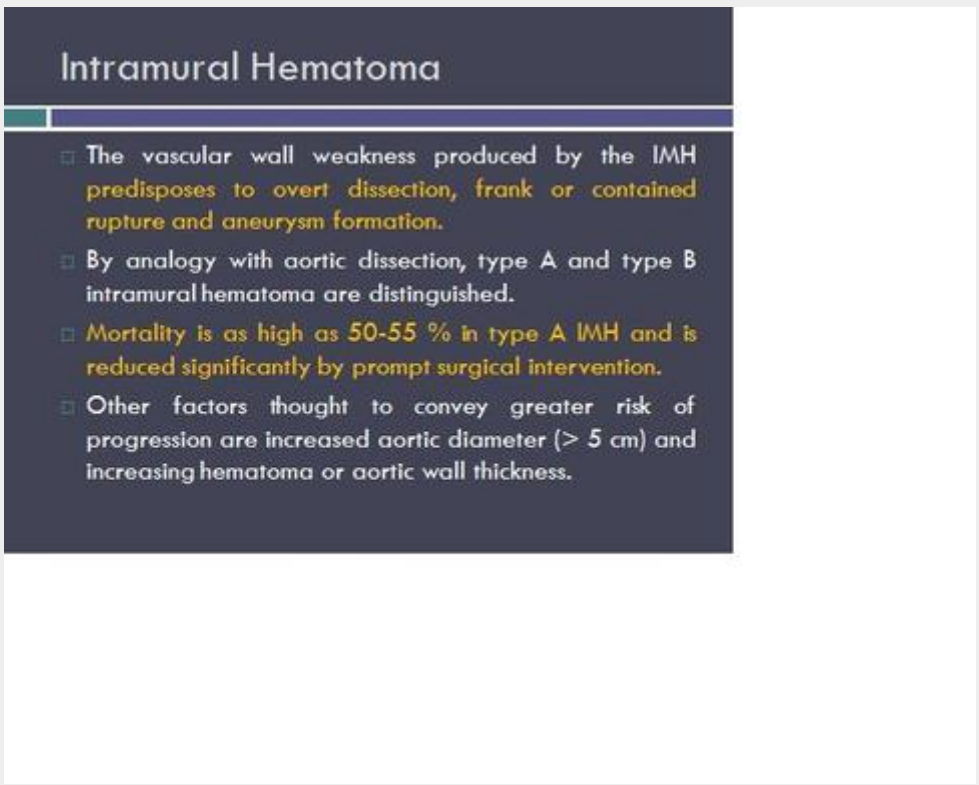
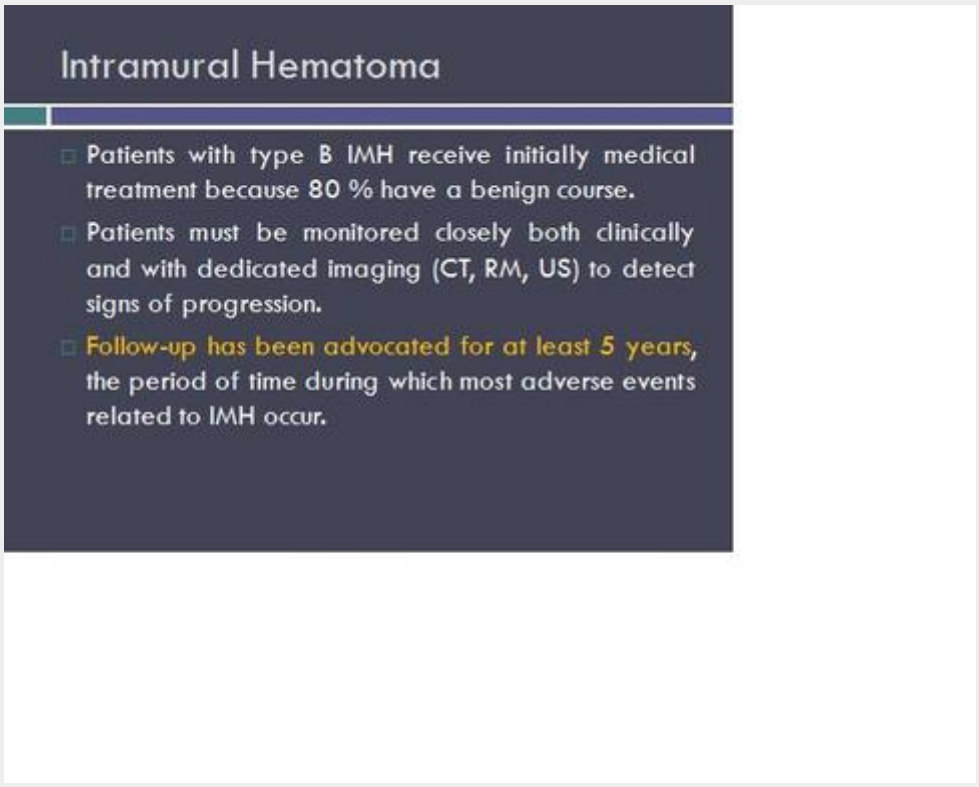

Intramural Hematoma (IMH)
Pathologic descriptor of a spontaneous bleed into the aortic wall media.
10-30 % of patients presenting with an acute nontraumatic aortic syndrome.
Primary event in hipertensive patients due to rupture of the vasa vasorum.
Can also develop secondary to a penetrating atherosclerotic ulcer.
Longitudinal and radial extension of the hematoma produces a clinical syndrome indistinguishable from classic aortic dissection.

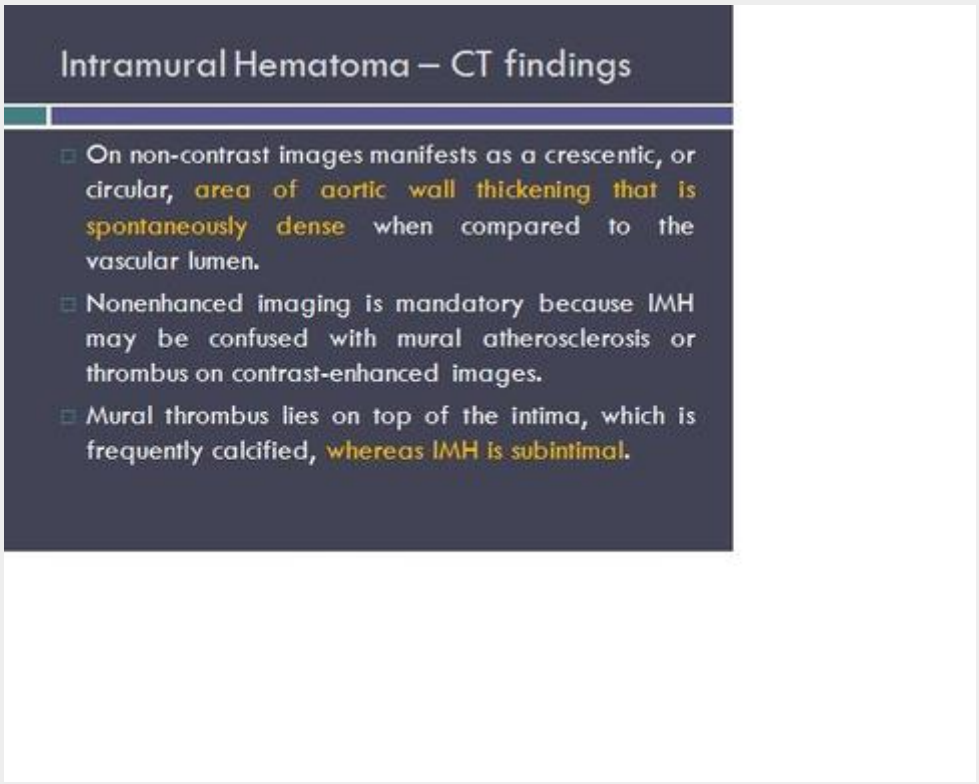
45.jpg


Intramural Hematoma
The vascular wall weakness produced by the IMH predisposes to overt dissection, frank or contained rupture and aneurysm formation.
By analogy with aortic dissection, type A and type B intramural hematoma are distinguished.
Mortality is as high as 50-55 % in type A IMH and is reduced significantly by prompt surgical intervention.
Other factors thought to convey greater risk of progression are increased aortic diameter (> 5 cm) and increasing hematoma or aortic wall thickness.

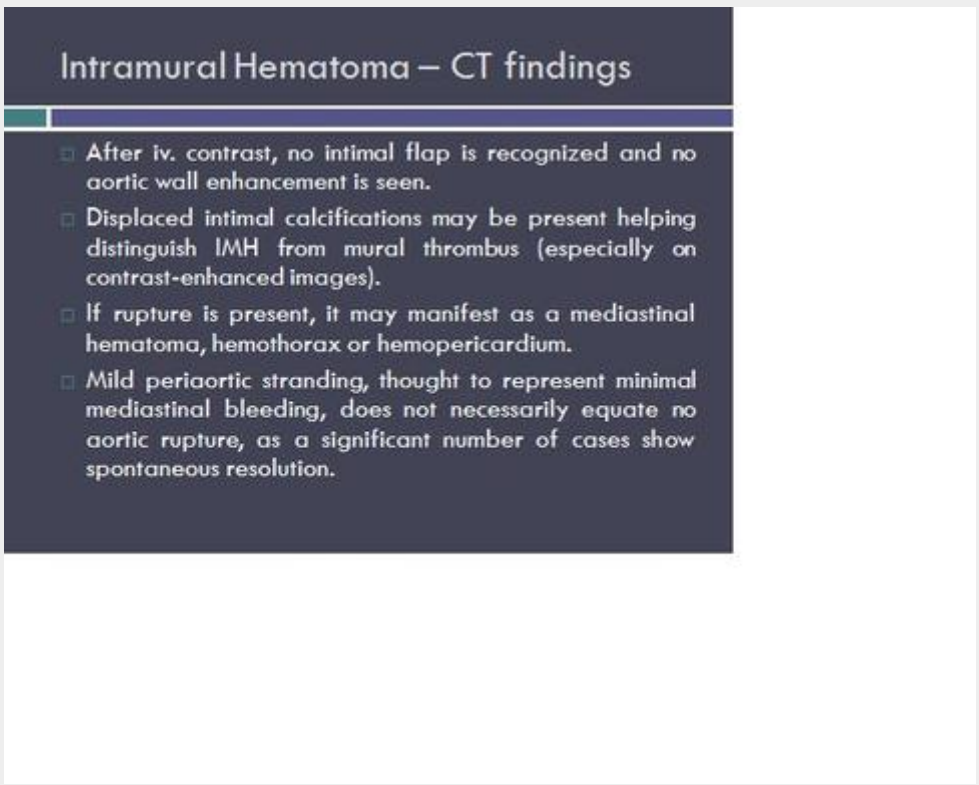
46.jpg


Intramural Hematoma
Patients with type B IMH receive initially medical treatment because 80 % have a benign course.
Patients must be monitored closely both clinically and with dedicated imaging (CT, RM, US) to detect signs of progression.
Follow-up has been advocated for at least 5 years, the period of time during which most adverse events related to IMH occur.

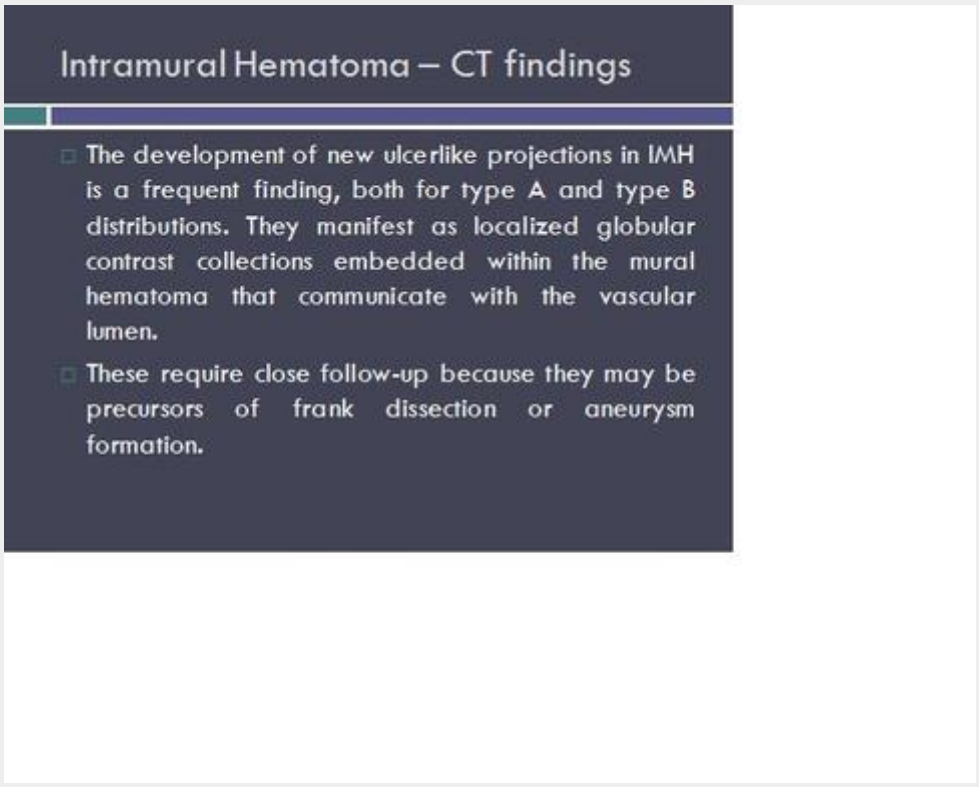
47.jpg


Intramural Hematoma – CT findings
On non-contrast images manifests as a crescentic, or circular, area of aortic wall thickening that is spontaneously dense when compared to the vascular lumen.
Nonenhanced imaging is mandatory because IMH may be confused with mural atherosclerosis or thrombus on contrast-enhanced images.
Mural thrombus lies on top of the intima, which is frequently calcified, whereas IMH is subintimal.

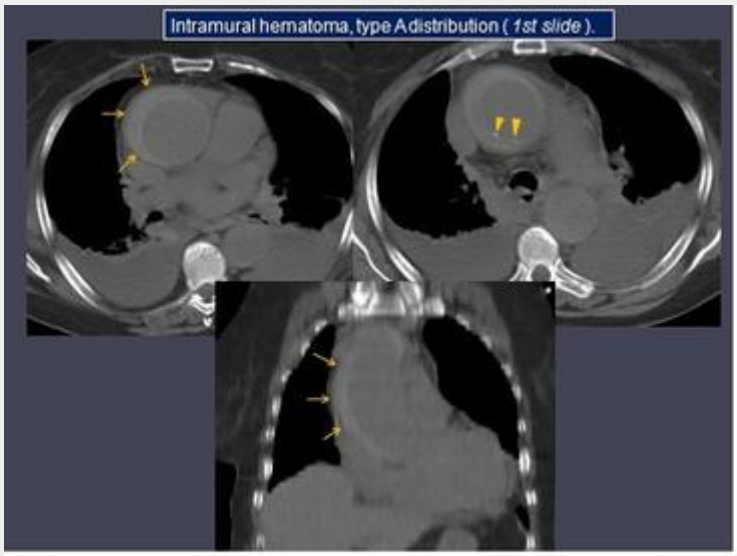
48.jpg


Intramural Hematoma – CT findings
After iv. contrast, no intimal flap is recognized and no aortic wall enhancement is seen.
Displaced intimal calcifications may be present helping distinguish IMH from mural thrombus (especially on contrast-enhanced images).
If rupture is present, it may manifest as a mediastinal hematoma, hemothorax or hemopericardium.
Mild periaortic stranding, thought to represent minimal mediastinal bleeding, does not necessarily equate no aortic rupture, as a significant number of cases show spontaneous resolution.

49.jpg


Intramural Hematoma – CT findings
The development of new ulcerlike projections in IMH is a frequent finding, both for type A and type B distributions. They manifest as localized globular contrast collections embedded within the mural hematoma that communicate with the vascular lumen.
These require close follow-up because they may be precursors of frank dissection or aneurysm formation.

50.jpg

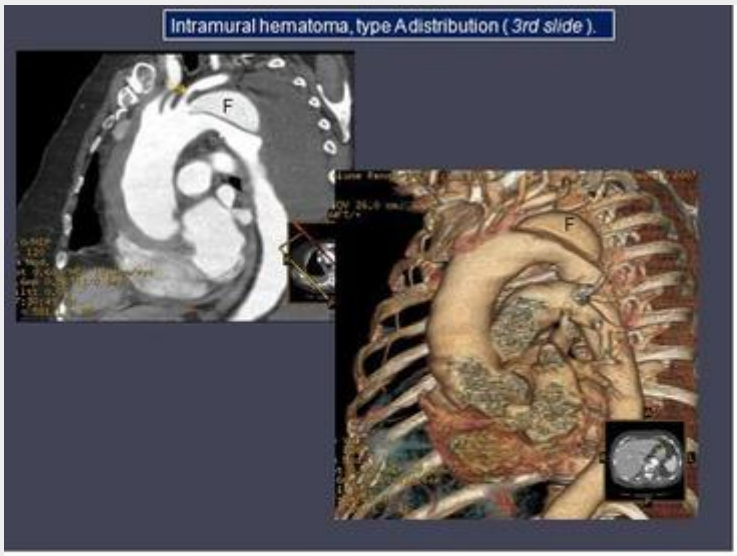


Intramural hematoma, type A distribution. Non-contrast enhanced CT demonstrates a hyperdense crescentic area in the lateral and anterior wall of the ascending aorta (arrows), with concomitant displacement of intimal calcifications (arrowheads).

51.jpg

Intramural hematoma, type A distribution. Intramural hematoma is harder to appreciate after contrast material injection (endoluminal thrombus can also have this appearance). There is also bilateral pleural effusion.

52.jpg

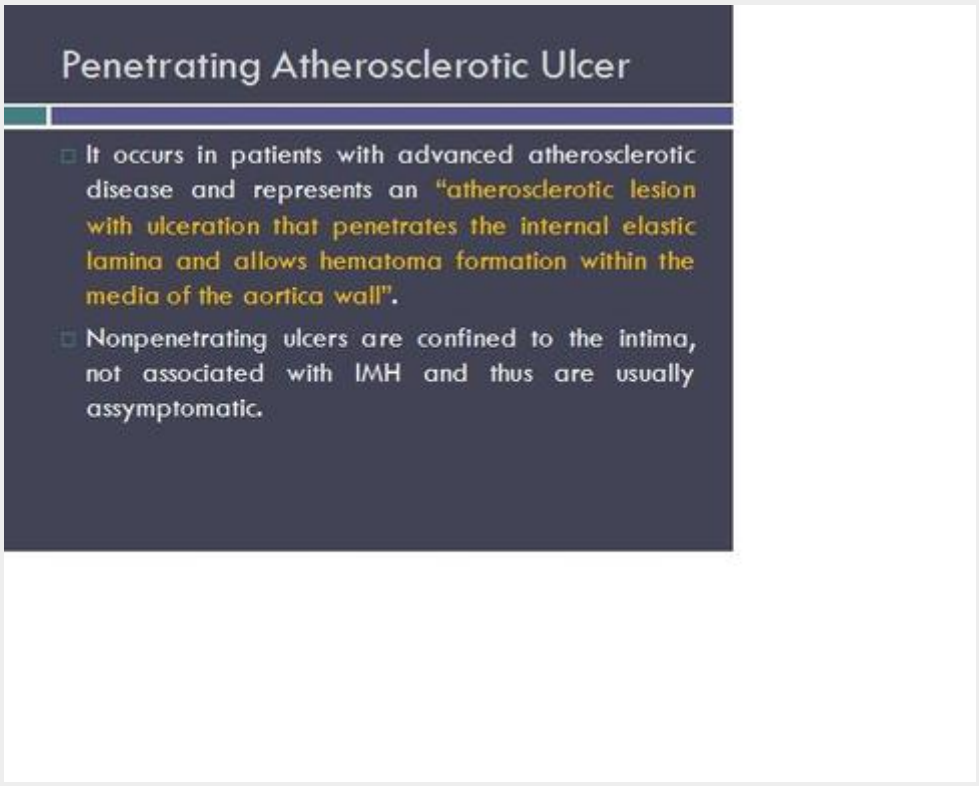


Intramural hematoma, type A distribution. This intramural hematoma has progressed into a small dissection, that starts just after the origin of the left subclavian artery (arrow). F = False lumen.

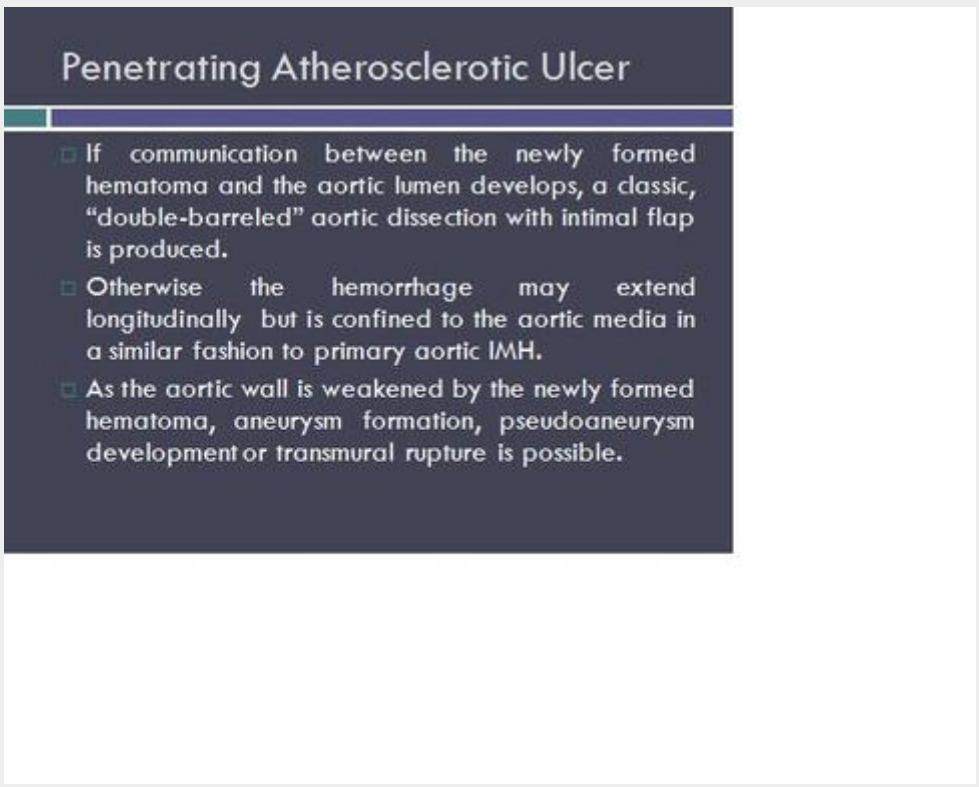
53.jpg

Intramural hematoma, type A distribution. Ten days later (right image), the false (F) lumen has acutely thrombosed (high attenuation material inside it), with exclusive enhancement of the true lumen.

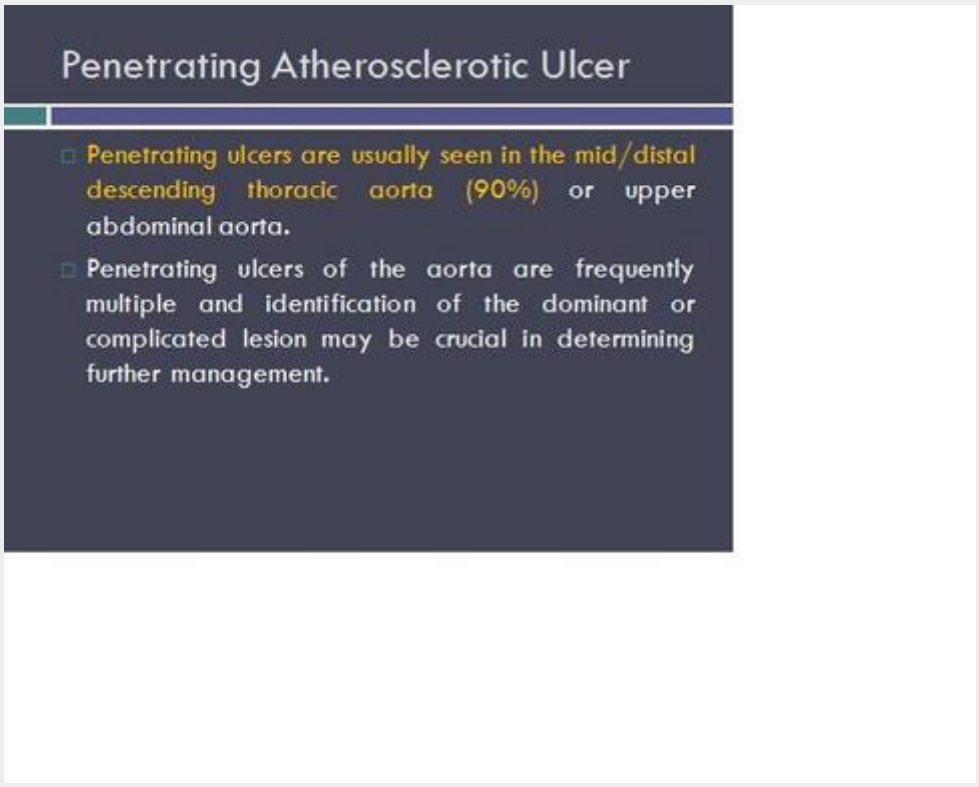
54.jpg


Penetrating Atherosclerotic Ulcer
It occurs in patients with advanced atherosclerotic disease and represents an "atherosclerotic lesion with ulceration that penetrates the internal elastic lamina and allows hematoma formation within the media of the aortica wall".
Nonpenetrating ulcers are confined to the intima, not associated with IMH and thus are usually assymptomatic.

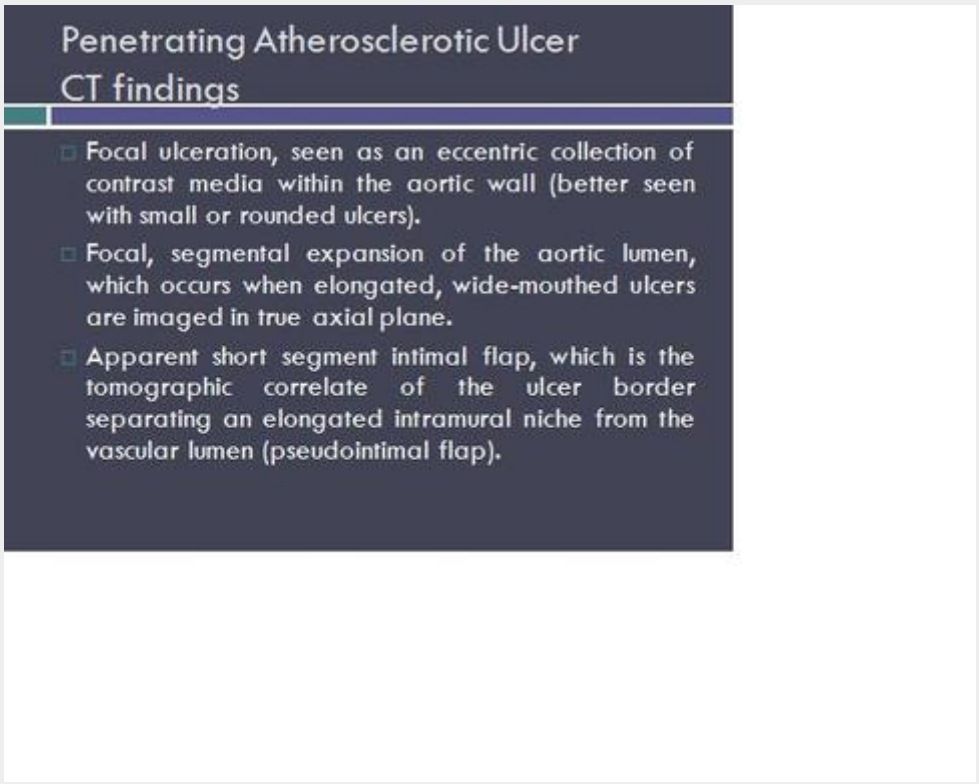
55.jpg


Penetrating Atherosclerotic Ulcer
If communication between the newly formed hematoma and the aortic lumen develops, a classic, "double-barreled" aortic dissection with intimal flap is produced.
Otherwise the hemorrhage may extend longitudinally but is confined to the aortic media in a similar fashion to primary aortic IMH.
As the aortic wall is weakened by the newly formed hematoma, aneurysm formation, pseudoaneurysm development or transmural rupture is possible.

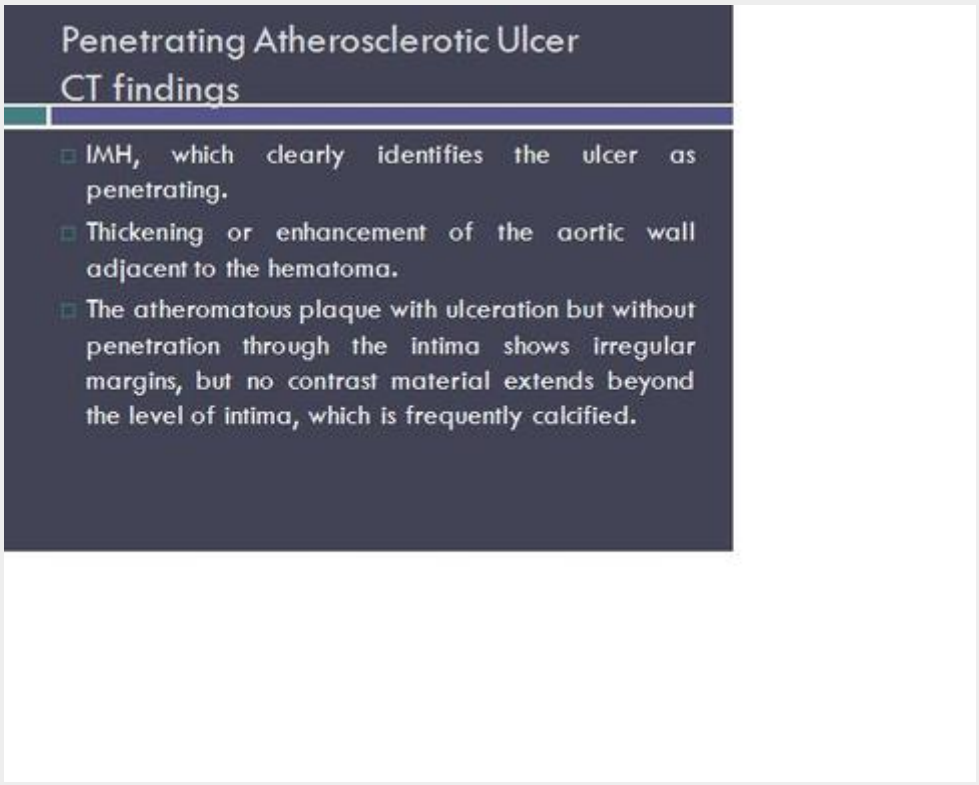
56.jpg


Penetrating Atherosclerotic Ulcer
Penetrating ulcers are usually seen in the mid/distal descending thoracic aorta (90%) or upper abdominal aorta.
Penetrating ulcers of the aorta are frequently multiple and identification of the dominant or complicated lesion may be crucial in determining further management.

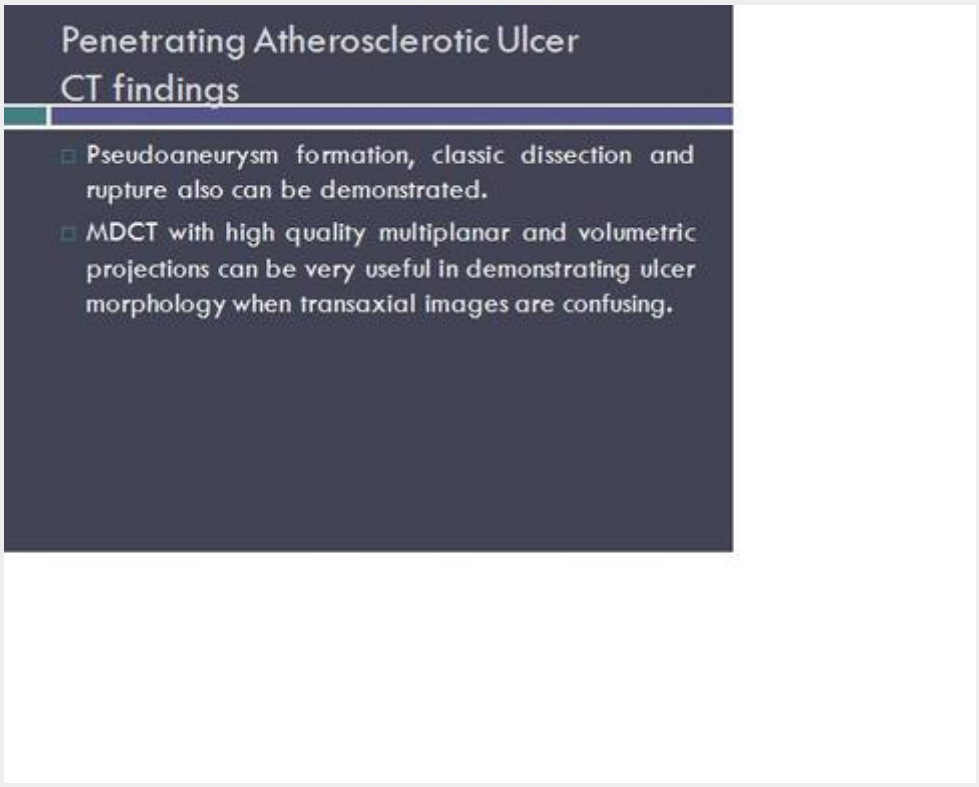
57.jpg


Penetrating Atherosclerotic Ulcer
CT findings
Focal ulceration, seen as an eccentric collection of contrast media within the aortic wall (better seen with small or rounded ulcers).
Focal, segmental expansion of the aortic lumen, which occurs when elongated, wide-mouthed ulcers are imaged in true axial plane.
Apparent short segment intimal flap, which is the tomographic correlate of the ulcer border separating an elongated intramural niche from the vascular lumen (pseudointimal flap).

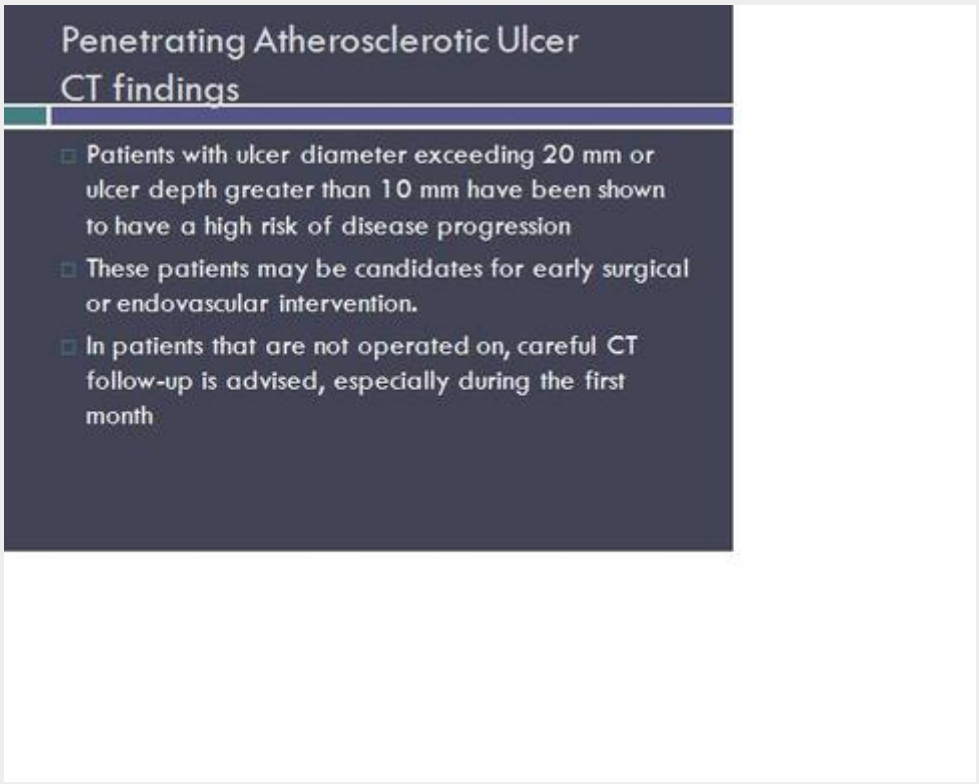
58.jpg


Penetrating Atherosclerotic Ulcer
CT findings
IMH, which clearly identifies the ulcer as penetrating.
Thickening or enhancement of the aortic wall adjacent to the hematoma.
The atheromatous plaque with ulceration but without penetration through the intima shows irregular margins, but no contrast material extends beyond the level of intima, which is frequently calcified.

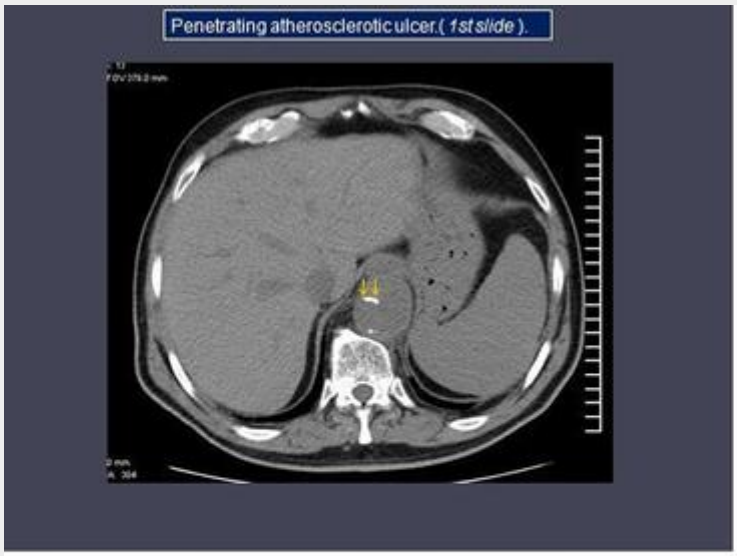
59.jpg


Penetrating Atherosclerotic Ulcer
CT findings
Pseudoaneurysm formation, classic dissection and rupture also can be demonstrated.
MDCT with high quality multiplanar and volumetric projections can be very useful in demonstrating ulcer morphology when transaxial images are confusing.

60.jpg


Penetrating Atherosclerotic Ulcer
CT findings
Patients with ulcer diameter exceeding 20 mm or ulcer depth greater than 10 mm have been shown to have a high risk of disease progression
These patients may be candidates for early surgical or endovascular intervention.
In patients that are not operated on, careful CT follow-up is advised, especially during the first month

61.jpg

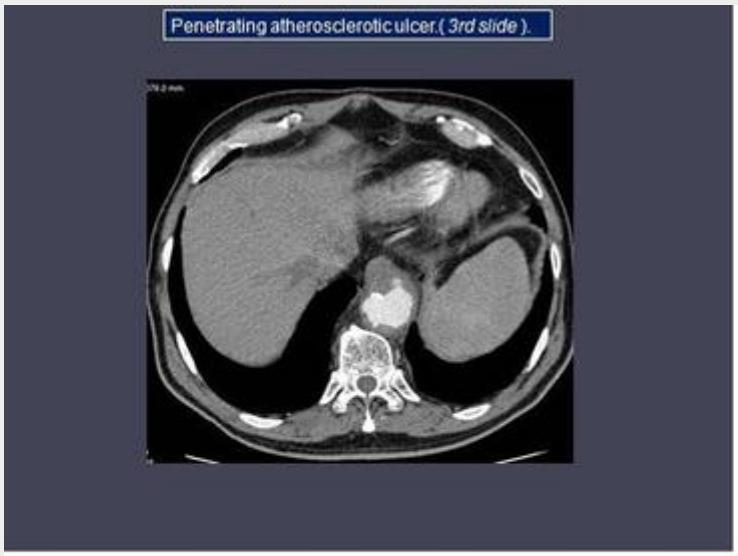


Penetrating atherosclerotic ulcer. Unenhanced CT shows bulge of the left antero-lateral aspect of the distal descending thoracic aorta and intima calcification (arrows).

62.jpg

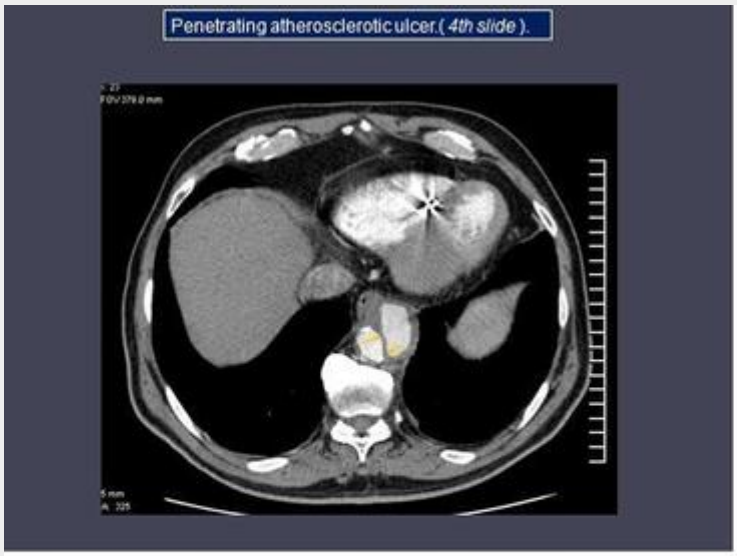
Penetrating atherosclerotic ulcer. Conventional angiography shows saccular aneurysm in the distal third of the descending thoracic aorta.

63.jpg



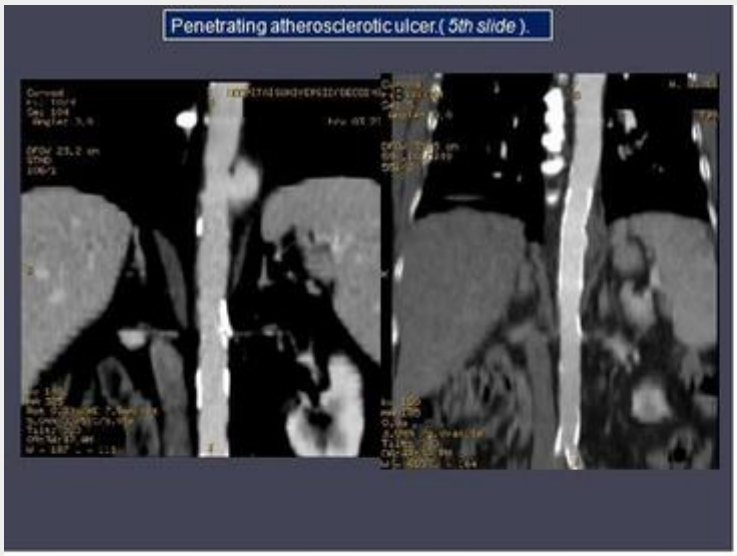
Penetrating atherosclerotic ulcer. Enhanced CT shows sacular aneurysm caused by penetrating atherosclerotic ulcer, associated with enhanced thickening of the aortic wall.

64.jpg



Apparent short segment intimal flap, which is the tomographic correlate of the ulcer border separating an elongated intramural niche from the vascular lumen - pseudointimal flap (arrows).

65.jpg

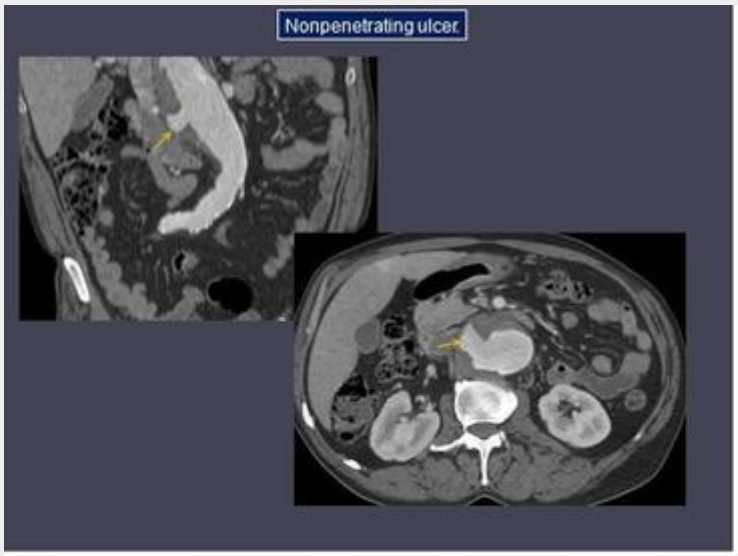


Penetrating atherosclerotic ulcer. Curved-MIP. Saccular aneurysm before (A) and after (B) stenting. MDCT with high quality multiplanar and volumetric projections can be very useful in demonstrating ulcer morphology when transaxial images are confusing.

66.jpg

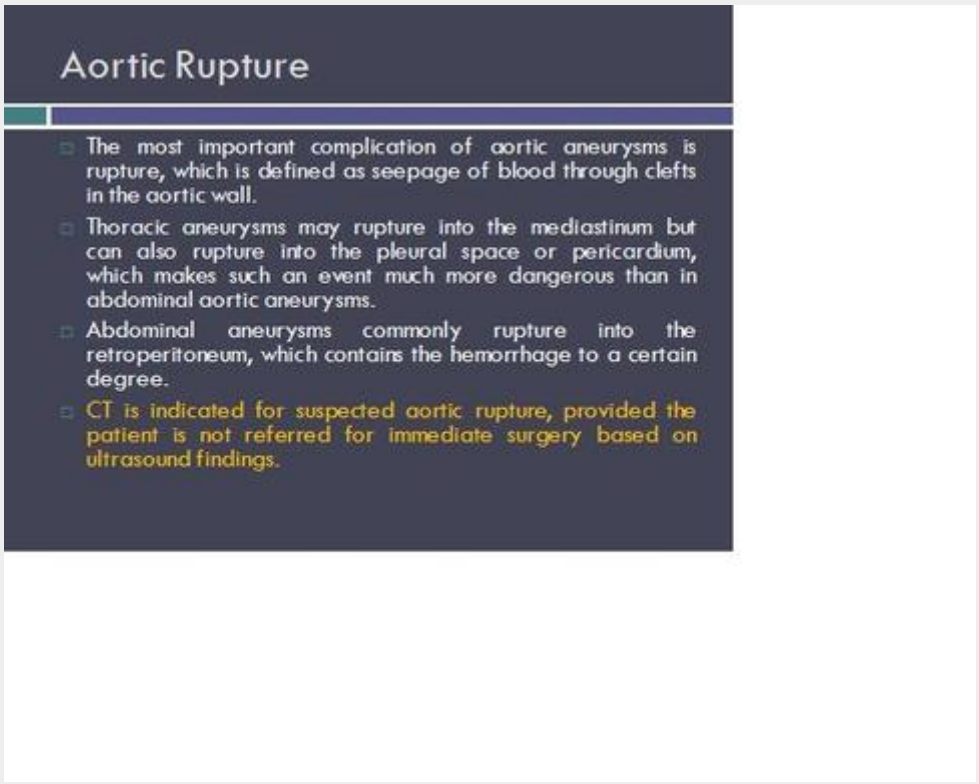
Penetrating atherosclerotic ulcer. VRT. Saccular aneurysm before (A) and after (B) stenting. MDCT with high quality multiplanar and volumetric projections can be very useful in demonstrating ulcer morphology when transaxial images are confusing.

67.jpg



Nonpenetrating ulcer. There is a thrombus with focal ulceration (arrows), but no contrast material is extending beyond level of intima and no intramural hematoma is present. The patient was assymptomatic.

68.jpg


Aortic Rupture
The most important complication of aortic aneurysms is rupture, which is defined as seepage of blood through clefts in the aortic wall.
Thoracic aneurysms may rupture into the mediastinum but can also rupture into the pleural space or pericardium, which makes such an event much more dangerous than in abdominal aortic aneurysms.
Abdominal aneurysms commonly rupture into the retroperitoneum, which contains the hemorrhage to a certain degree.
CT is indicated for suspected aortic rupture, provided the patient is not referred for immediate surgery based on ultrasound findings.

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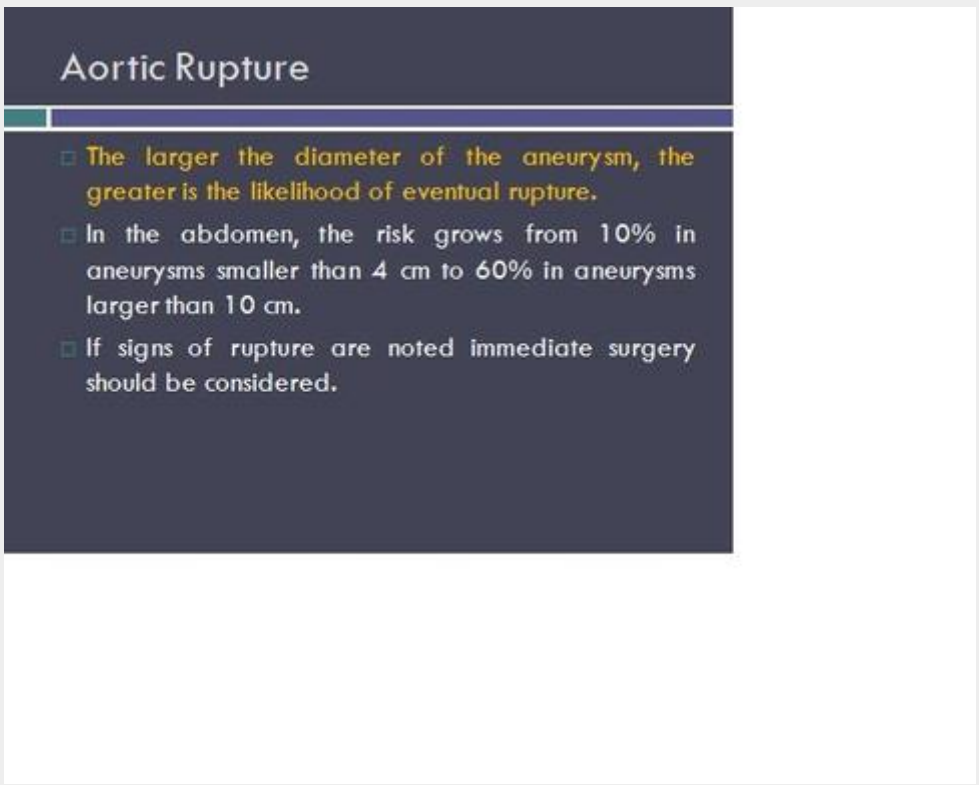
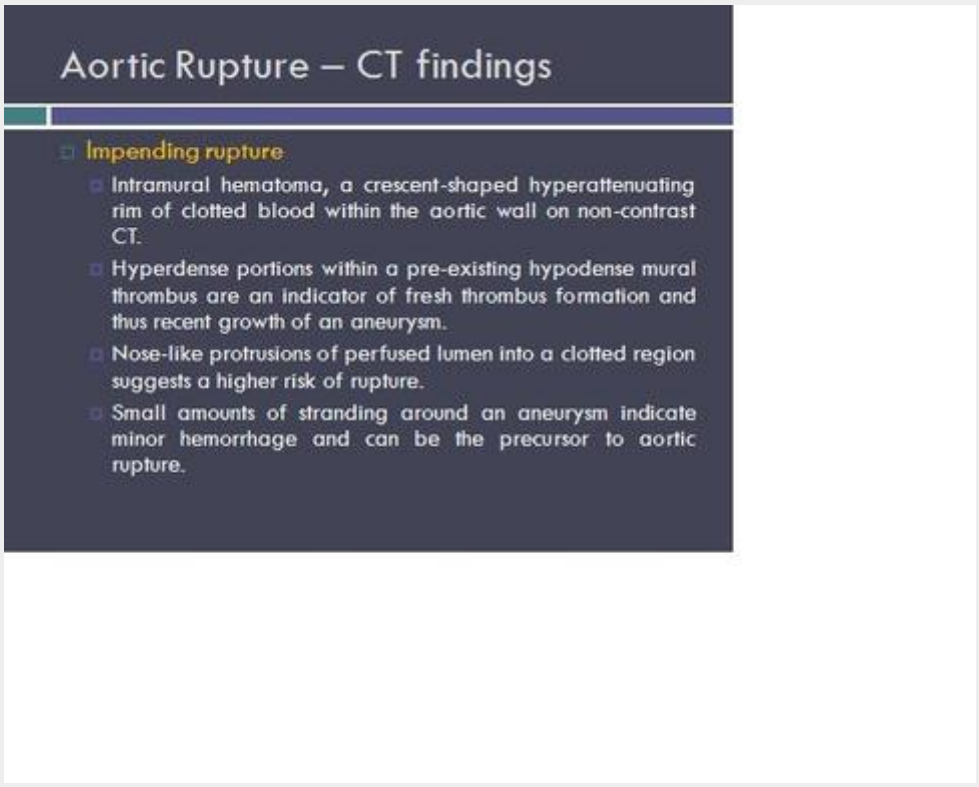
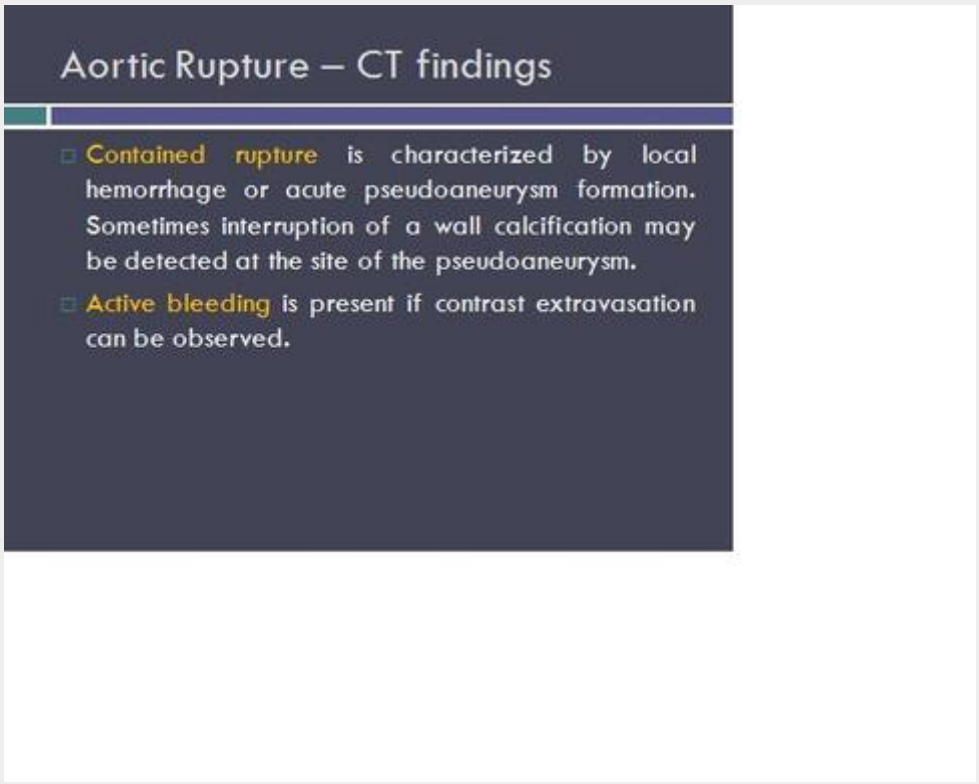

Aortic Rupture
The larger the diameter of the aneurysm, the greater is the likelihood of eventual rupture.
In the abdomen, the risk grows from 10% in aneurysms smaller than 4 cm to 60% in aneurysms larger than 10 cm.
If signs of rupture are noted immediate surgery should be considered.

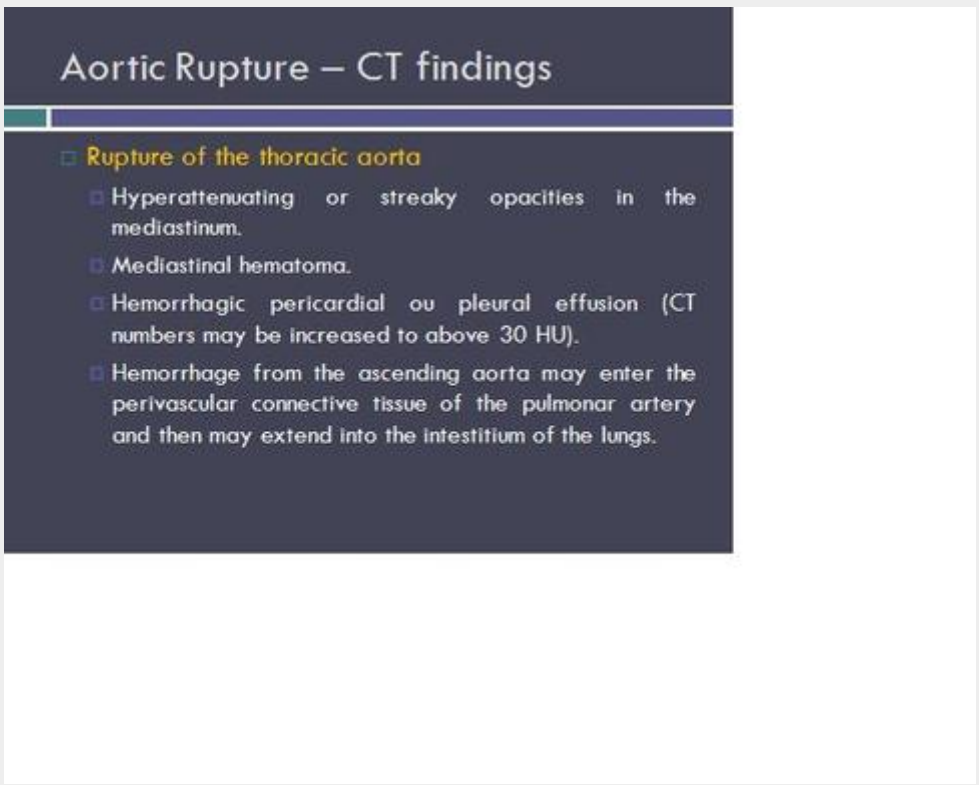
70.jpg


Aortic Rupture – CT findings
Impending rupture
Intramural hematoma, a crescent-shaped hyperattenuating rim of clotted blood within the aortic wall on non-contrast CT.
Hyperdense portions within a pre-existing hypodense mural thrombus are an indicator of fresh thrombus formation and thus recent growth of an aneurysm.
Nose-like protrusions of perfused lumen into a clotted region suggests a higher risk of rupture.
Small amounts of stranding around an aneurysm indicate minor hemorrhage and can be the precursor to aortic rupture.

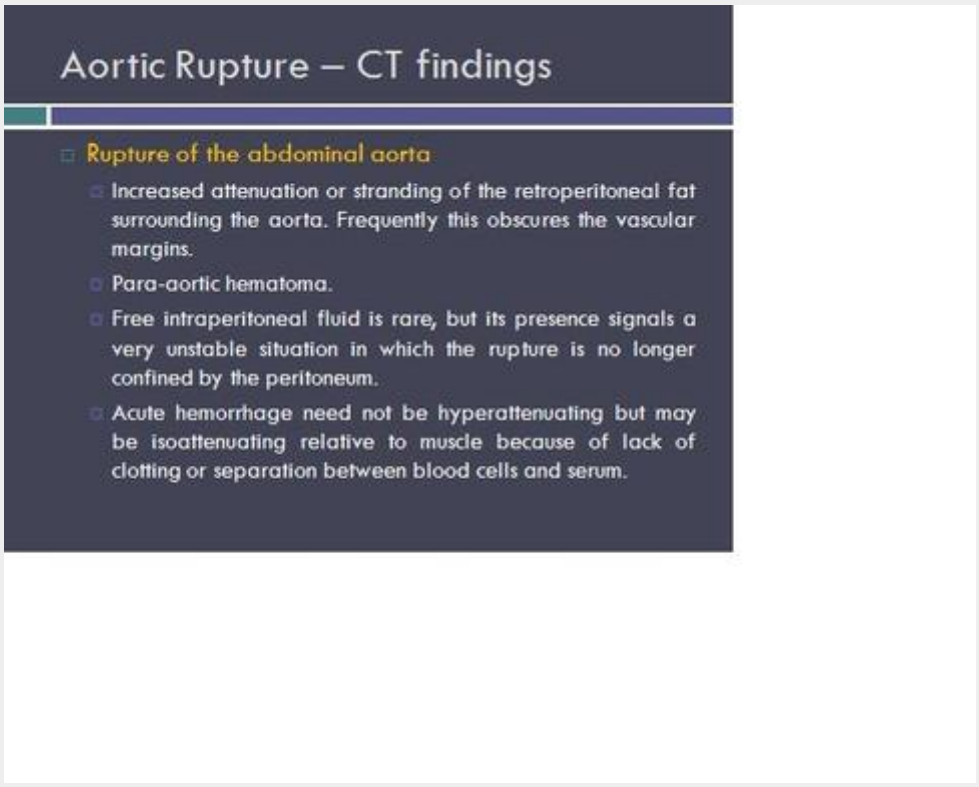
71.jpg


Aortic Rupture – CT findings
Contained rupture is characterized by local hemorrhage or acute pseudoaneurysm formation. Sometimes interruption of a wall calcification may be detected at the site of the pseudoaneurysm.
Active bleeding is present if contrast extravasation can be observed.

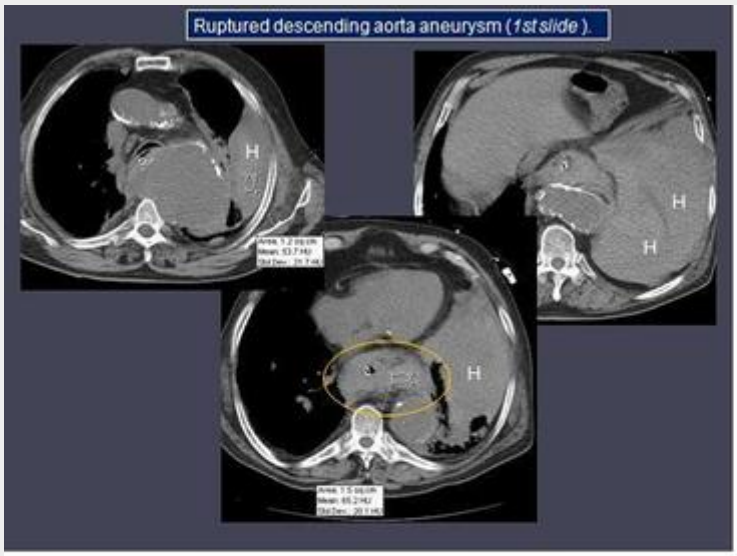
72.jpg


Aortic Rupture – CT findings
Rupture of the thoracic aorta
Hyperattenuating or streaky opacities in the mediastinum.
Mediastinal hematoma.
Hemorrhagic pericardial ou pleural effusion (CT numbers may be increased to above 30 HU).
Hemorrhage from the ascending aorta may enter the perivascular connective tissue of the pulmonar artery and then may extend into the intestitium of the lungs.

73.jpg

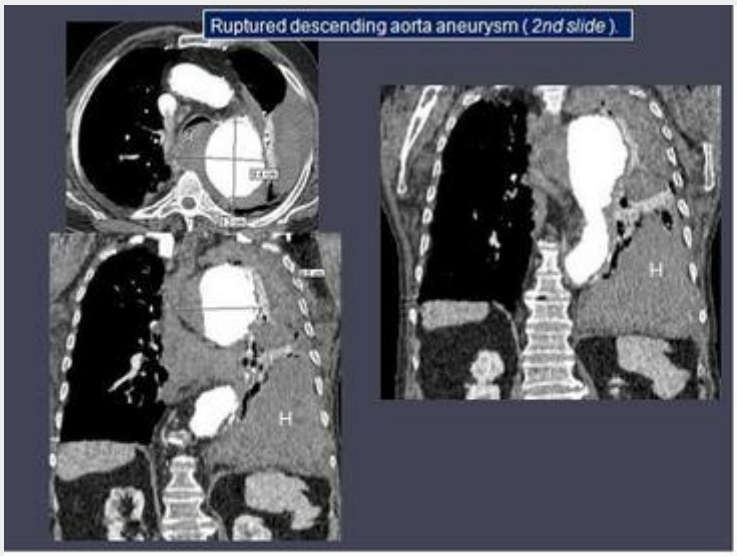

Aortic Rupture – CT findings
Rupture of the abdominal aorta
Increased attenuation or stranding of the retroperitoneal fat surrounding the aorta. Frequently this obscures the vascular margins.
Para-aortic hematoma.
Free intraperitoneal fluid is rare, but its presence signals a very unstable situation in which the rupture is no longer confined by the peritoneum.
Acute hemorrhage need not be hyperattenuating but may be isoattenuating relative to muscle because of lack of clotting or separation between blood cells and serum.

74.jpg



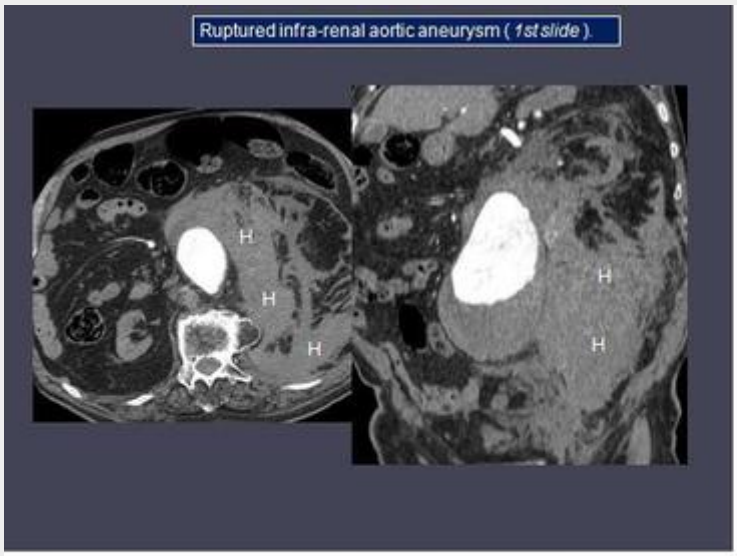
Ruptured descending aorta aneurysm. There is a large left hemothorax (H) (HU > to 50) and hematoma in posterior mediastinum (circle).

75.jpg



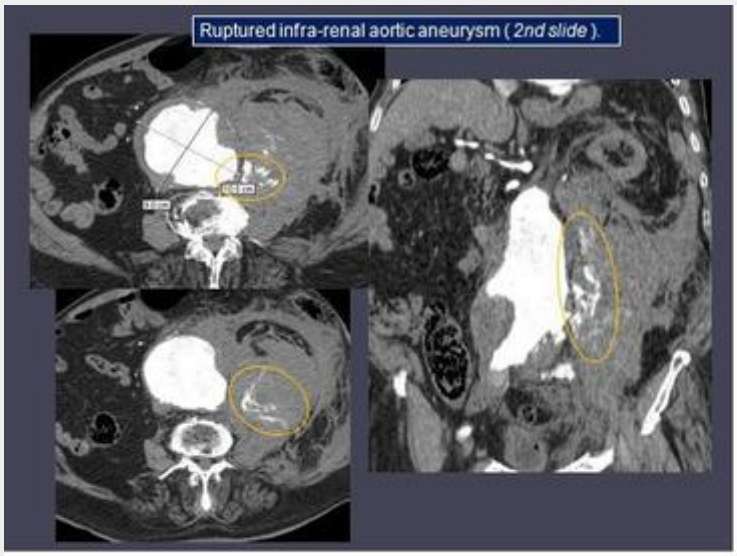
Ruptured descending aorta aneurysm. After CIV there was no active contrast extravasation. Note that the left hemidiaphragm is somewhat lower than normal due to the volumous left hemothorax (H).

76.jpg



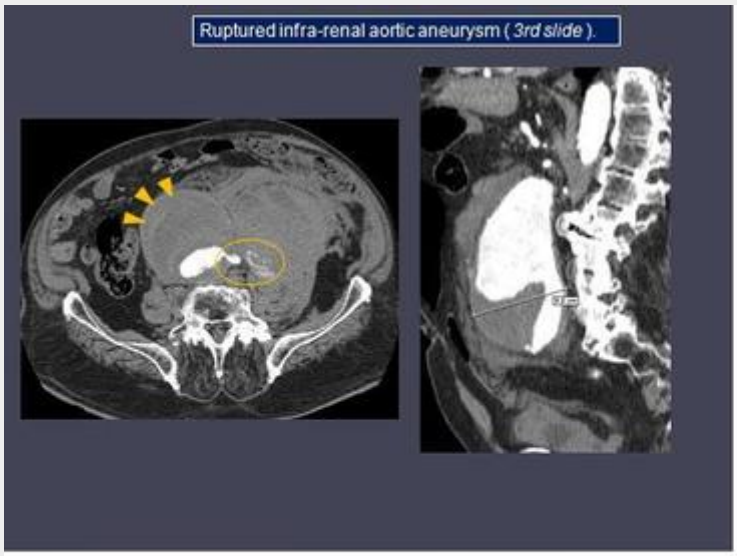
Ruptured infra-renal aortic aneurysm. Volumous left para-aortic hematoma (H).

77.jpg



Ruptured infra-renal aortic aneurysm. Active bleeding is present indicated by active contrast extravasation (circles).

78.jpg



Ruptured infra-renal aortic aneurysm. Note the high attenuation portions within the mural thrombus of the aneurysm indicating fresh thrombotic material (arrowheads). There is also focal area of wall rupture and active contrast extravasation.

79.jpg

Contained rupture of ascending aorta characterized by acute pseudoaneurysm formation (circle).

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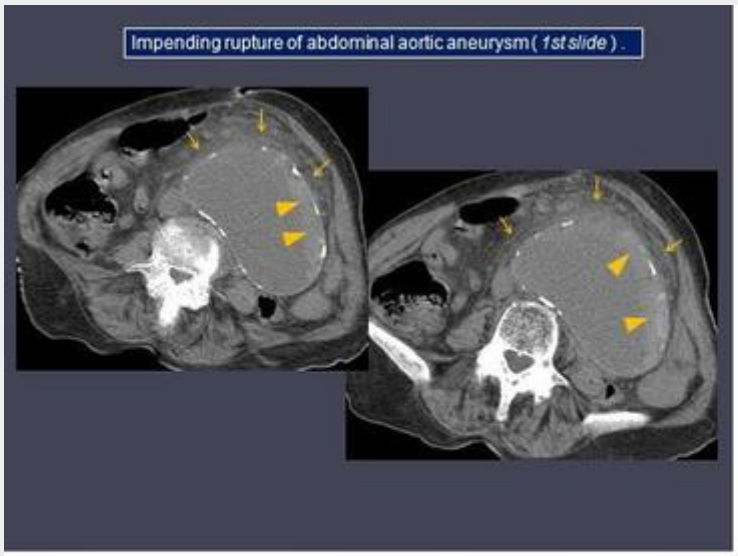
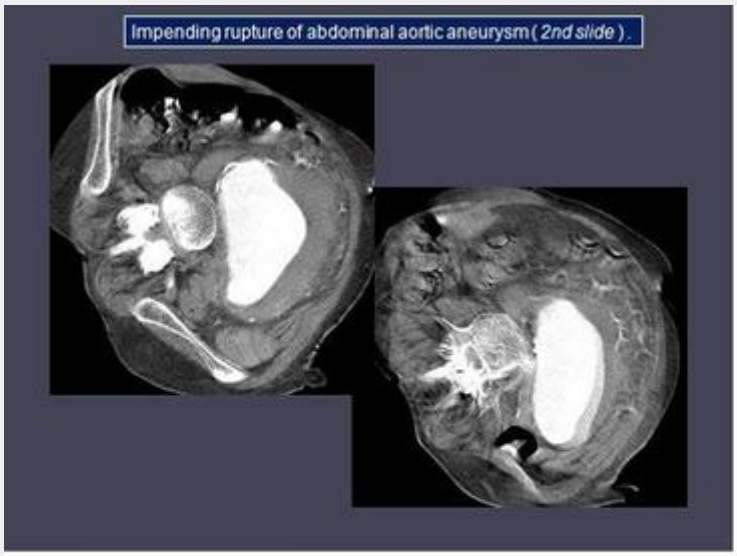


Impending rupture of abdominal aortic aneurysm. Hyperdense portions (arrowheads) within a pre-existing hypodense mural thrombus are an indicator of fresh thrombus formation and thus recent growth of an aneurysm. There is also stranding (arrows) around the aneurysm obscuring the vascular margins, an important sign that can indicate minor hemorrhage.

81.jpg

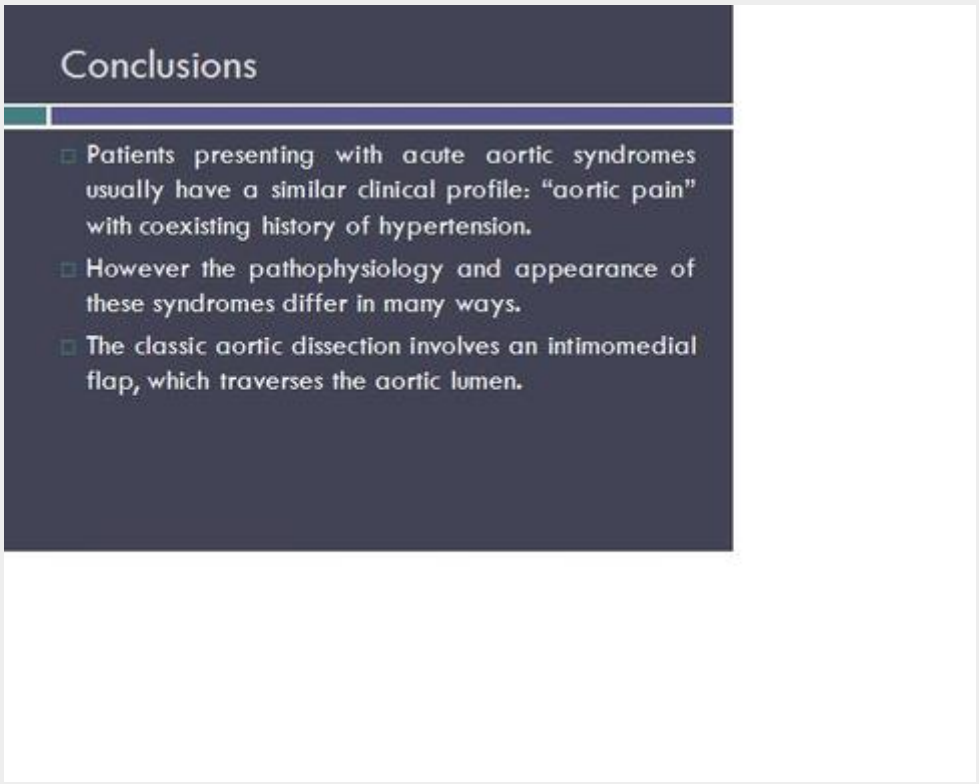


Impending rupture of abdominal aortic aneurysm. After CIV the patient moved a loted with marked motion artifacts. Apparently there was no active contrast extravasation.

4. Conclusion

.....Conclusion.....

82.jpg


Conclusions
Patients presenting with acute aortic syndromes usually have a similar clinical profile: "aortic pain" with coexisting history of hypertension.
However the pathophysiology and appearance of these syndromes differ in many ways.
The classic aortic dissection involves an intimomedial flap, which traverses the aortic lumen.

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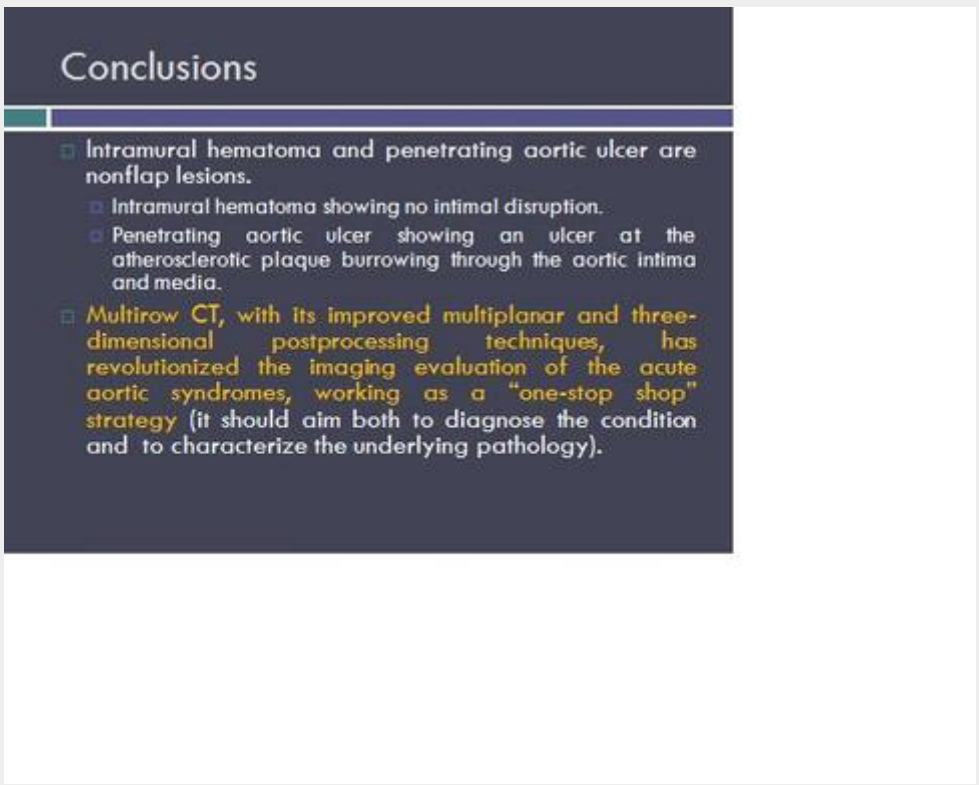
Conclusions
Intramural hematoma and penetrating aortic ulcer are nonflap lesions.
Intramural hematoma showing no intimal disruption.
Penetrating aortic ulcer showing an ulcer at the atherosclerotic plaque burrowing through the aortic intima and media.
Multirow CT, with its improved multiplanar and three-dimensional postprocessing techniques, has revolutionized the imaging evaluation of the acute aortic syndromes, working as a "one-stop shop" strategy (it should aim both to diagnose the condition and to characterize the underlying pathology).

5. References

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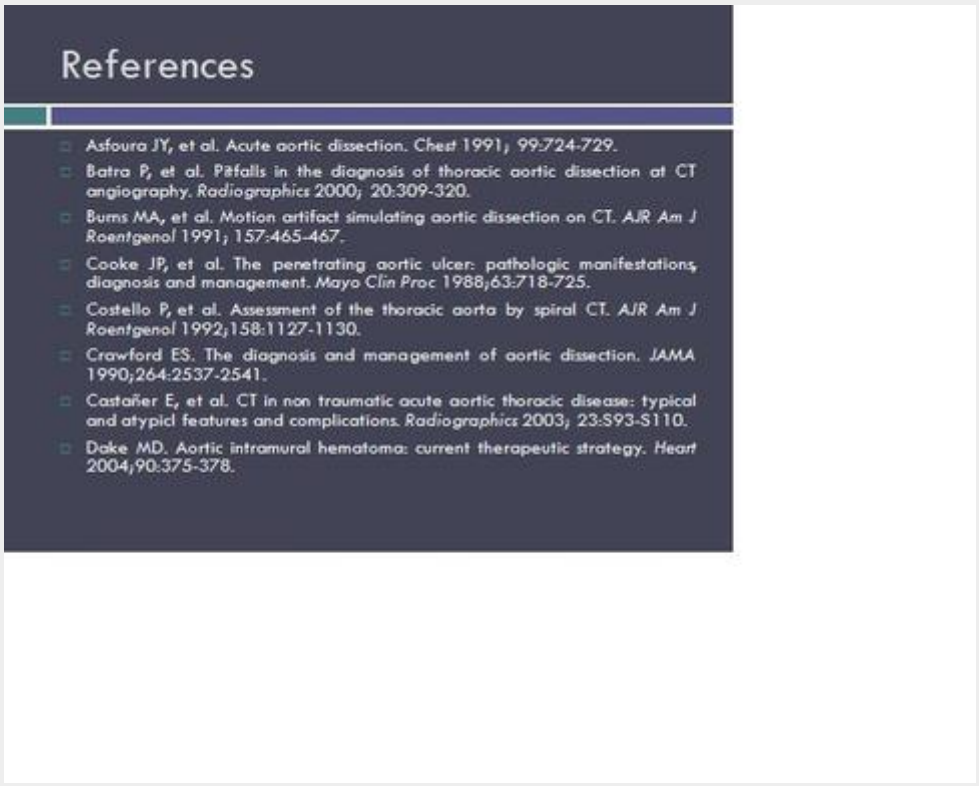

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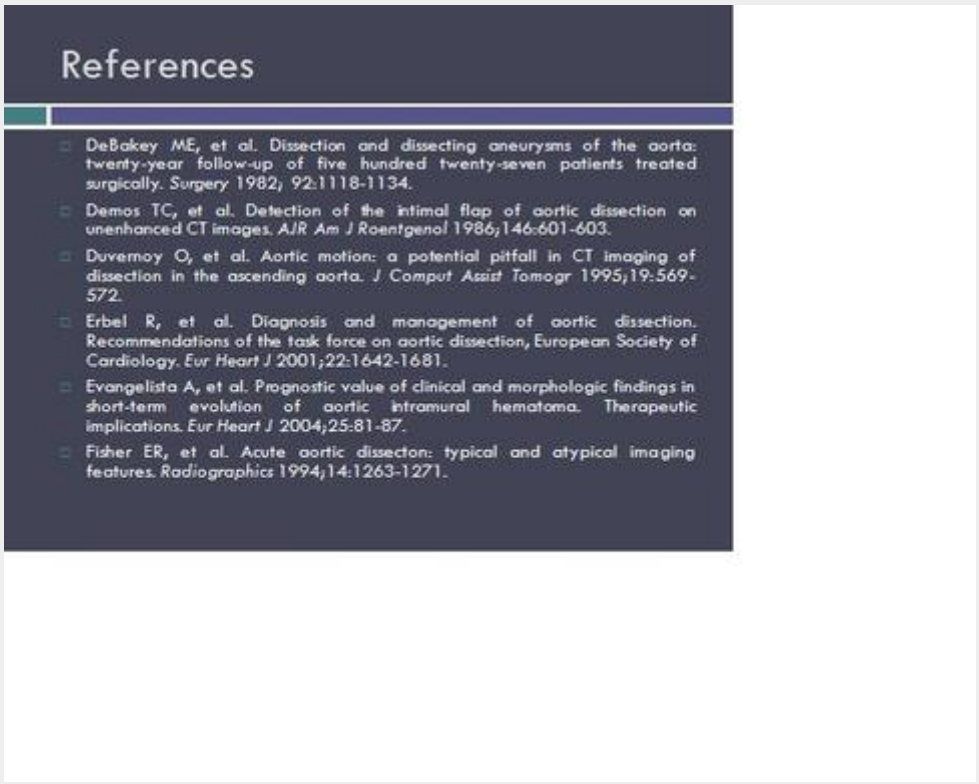
References
DeBakey ME, et al. Dissection and dissecting aneurysms of the aorta: twenty-year follow-up of five hundred twenty-seven patients treated surgically. Surgery 1982; 92:1118-1134.
Demos TC, et al. Detection of the intimal flap of aortic dissection on unenhanced CT images. AJR Am J Roentgenol 1986;146:601-603.
Duvernoy O, et al. Aortic motion: a potential pitfall in CT imaging of dissection in the ascending aorta. J Comput Assist Tomogr 1995;19:569-572.
Erbel R, et al. Diagnosis and management of aortic dissection. Recommendations of the task force on aortic dissection, European Society of Cardiology. Eur Heart J 2001;22:1642-1681.
Evangelista A, et al. Prognostic value of clinical and morphologic findings in short-term evolution of aortic intramural hematoma. Therapeutic implications. Eur Heart J 2004;25:81-87.
Fisher ER, et al. Acute aortic dissecton: typical and atypical imaging features. Radiographics 1994;14:1263-1271.

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References
Gallagher S, et al. Streak artefacts of the thoracic aorta: pseudodissection. J Comput Assist Tomogr 1984;8:688-693.
Godwin JD, et al. Problems and pitfalls in the evaluation of thoracic aortic dissection by computed tomography. J Comput Assist Tomogr 1982;6:750-756.
Gotway MB, et al. Thoracic aorta imaging with multislice CT. Radiol Clin North Am 2003;41:521-543.
Harris JA, et al. Penetrating atherosclerotic ulcers of the aorta. J Vasc Surg 1994;19:619-626.
Hayashi H, et al. Penetrating atherosclerotic ulcer of the aorta: imaginf features and disease concept. Radiographics 2000;20:995-1005.
Heiberg E, et al. CT findings in thoracic aortic dissection. AJR am J Roentgenol 1981;136:13-17.
Kapoor V, et al. Intimomedial rupture: a new CT finding to distinguish true from false lumen in aortic dissection. AJR am J Roentgenol 2004;183:109-112.
Kastan DJ, et al. Intimo-intimal intussusception: an unusual presentation of aortic dissection. AJR am J Roentgenol 1988;151:603-604.

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References
Kazerooni EA, et al. Penetrating atherosclerotic ulcers of the descending thoracic aorta: evaluation with CT and distinction from aortic dissection. Radiology 1992;183:759-765.
Landay MJ, et al. "Hyperdense" aortic wall: potential pitfall in CT screening for aortic dissection. J Comput Assist Tomogr 1991;15:561-564.
LePage MA, et al. Aortic dissection: CT features that distinguishe true lumen from false lumen. Ajr Am J Roentgenol 2001;177:207-211.
Levy JR, et al. Imaging of penetrating atherosclerotic ulcers of the aorta. Ajr Am J Roentgenol 1999;173:151-154.
Macura KJ, et al. Pathogenesis in acute aortic syndromes: aortic dissection, intramural hematoma and penetrating atherosclerotic ulcer. Ajr Am J Roentgenol 2003;181:309-316.
Macura KJ, et al. Role of computed tomography and magnetic resonance imaging in assessment of acute aortic syndromes. Semin Ultrasound CT MR 2003;24:232-254.
Nienaber CA, et al. Aortic dissection: new frontiers in diagnosis and management. Part I: From etiology to diagnostic strategies. Circulation 2003;108:628-635.

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6. Personal Information

.....Personal Information.....

89.jpg


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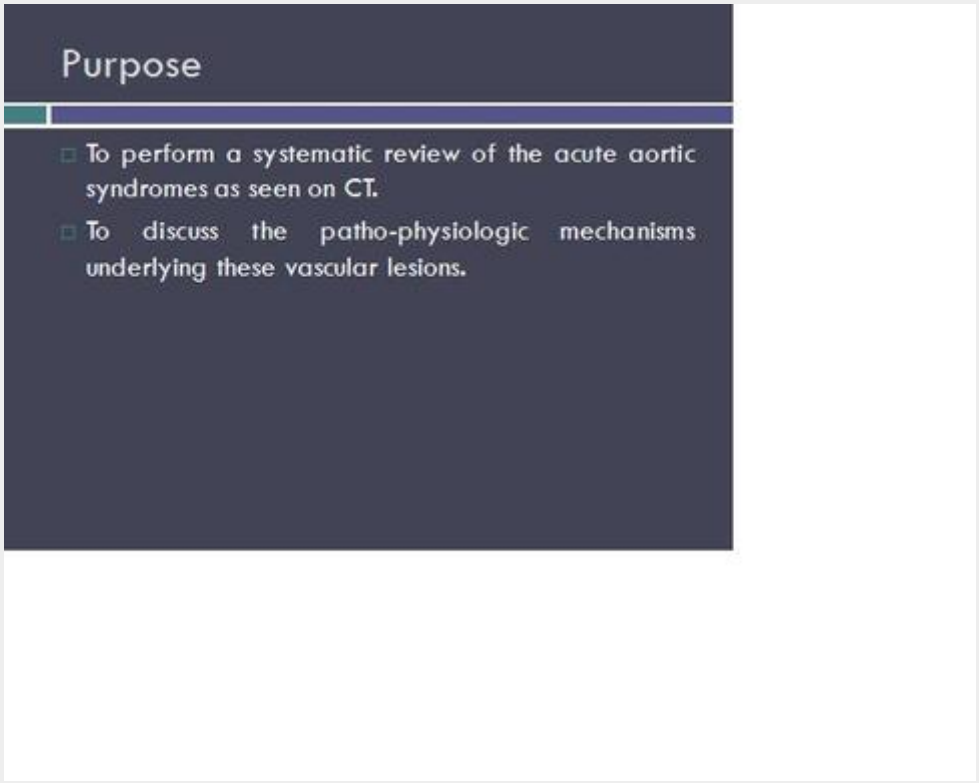
7. Mediafiles

1.jpg



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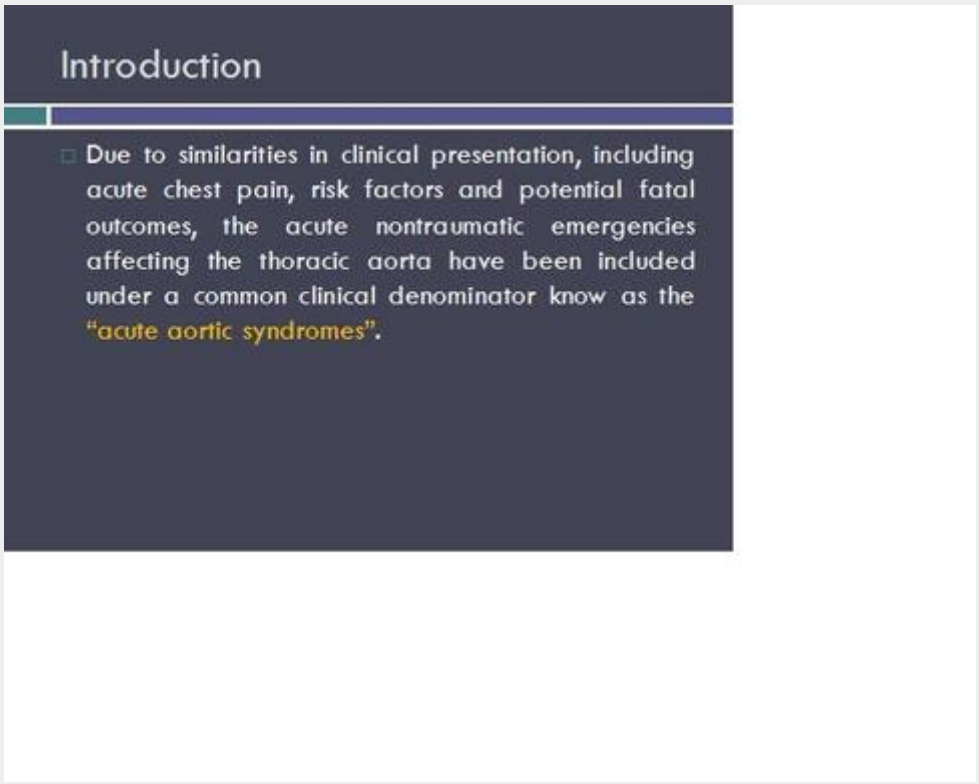
Introduction
Due to similarities in clinical presentation, including acute chest pain, risk factors and potential fatal outcomes, the acute nontraumatic emergencies affecting the thoracic aorta have been included under a common clinical denominator know as the "acute aortic syndromes".

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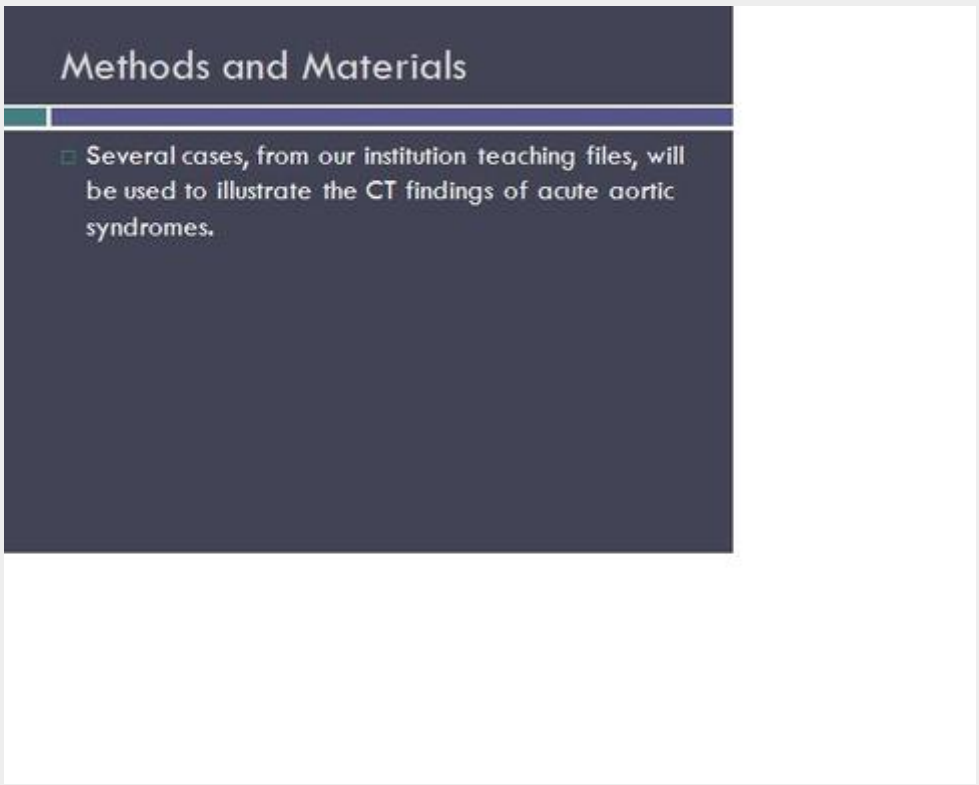
Methods and Materials
Several cases, from our institution teaching files, will be used to illustrate the CT findings of acute aortic syndromes.

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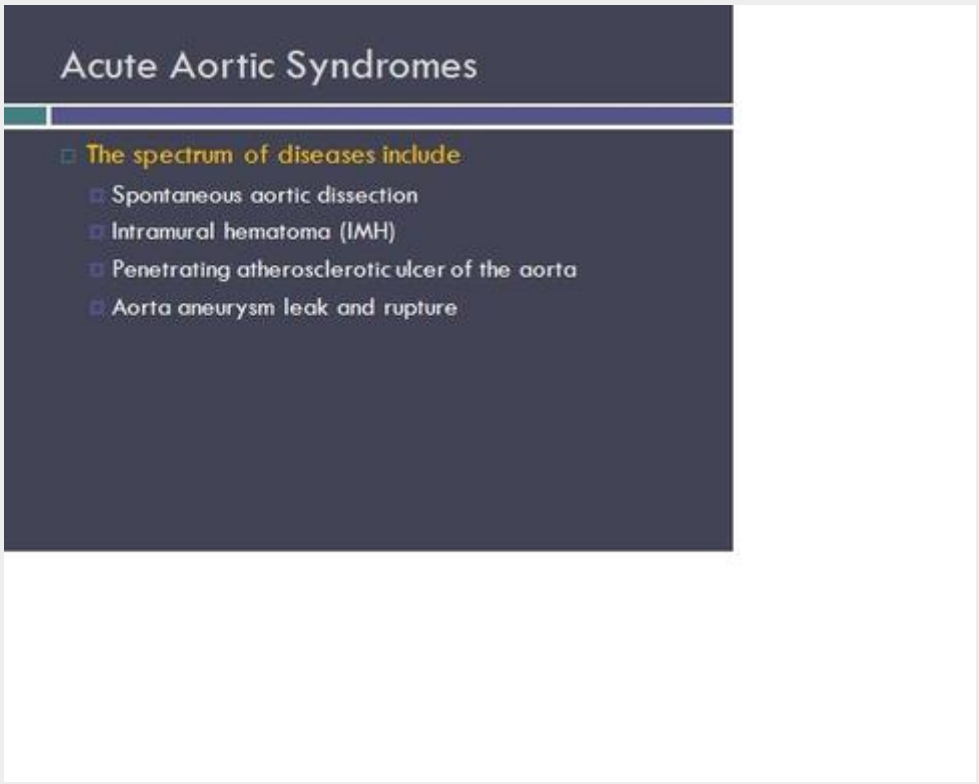
Acute Aortic Syndromes
The spectrum of diseases include
Spontaneous aortic dissection
Intramural hematoma (IMH)
Penetrating atherosclerotic ulcer of the aorta
Aorta aneurysm leak and rupture

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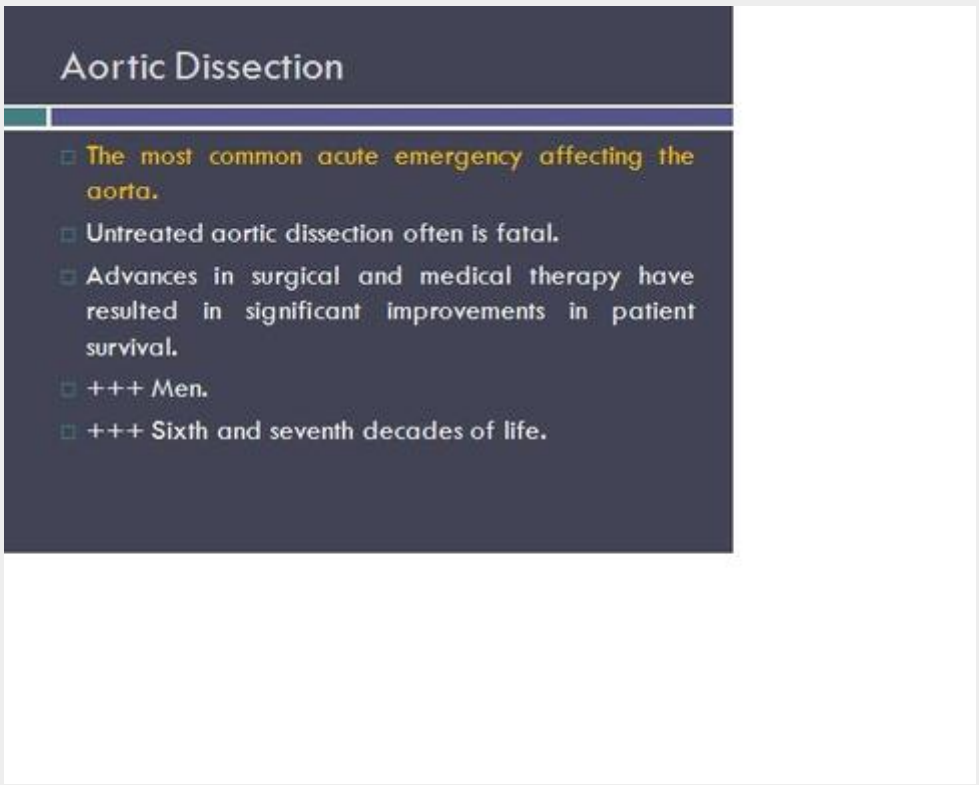
Aortic Dissection
The most common acute emergency affecting the aorta.
Untreated aortic dissection often is fatal.
Advances in surgical and medical therapy have resulted in significant improvements in patient survival.
+++ Men.
+++ Sixth and seventh decades of life.

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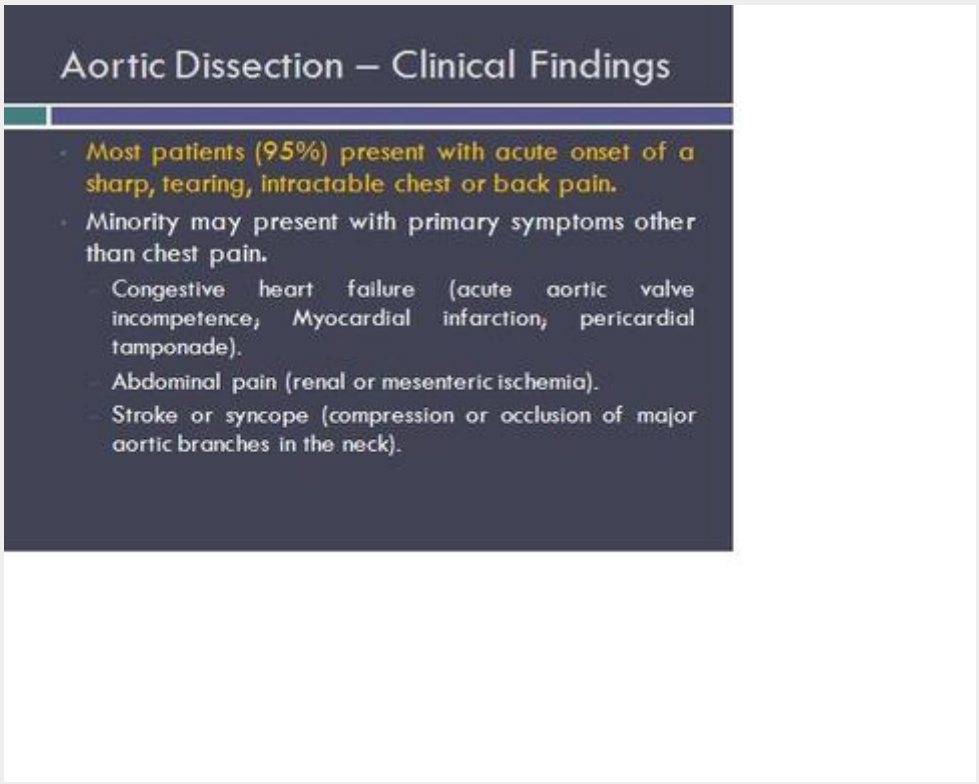
Aortic Dissection – Clinical Findings
Most patients (95%) present with acute onset of a sharp, tearing, intractable chest or back pain.
Minority may present with primary symptoms other than chest pain.
Congestive heart failure (acute aortic valve incompetence, Myocardial infarction, pericardial tamponade).
Abdominal pain (renal or mesenteric ischemia).
Stroke or syncope (compression or occlusion of major aortic branches in the neck).

7.jpg


Aortic Dissection – Clinical Findings
The most common predisposing condition is hypertension, that is present in up to 90% of patients.
Other important predisposing factors:
Inherited connective tissue disorders (Marfan and Ehlers-Danlos syndrome).
Cystic medial degeneration.
Annuloaortic ectasia.
Bicuspid aortic valve and aortitis.
Cocaine and amphetamine abuse.
May be iatrogenic sites of aortic cannulation; bypass grafting; cross-clamping; catheterization.

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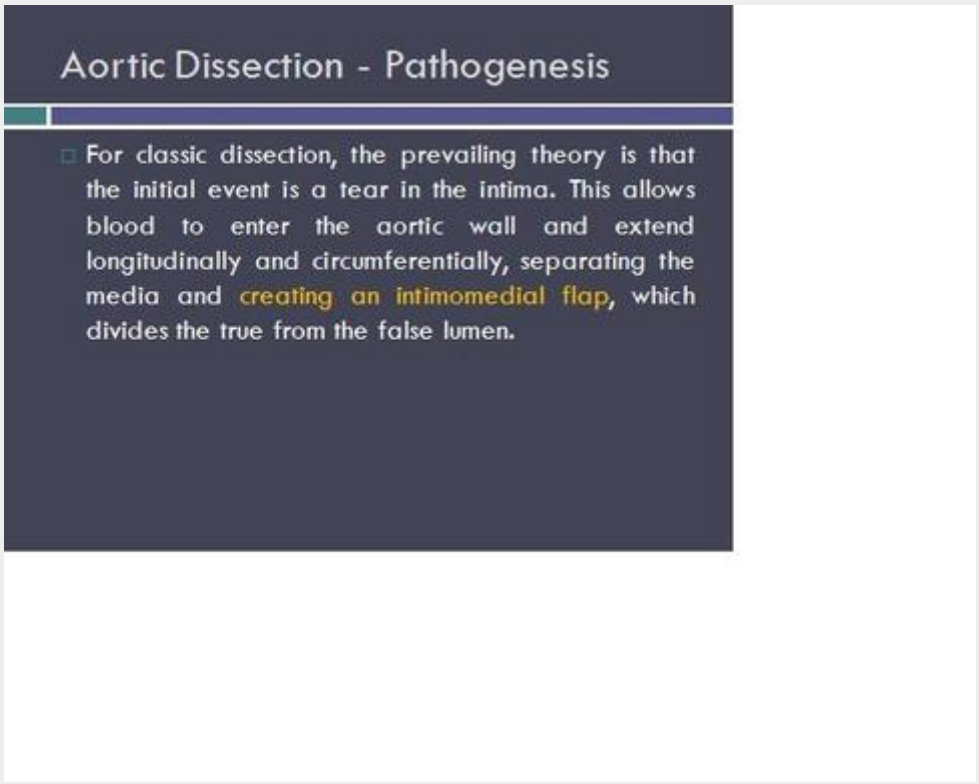
Aortic Dissection - Pathogenesis
For classic dissection, the prevailing theory is that the initial event is a tear in the intima. This allows blood to enter the aortic wall and extend longitudinally and circumferentially, separating the media and creating an intimomedial flap, which divides the true from the false lumen.

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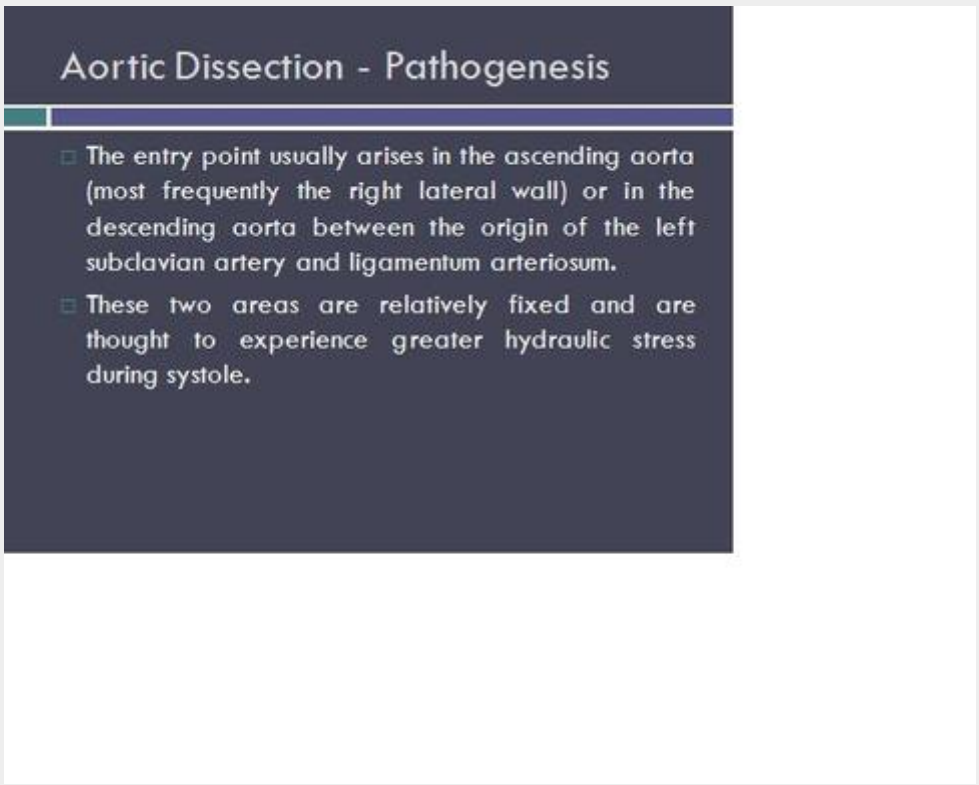
Aortic Dissection - Pathogenesis
The entry point usually arises in the ascending aorta (most frequently the right lateral wall) or in the descending aorta between the origin of the left subclavian artery and ligamentum arteriosum.
These two areas are relatively fixed and are thought to experience greater hydraulic stress during systole.

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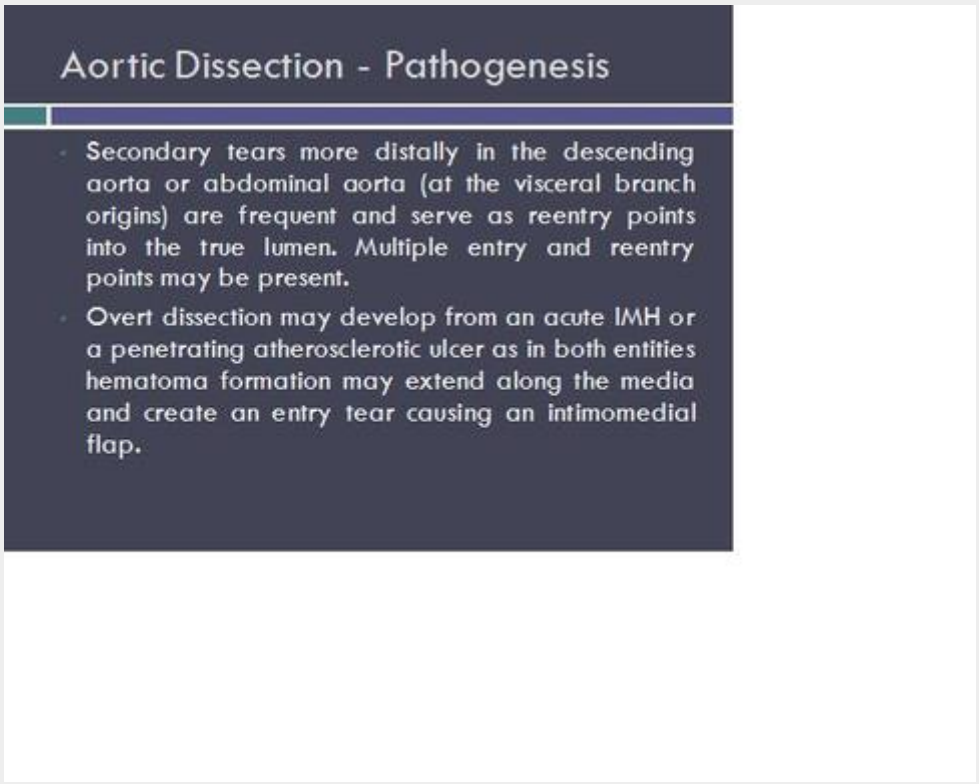
Aortic Dissection - Pathogenesis
Secondary tears more distally in the descending aorta or abdominal aorta (at the visceral branch origins) are frequent and serve as reentry points into the true lumen. Multiple entry and reentry points may be present.
Overt dissection may develop from an acute IMH or a penetrating atherosclerotic ulcer as in both entities hematoma formation may extend along the media and create an entry tear causing an intimomedial flap.

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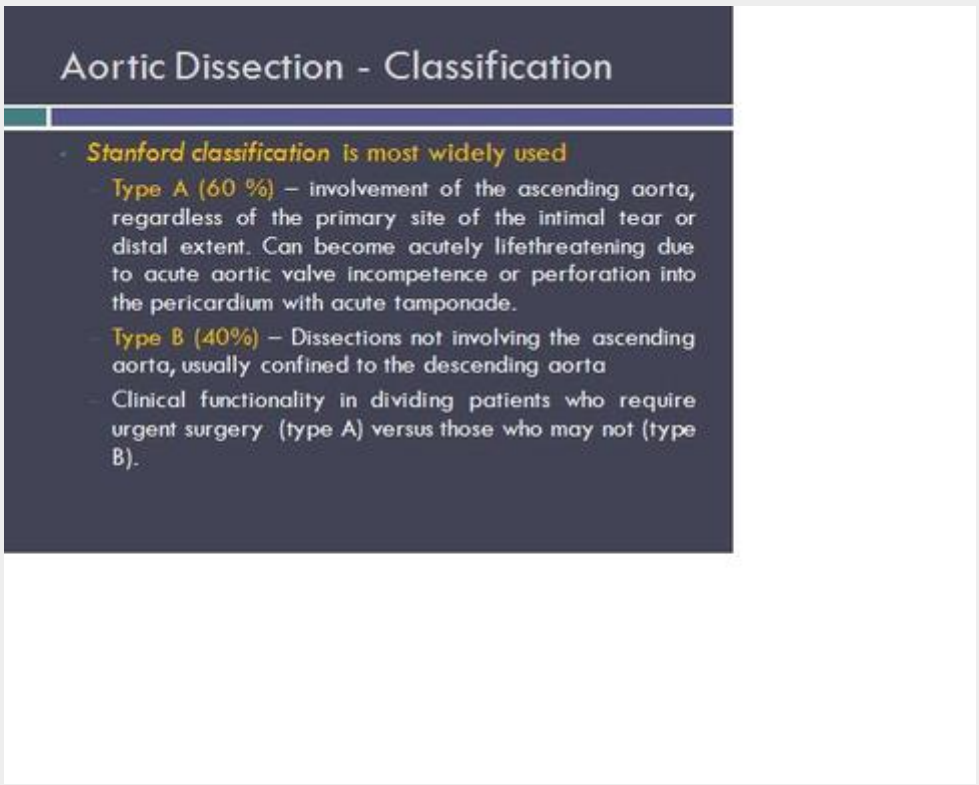
Aortic Dissection - Classification
Stanford classification is most widely used
Type A (60 %) – involvement of the ascending aorta, regardless of the primary site of the intimal tear or distal extent. Can become acutely lifethreatening due to acute aortic valve incompetence or perforation into the pericardium with acute tamponade.
Type B (40%) – Dissections not involving the ascending aorta, usually confined to the descending aorta
Clinical functionality in dividing patients who require urgent surgery (type A) versus those who may not (type B).

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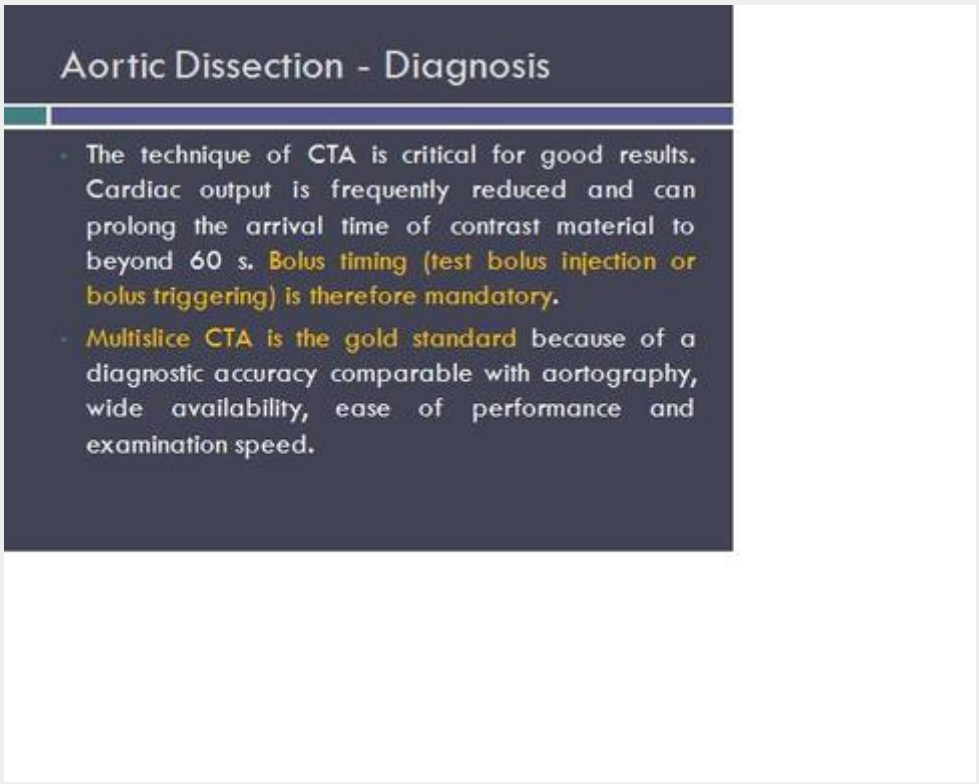
Aortic Dissection - Diagnosis
The technique of CTA is critical for good results. Cardiac output is frequently reduced and can prolong the arrival time of contrast material to beyond 60 s. Bolus timing (test bolus injection or bolus triggering) is therefore mandatory.
Multislice CTA is the gold standard because of a diagnostic accuracy comparable with aortography, wide availability, ease of performance and examination speed.

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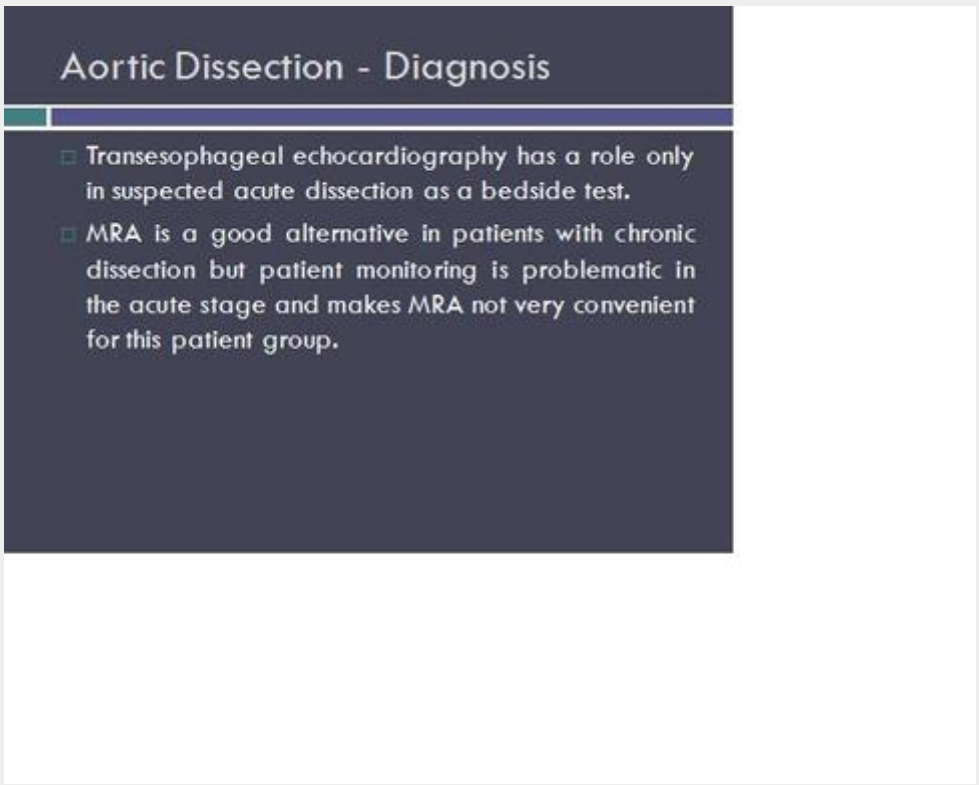
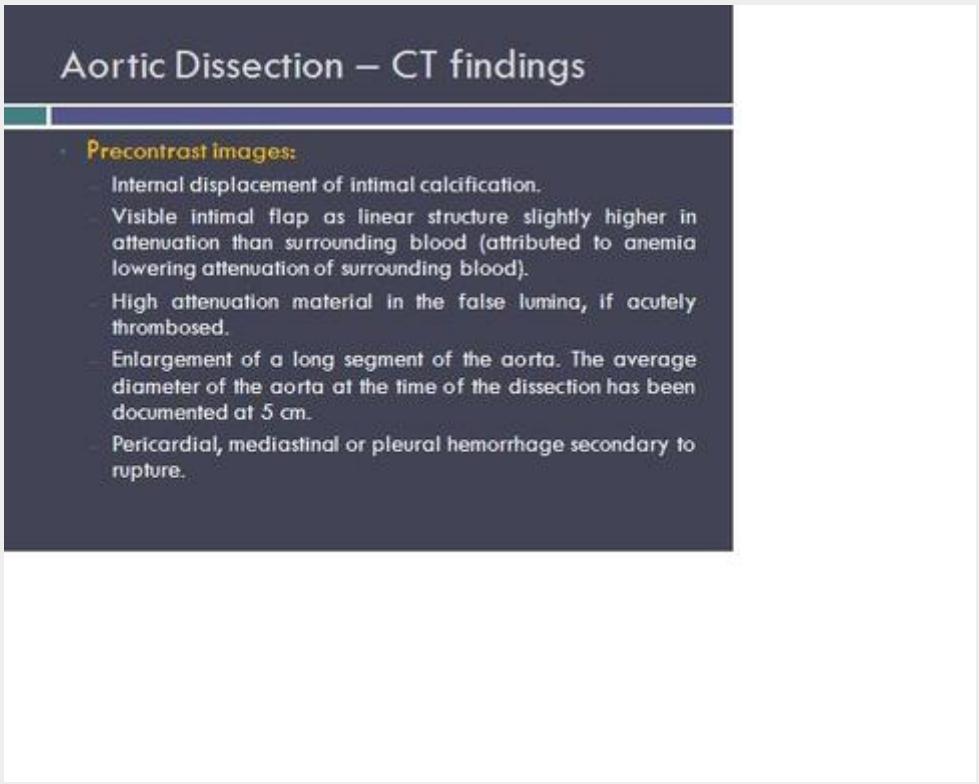
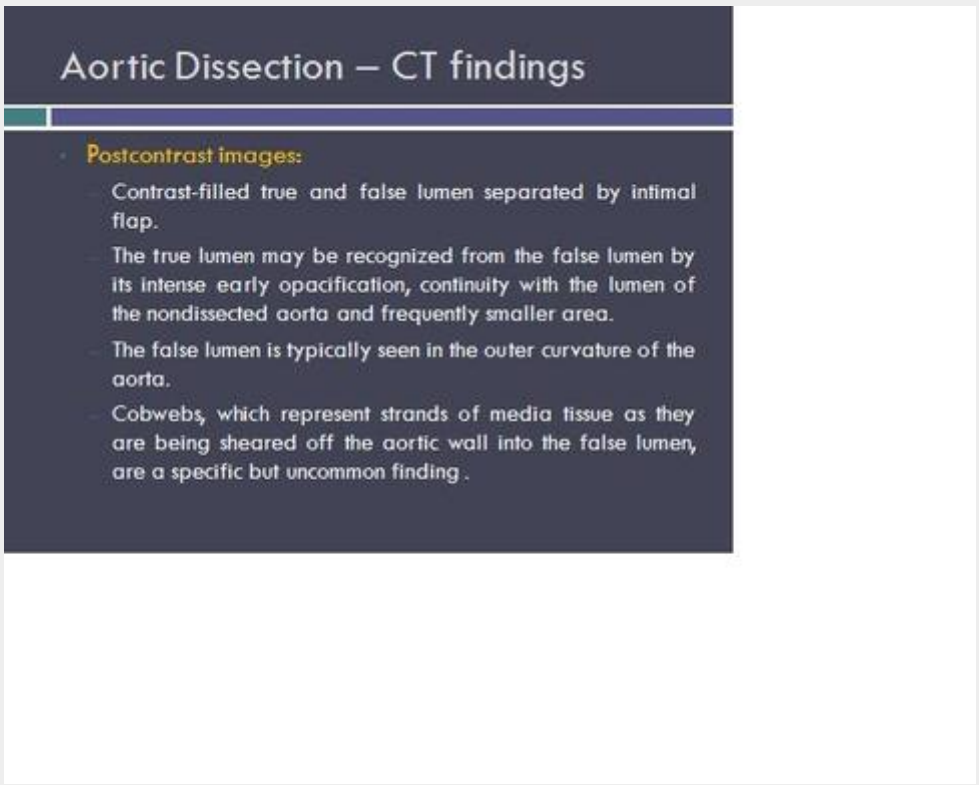

Aortic Dissection - Diagnosis
Transesophageal echocardiography has a role only in suspected acute dissection as a bedside test.
MRA is a good alternative in patients with chronic dissection but patient monitoring is problematic in the acute stage and makes MRA not very convenient for this patient group.

14.jpg


Aortic Dissection – CT findings
Precontrast images:
Internal displacement of intimal calcification.
Visible intimal flap as linear structure slightly higher in attenuation than surrounding blood (attributed to anemia lowering attenuation of surrounding blood).
High attenuation material in the false lumina, if acutely thrombosed.
Enlargement of a long segment of the aorta. The average diameter of the aorta at the time of the dissection has been documented at 5 cm.
Pericardial, mediastinal or pleural hemorrhage secondary to rupture.

15.jpg


Aortic Dissection – CT findings
Postcontrast images:
Contrast-filled true and false lumen separated by intimal flap.
The true lumen may be recognized from the false lumen by its intense early opacification, continuity with the lumen of the nondissected aorta and frequently smaller area.
The false lumen is typically seen in the outer curvature of the aorta.
Cobwebs, which represent strands of media tissue as they are being sheared off the aortic wall into the false lumen, are a specific but uncommon finding .

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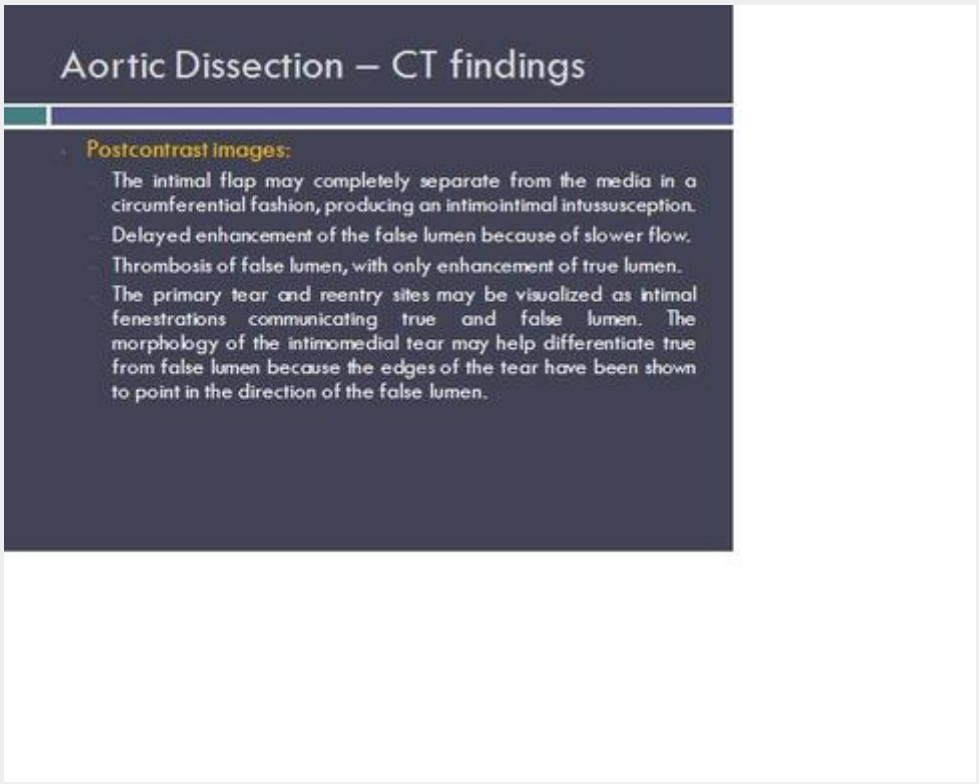
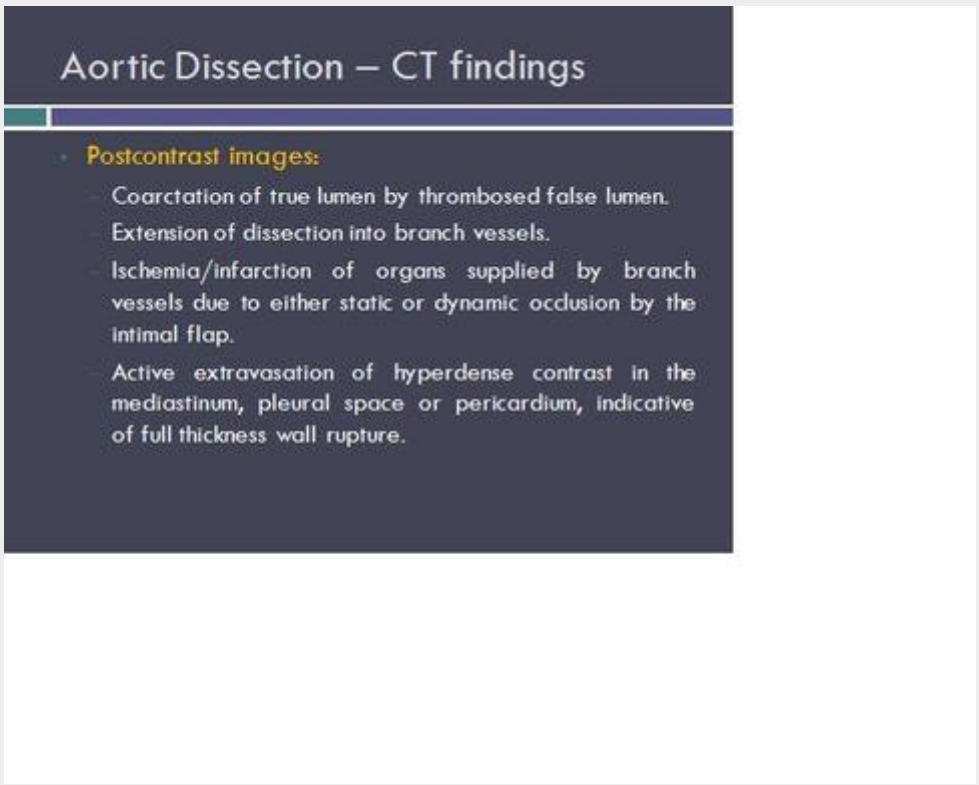

Aortic Dissection – CT findings
Postcontrast images:
The intimal flap may completely separate from the media in a circumferential fashion, producing an intimointimal intussusception.
Delayed enhancement of the false lumen because of slower flow.
Thrombosis of false lumen, with only enhancement of true lumen.
The primary tear and reentry sites may be visualized as intimal fenestrations communicating true and false lumen. The morphology of the intimomedial tear may help differentiate true from false lumen because the edges of the tear have been shown to point in the direction of the false lumen.

17.jpg


Aortic Dissection – CT findings
Postcontrast images:
Coarctation of true lumen by thrombosed false lumen.
Extension of dissection into branch vessels.
Ischemia/infarction of organs supplied by branch vessels due to either static or dynamic occlusion by the intimal flap.
Active extravasation of hyperdense contrast in the mediastinum, pleural space or pericardium, indicative of full thickness wall rupture.

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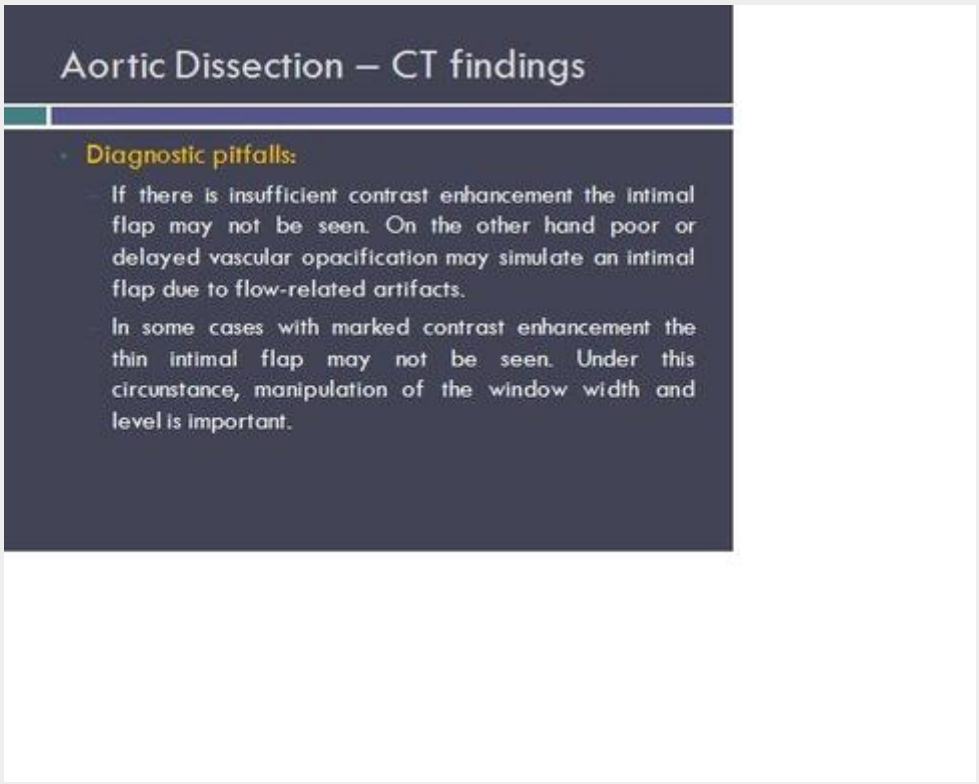
Aortic Dissection – CT findings
Diagnostic pitfalls:
If there is insufficient contrast enhancement the intimal flap may not be seen. On the other hand poor or delayed vascular opacification may simulate an intimal flap due to flow-related artifacts.
In some cases with marked contrast enhancement the thin intimal flap may not be seen. Under this circunstance, manipulation of the window width and level is important.

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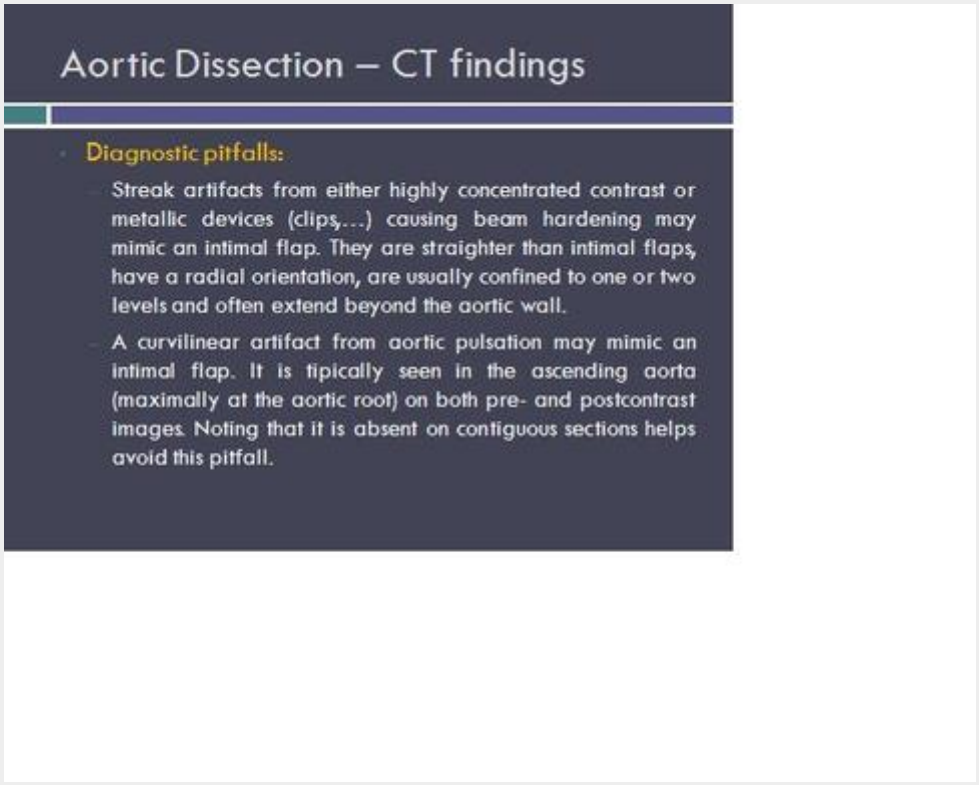
Aortic Dissection – CT findings
Diagnostic pitfalls:
Streak artifacts from either highly concentrated contrast or metallic devices (clips,...) causing beam hardening may mimic an intimal flap. They are straighter than intimal flaps, have a radial orientation, are usually confined to one or two levels and often extend beyond the aortic wall.
A curvilinear artifact from aortic pulsation may mimic an intimal flap. It is tipically seen in the ascending aorta (maximally at the aortic root) on both pre- and postcontrast images. Noting that it is absent on contiguous sections helps avoid this pitfall.

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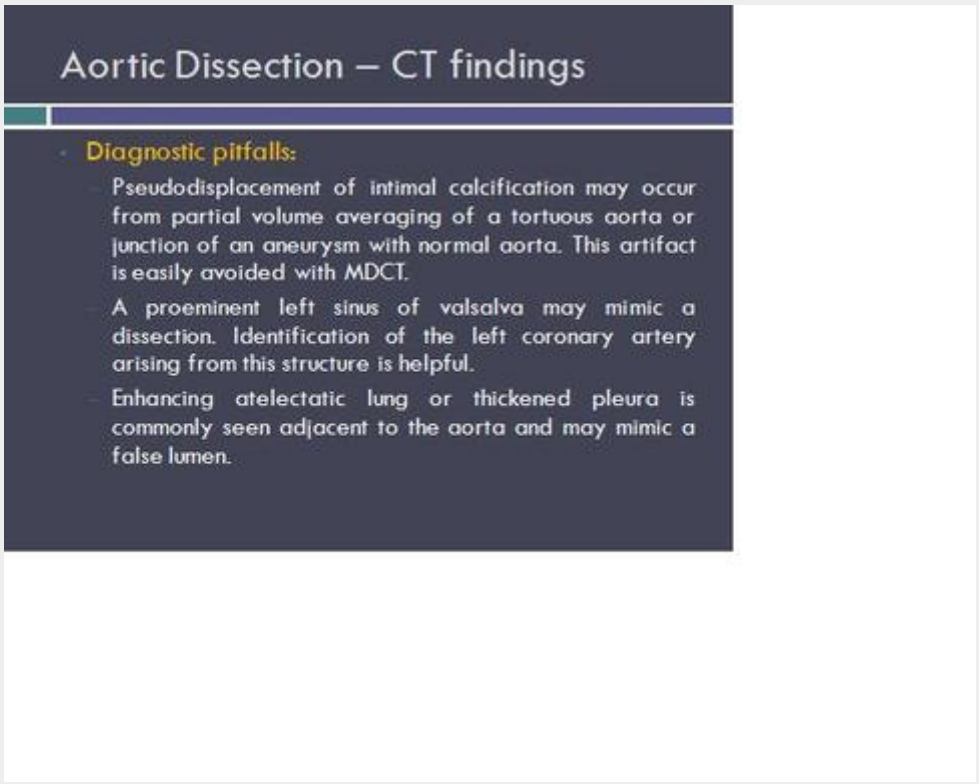
Aortic Dissection – CT findings
Diagnostic pitfalls:
Pseudodisplacement of intimal calcification may occur from partial volume averaging of a tortuous aorta or junction of an aneurysm with normal aorta. This artifact is easily avoided with MDCT.
A proeminent left sinus of valsalva may mimic a dissection. Identification of the left coronary artery arising from this structure is helpful.
Enhancing atelectatic lung or thickened pleura is commonly seen adjacent to the aorta and may mimic a false lumen.

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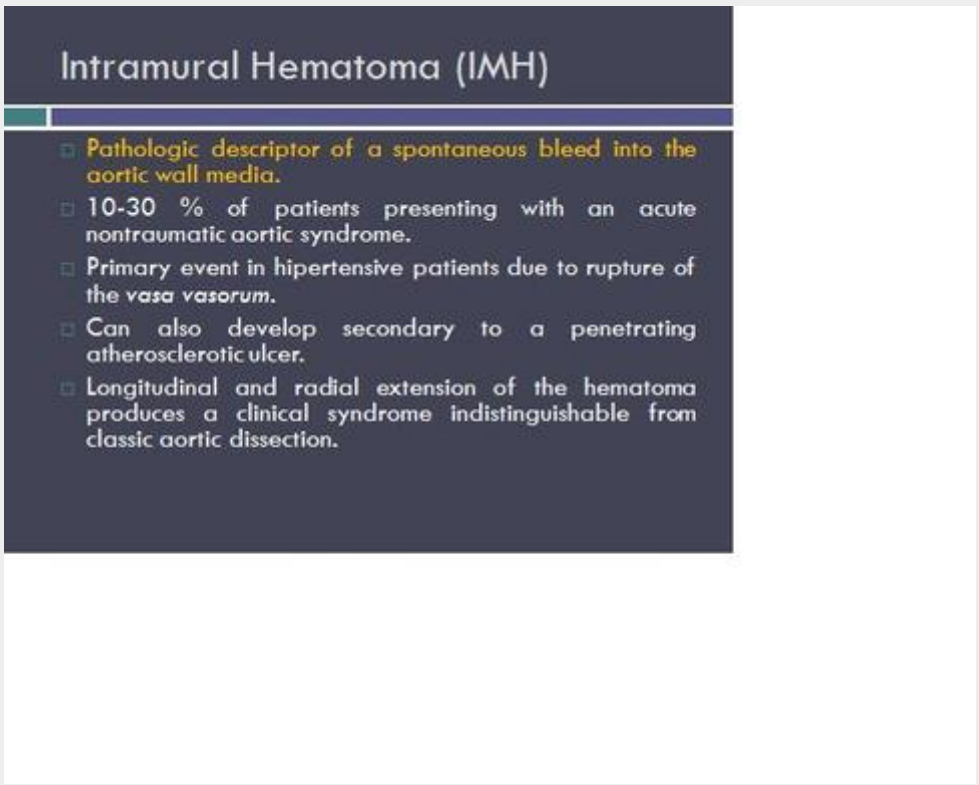
Intramural Hematoma (IMH)
Pathologic descriptor of a spontaneous bleed into the aortic wall media.
10-30 % of patients presenting with an acute nontraumatic aortic syndrome.
Primary event in hipertensive patients due to rupture of the vasa vasorum.
Can also develop secondary to a penetrating atherosclerotic ulcer.
Longitudinal and radial extension of the hematoma produces a clinical syndrome indistinguishable from classic aortic dissection.

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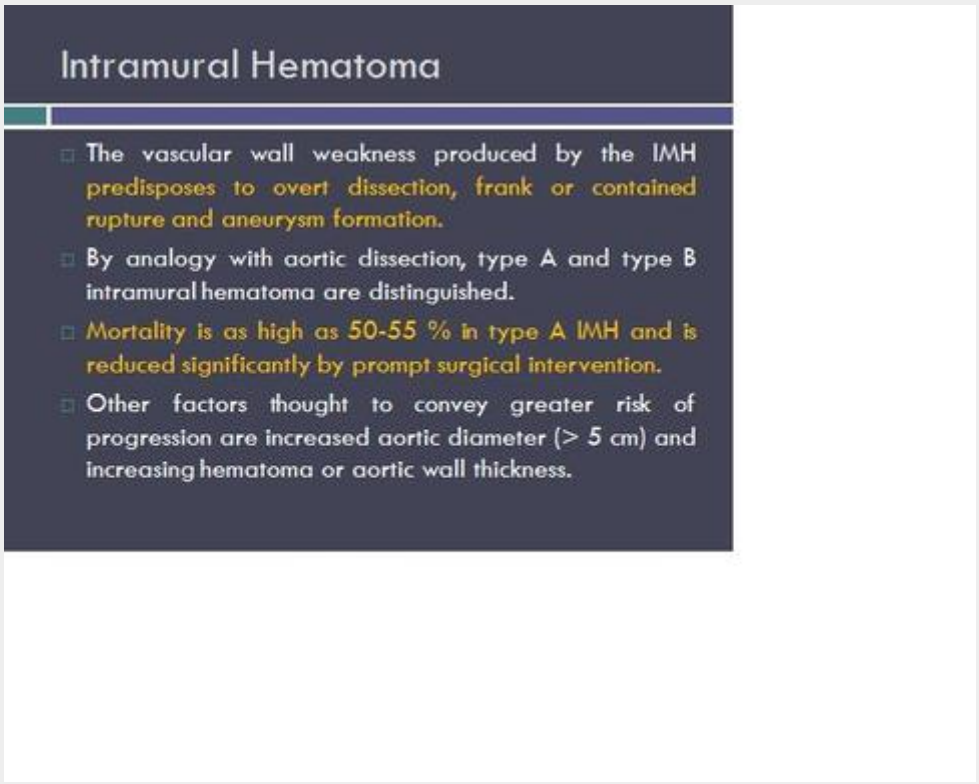
Intramural Hematoma
The vascular wall weakness produced by the IMH predisposes to overt dissection, frank or contained rupture and aneurysm formation.
By analogy with aortic dissection, type A and type B intramural hematoma are distinguished.
Mortality is as high as 50-55 % in type A IMH and is reduced significantly by prompt surgical intervention.
Other factors thought to convey greater risk of progression are increased aortic diameter (> 5 cm) and increasing hematoma or aortic wall thickness.

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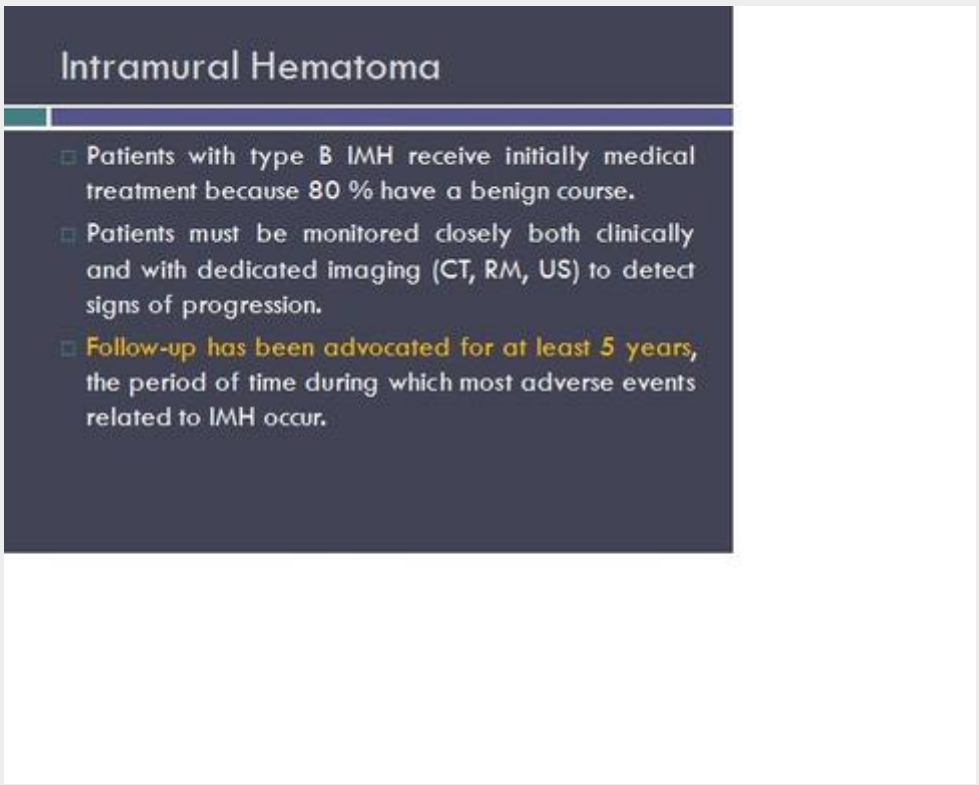
Intramural Hematoma
Patients with type B IMH receive initially medical treatment because 80 % have a benign course.
Patients must be monitored closely both clinically and with dedicated imaging (CT, RM, US) to detect signs of progression.
Follow-up has been advocated for at least 5 years, the period of time during which most adverse events related to IMH occur.

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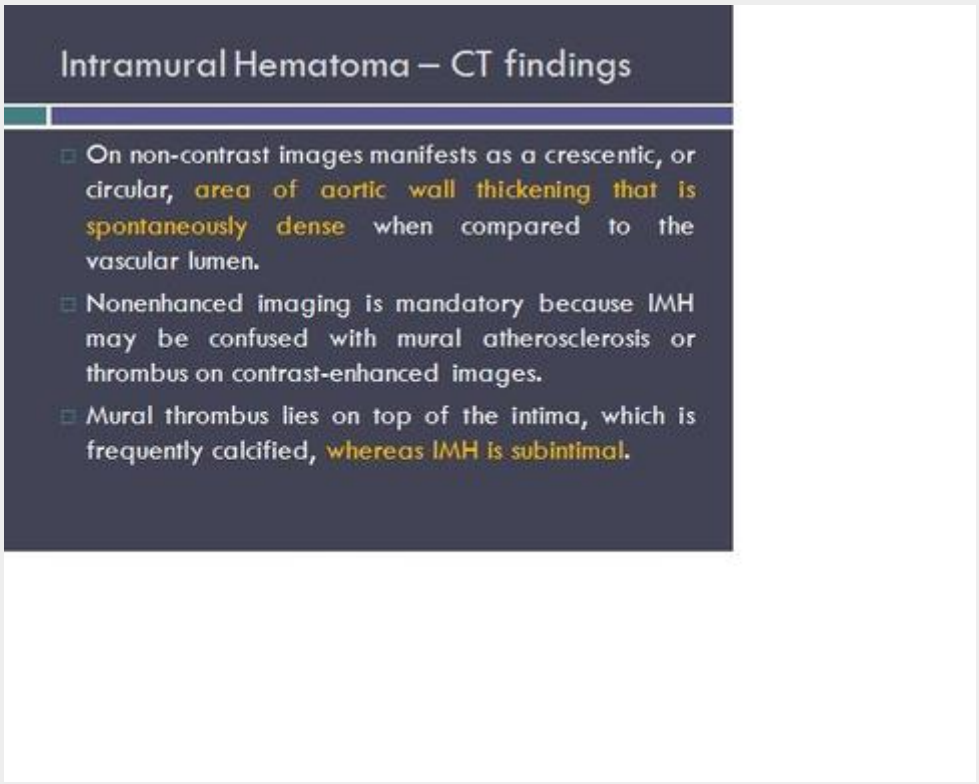
Intramural Hematoma – CT findings
On non-contrast images manifests as a crescentic, or circular, area of aortic wall thickening that is spontaneously dense when compared to the vascular lumen.
Nonenhanced imaging is mandatory because IMH may be confused with mural atherosclerosis or thrombus on contrast-enhanced images.
Mural thrombus lies on top of the intima, which is frequently calcified, whereas IMH is subintimal.

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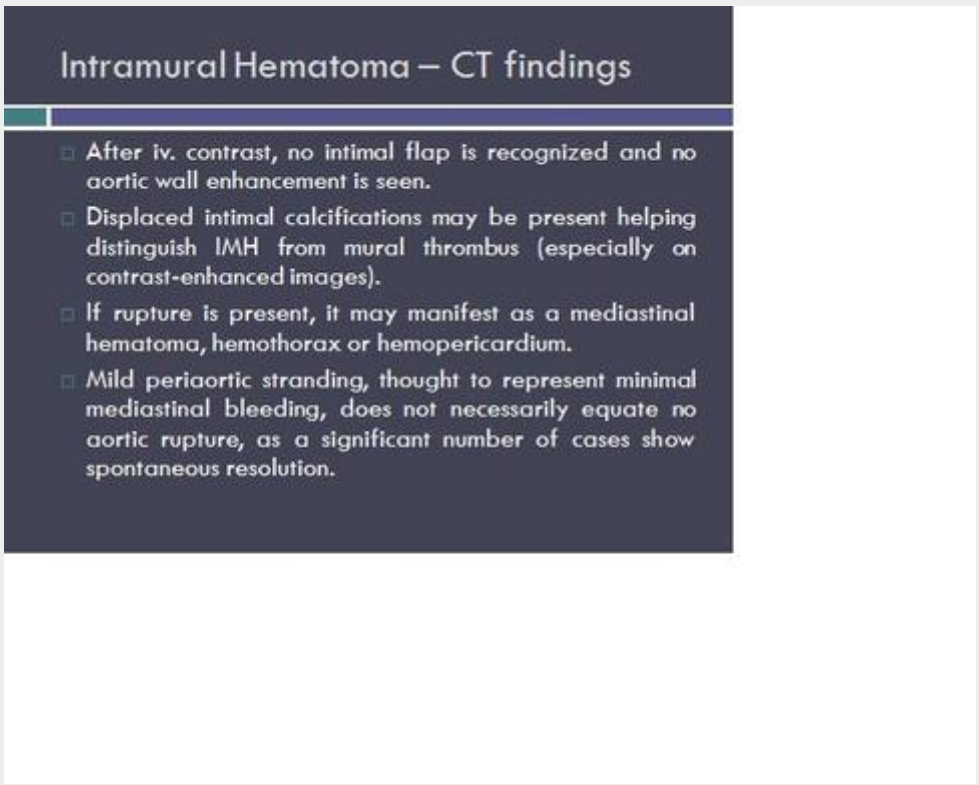
Intramural Hematoma – CT findings
After iv. contrast, no intimal flap is recognized and no aortic wall enhancement is seen.
Displaced intimal calcifications may be present helping distinguish IMH from mural thrombus (especially on contrast-enhanced images).
If rupture is present, it may manifest as a mediastinal hematoma, hemothorax or hemopericardium.
Mild periaortic stranding, thought to represent minimal mediastinal bleeding, does not necessarily equate no aortic rupture, as a significant number of cases show spontaneous resolution.

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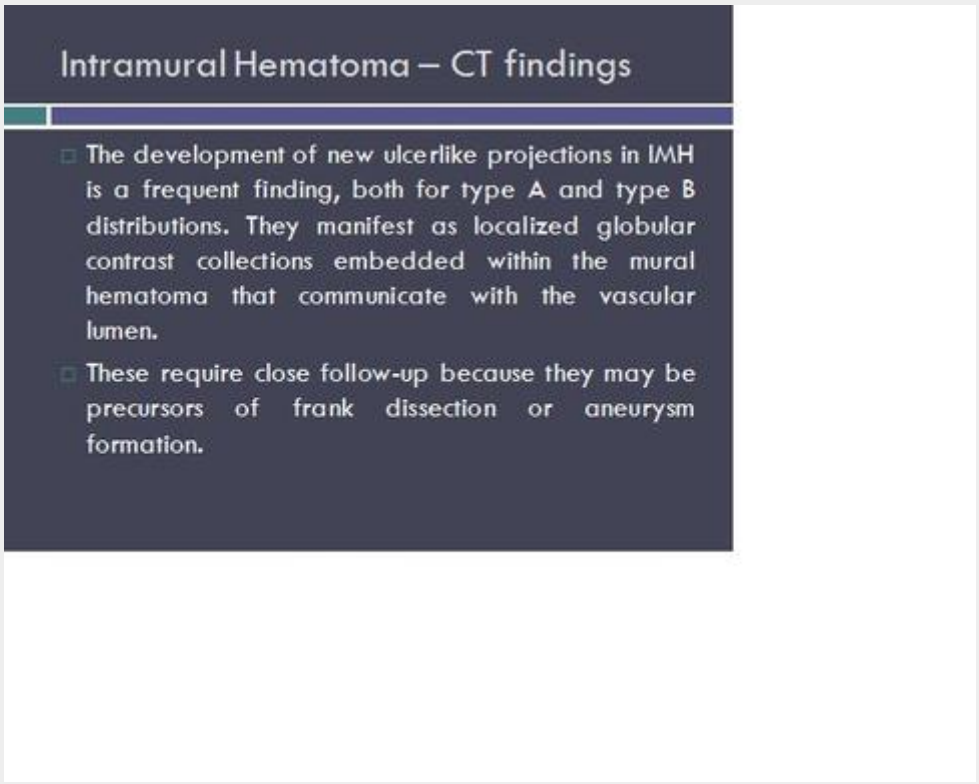
Intramural Hematoma – CT findings
The development of new ulcerlike projections in IMH is a frequent finding, both for type A and type B distributions. They manifest as localized globular contrast collections embedded within the mural hematoma that communicate with the vascular lumen.
These require close follow-up because they may be precursors of frank dissection or aneurysm formation.

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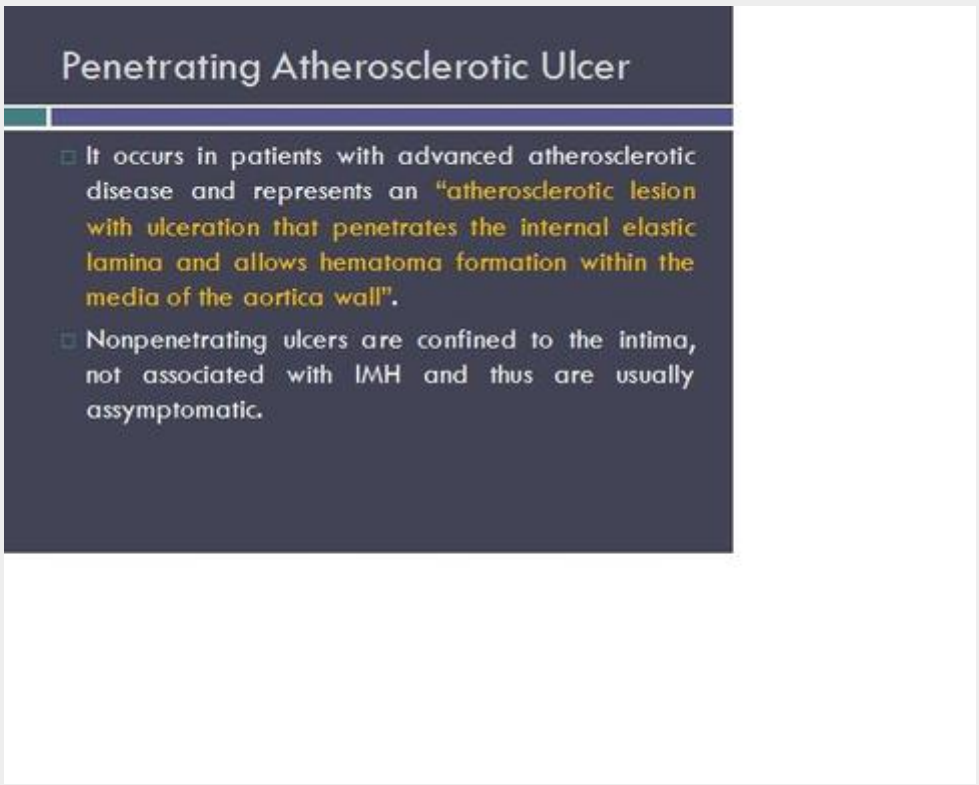
Penetrating Atherosclerotic Ulcer
It occurs in patients with advanced atherosclerotic disease and represents an "atherosclerotic lesion with ulceration that penetrates the internal elastic lamina and allows hematoma formation within the media of the aortica wall".
Nonpenetrating ulcers are confined to the intima, not associated with IMH and thus are usually assymptomatic.

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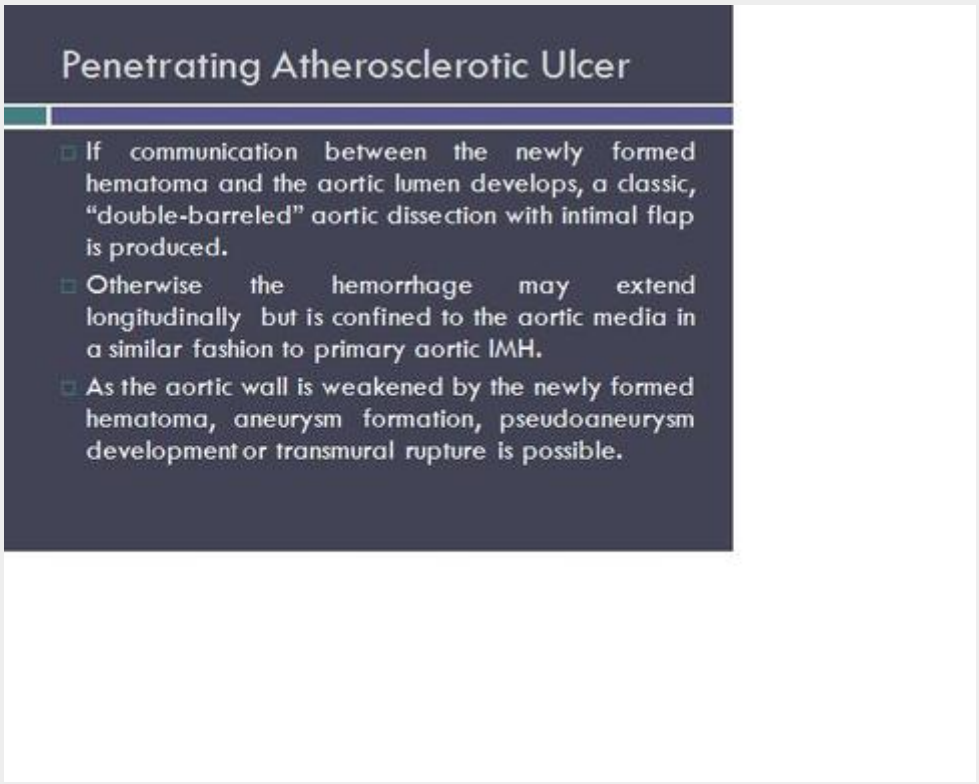
Penetrating Atherosclerotic Ulcer
If communication between the newly formed hematoma and the aortic lumen develops, a classic, "double-barreled" aortic dissection with intimal flap is produced.
Otherwise the hemorrhage may extend longitudinally but is confined to the aortic media in a similar fashion to primary aortic IMH.
As the aortic wall is weakened by the newly formed hematoma, aneurysm formation, pseudoaneurysm development or transmural rupture is possible.

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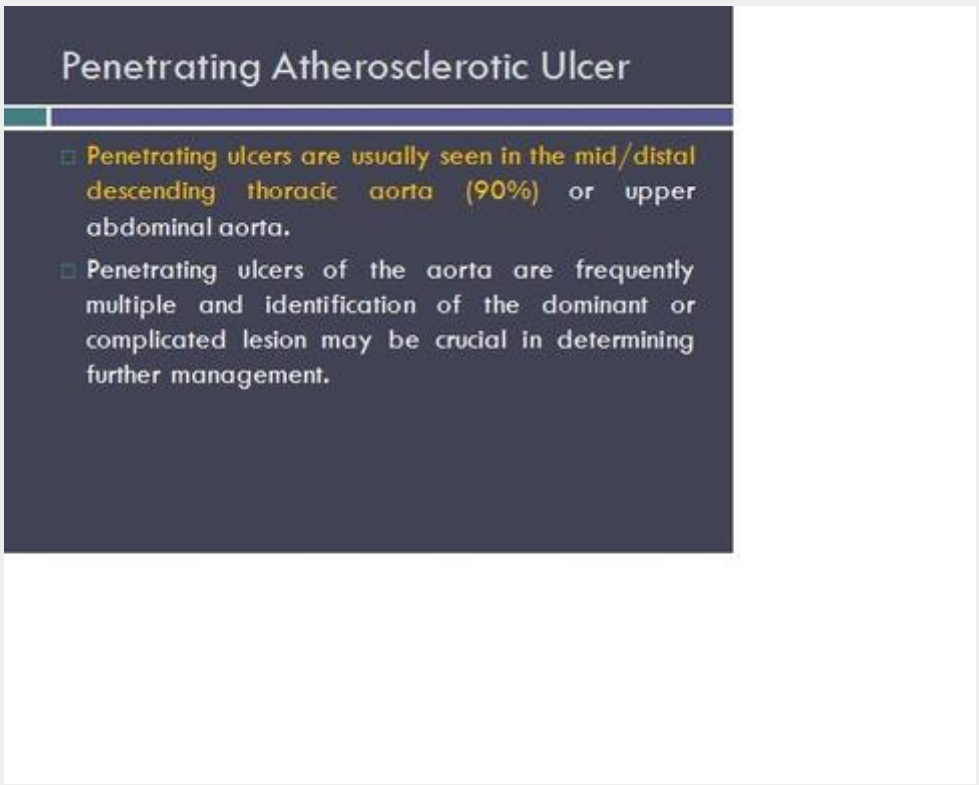
Penetrating Atherosclerotic Ulcer
Penetrating ulcers are usually seen in the mid/distal descending thoracic aorta (90%) or upper abdominal aorta.
Penetrating ulcers of the aorta are frequently multiple and identification of the dominant or complicated lesion may be crucial in determining further management.

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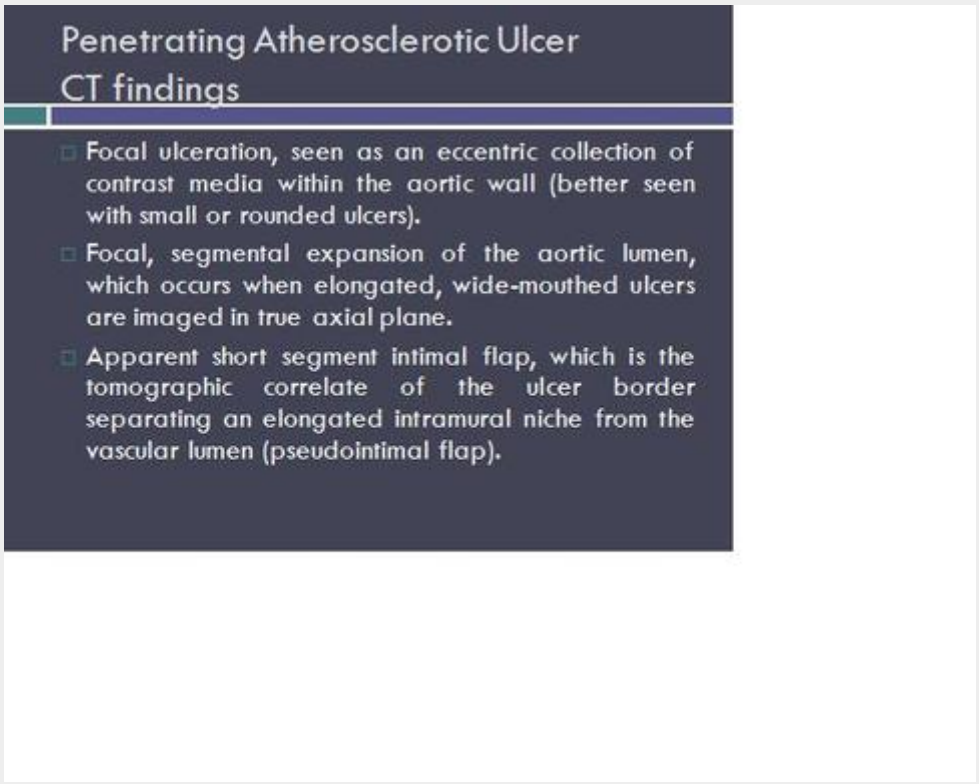
Penetrating Atherosclerotic Ulcer
CT findings
Focal ulceration, seen as an eccentric collection of contrast media within the aortic wall (better seen with small or rounded ulcers).
Focal, segmental expansion of the aortic lumen, which occurs when elongated, wide-mouthed ulcers are imaged in true axial plane.
Apparent short segment intimal flap, which is the tomographic correlate of the ulcer border separating an elongated intramural niche from the vascular lumen (pseudointimal flap).

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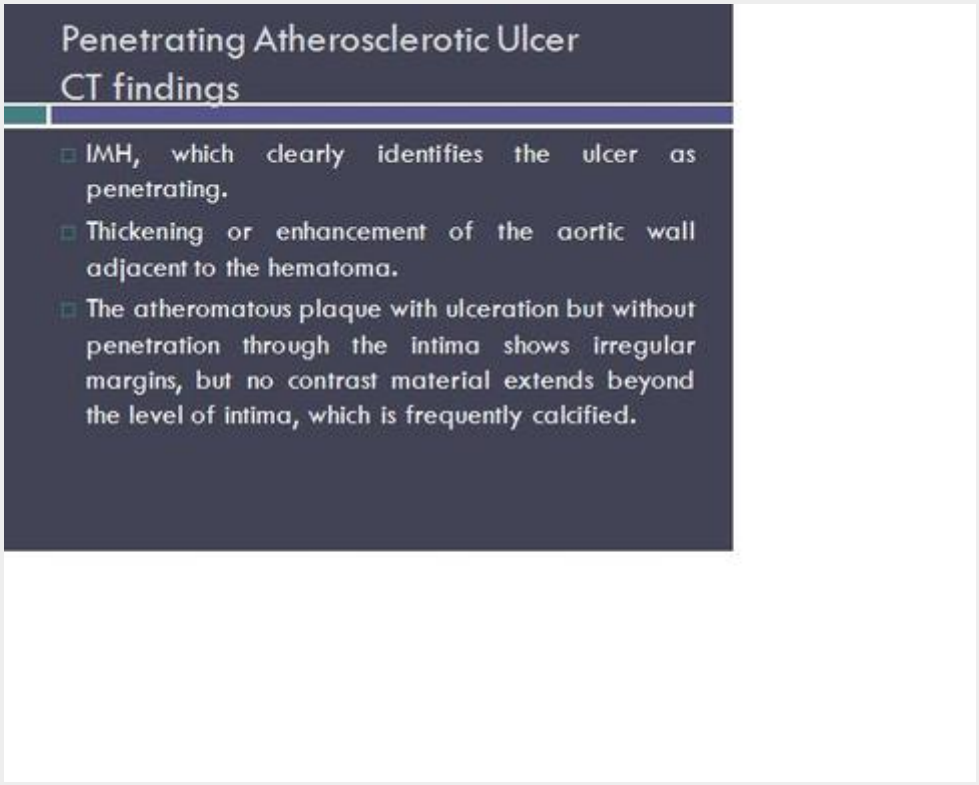
Penetrating Atherosclerotic Ulcer
CT findings
IMH, which clearly identifies the ulcer as penetrating.
Thickening or enhancement of the aortic wall adjacent to the hematoma.
The atheromatous plaque with ulceration but without penetration through the intima shows irregular margins, but no contrast material extends beyond the level of intima, which is frequently calcified.

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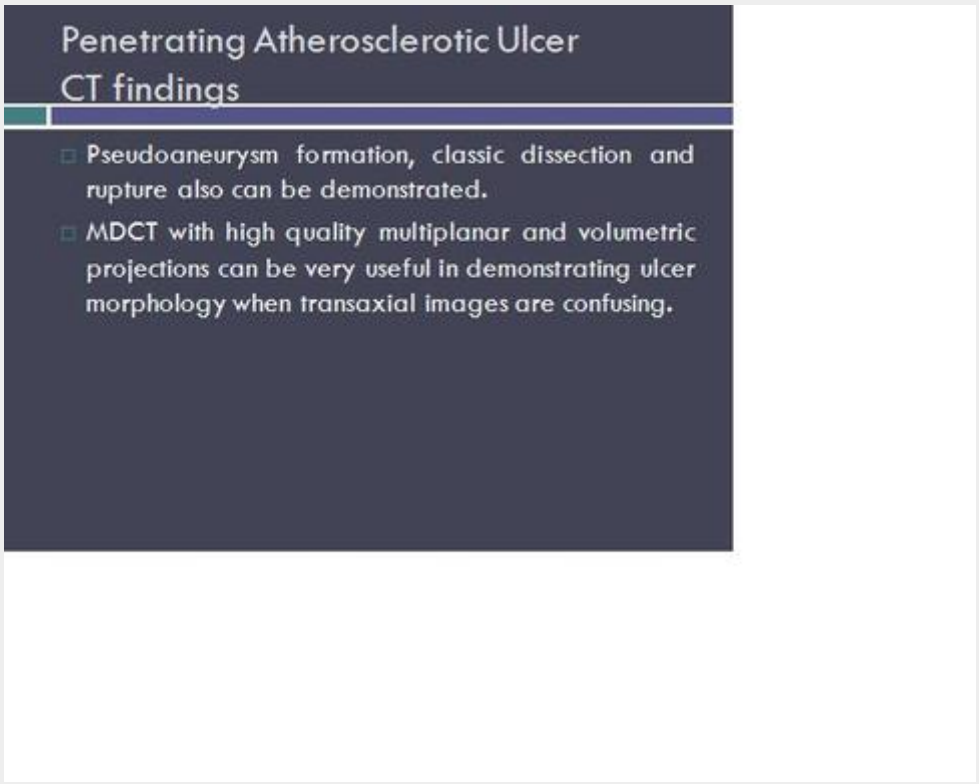
Penetrating Atherosclerotic Ulcer
CT findings
Pseudoaneurysm formation, classic dissection and rupture also can be demonstrated.
MDCT with high quality multiplanar and volumetric projections can be very useful in demonstrating ulcer morphology when transaxial images are confusing.

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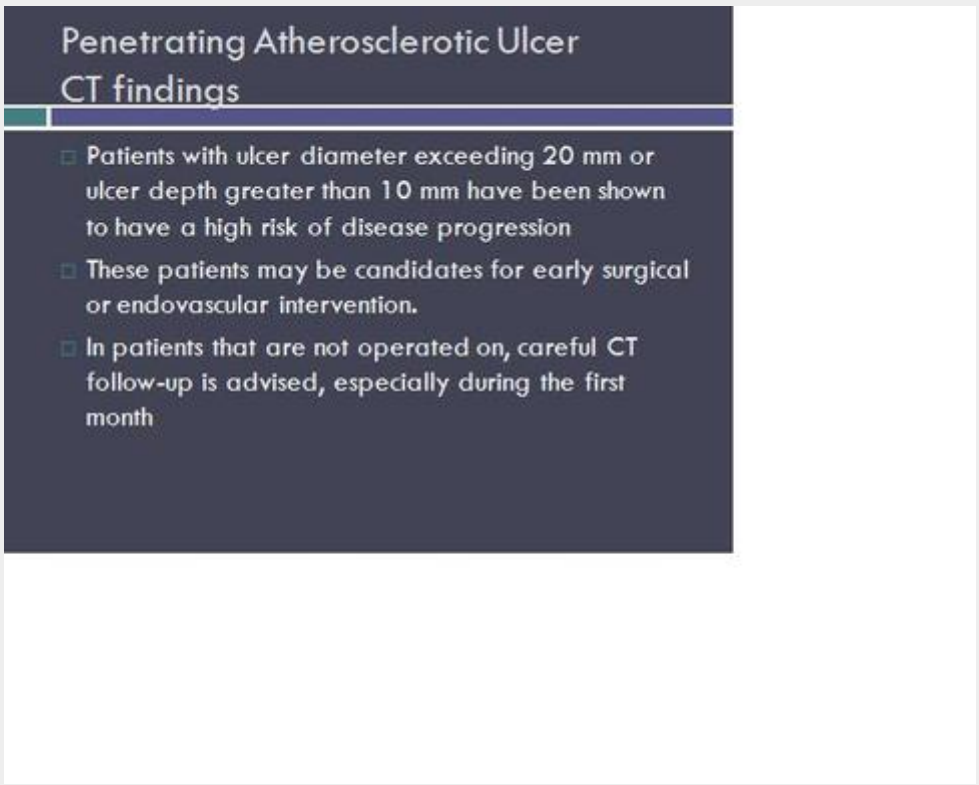
Penetrating Atherosclerotic Ulcer
CT findings
Patients with ulcer diameter exceeding 20 mm or ulcer depth greater than 10 mm have been shown to have a high risk of disease progression
These patients may be candidates for early surgical or endovascular intervention.
In patients that are not operated on, careful CT follow-up is advised, especially during the first month

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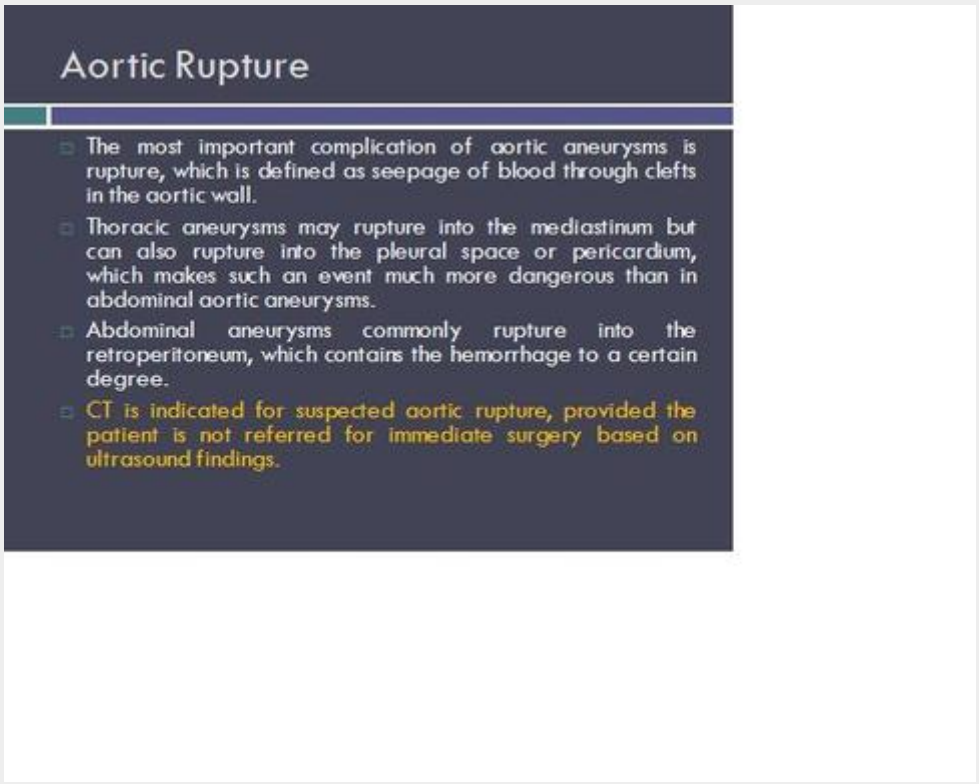
Aortic Rupture
The most important complication of aortic aneurysms is rupture, which is defined as seepage of blood through clefts in the aortic wall.
Thoracic aneurysms may rupture into the mediastinum but can also rupture into the pleural space or pericardium, which makes such an event much more dangerous than in abdominal aortic aneurysms.
Abdominal aneurysms commonly rupture into the retroperitoneum, which contains the hemorrhage to a certain degree.
CT is indicated for suspected aortic rupture, provided the patient is not referred for immediate surgery based on ultrasound findings.

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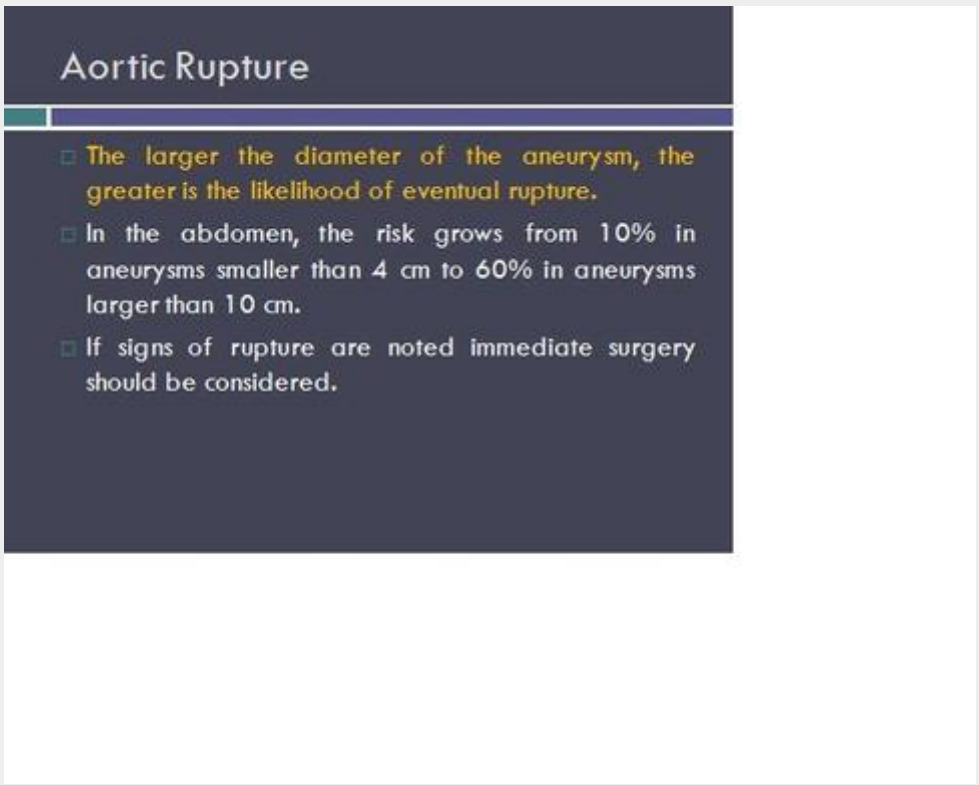
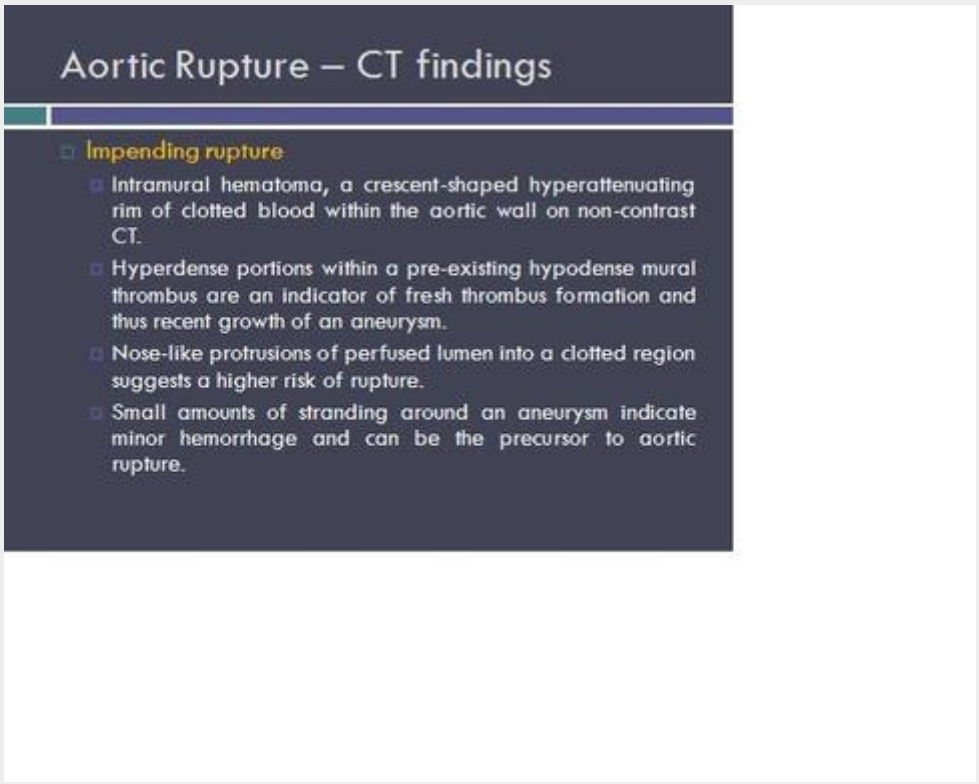
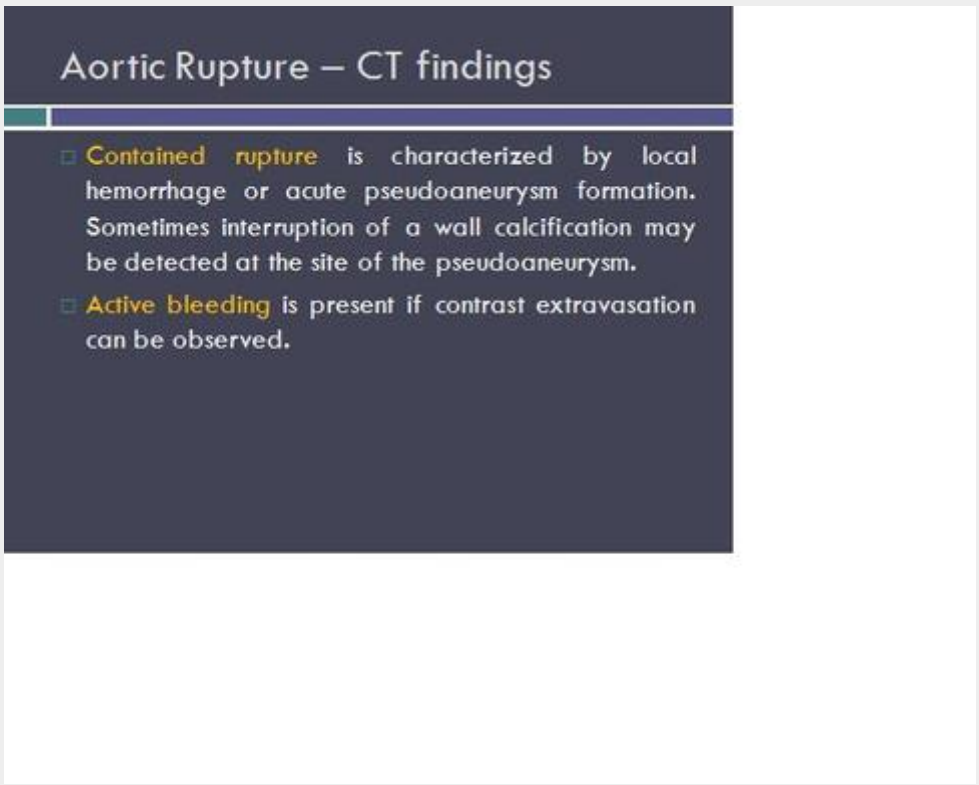

Aortic Rupture
The larger the diameter of the aneurysm, the greater is the likelihood of eventual rupture.
In the abdomen, the risk grows from 10% in aneurysms smaller than 4 cm to 60% in aneurysms larger than 10 cm.
If signs of rupture are noted immediate surgery should be considered.

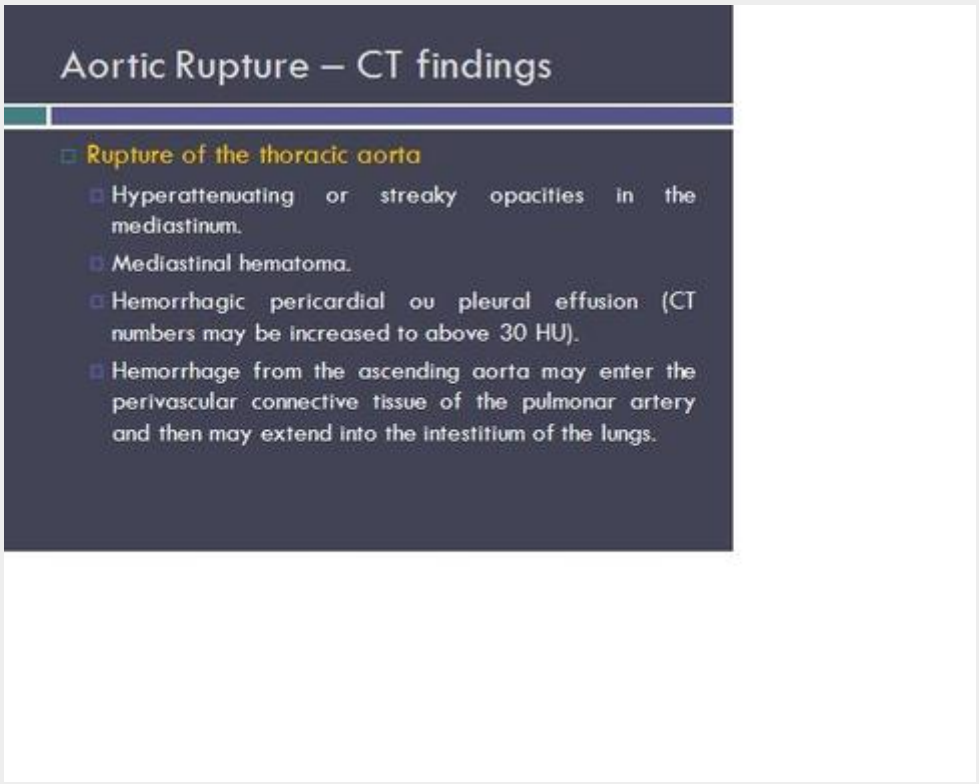
70.jpg


Aortic Rupture – CT findings
Impending rupture
Intramural hematoma, a crescent-shaped hyperattenuating rim of clotted blood within the aortic wall on non-contrast CT.
Hyperdense portions within a pre-existing hypodense mural thrombus are an indicator of fresh thrombus formation and thus recent growth of an aneurysm.
Nose-like protrusions of perfused lumen into a clotted region suggests a higher risk of rupture.
Small amounts of stranding around an aneurysm indicate minor hemorrhage and can be the precursor to aortic rupture.

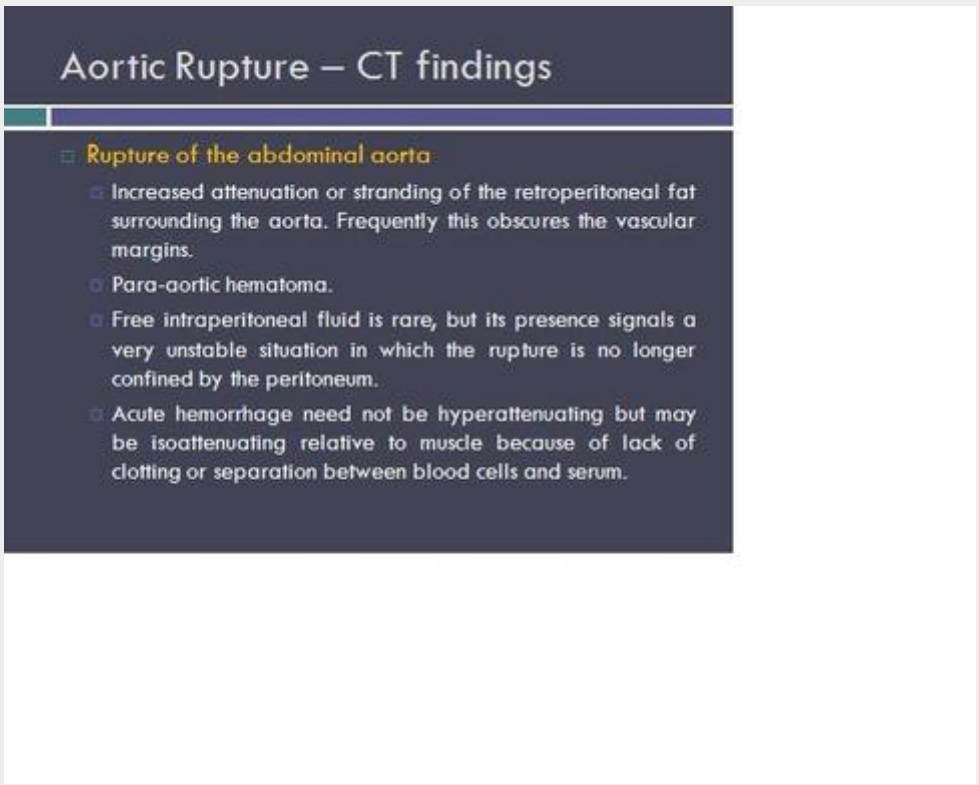
71.jpg


Aortic Rupture – CT findings
Contained rupture is characterized by local hemorrhage or acute pseudoaneurysm formation. Sometimes interruption of a wall calcification may be detected at the site of the pseudoaneurysm.
Active bleeding is present if contrast extravasation can be observed.

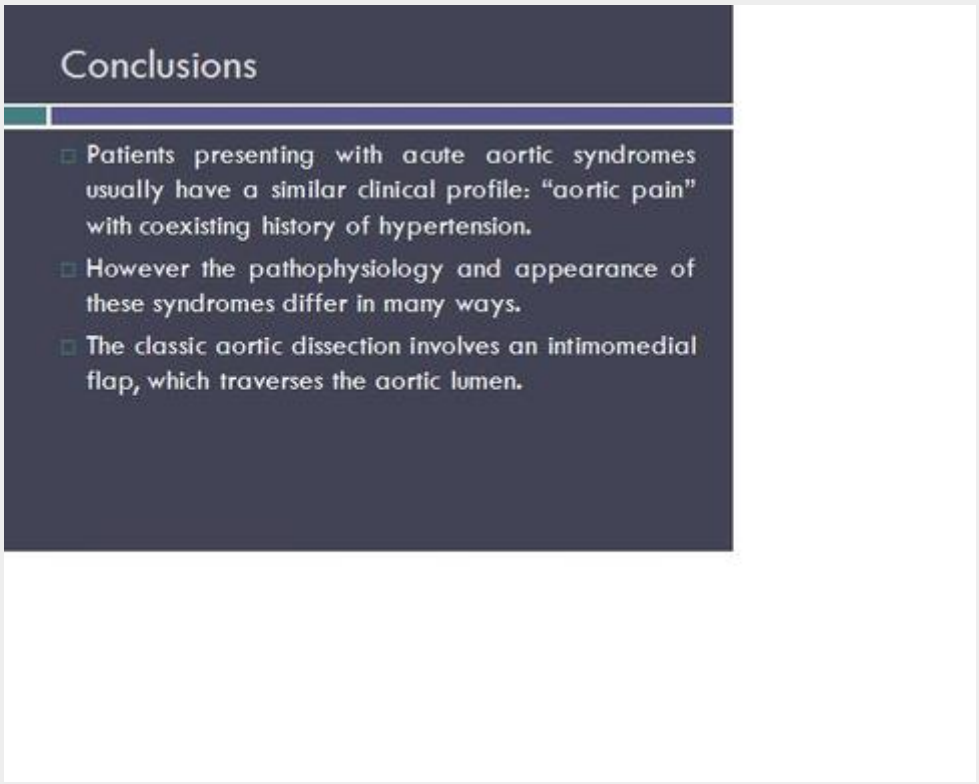
72.jpg


Aortic Rupture – CT findings
Rupture of the thoracic aorta
Hyperattenuating or streaky opacities in the mediastinum.
Mediastinal hematoma.
Hemorrhagic pericardial ou pleural effusion (CT numbers may be increased to above 30 HU).
Hemorrhage from the ascending aorta may enter the perivascular connective tissue of the pulmonar artery and then may extend into the intestitium of the lungs.

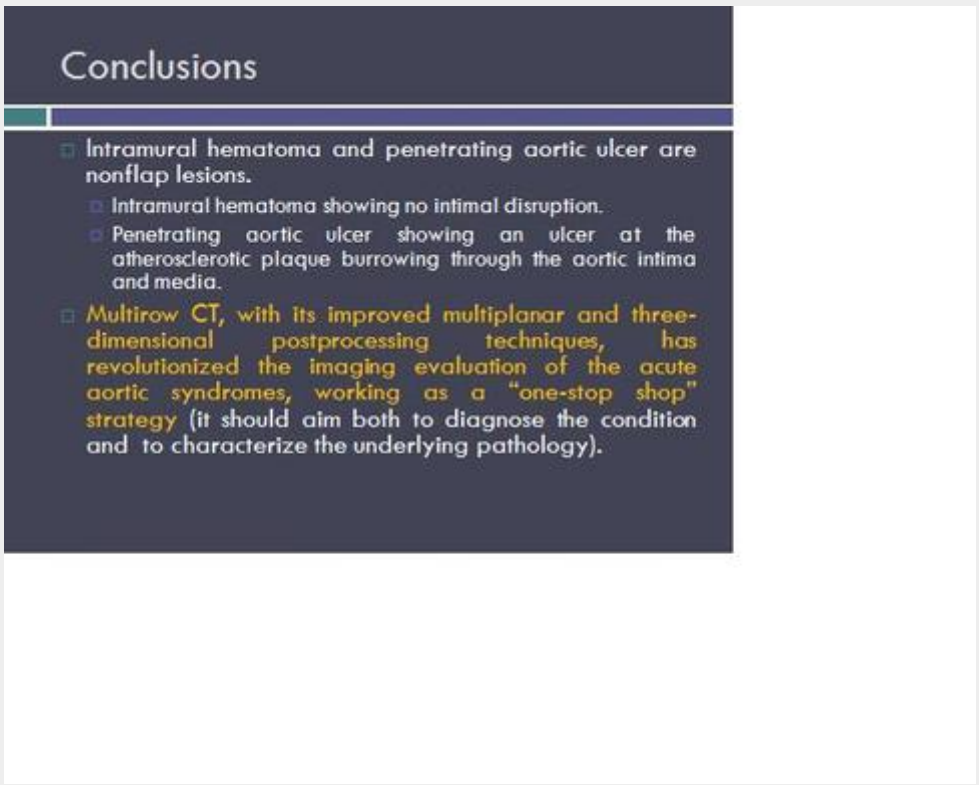
73.jpg


Aortic Rupture – CT findings
Rupture of the abdominal aorta
Increased attenuation or stranding of the retroperitoneal fat surrounding the aorta. Frequently this obscures the vascular margins.
Para-aortic hematoma.
Free intraperitoneal fluid is rare, but its presence signals a very unstable situation in which the rupture is no longer confined by the peritoneum.
Acute hemorrhage need not be hyperattenuating but may be isoattenuating relative to muscle because of lack of clotting or separation between blood cells and serum.

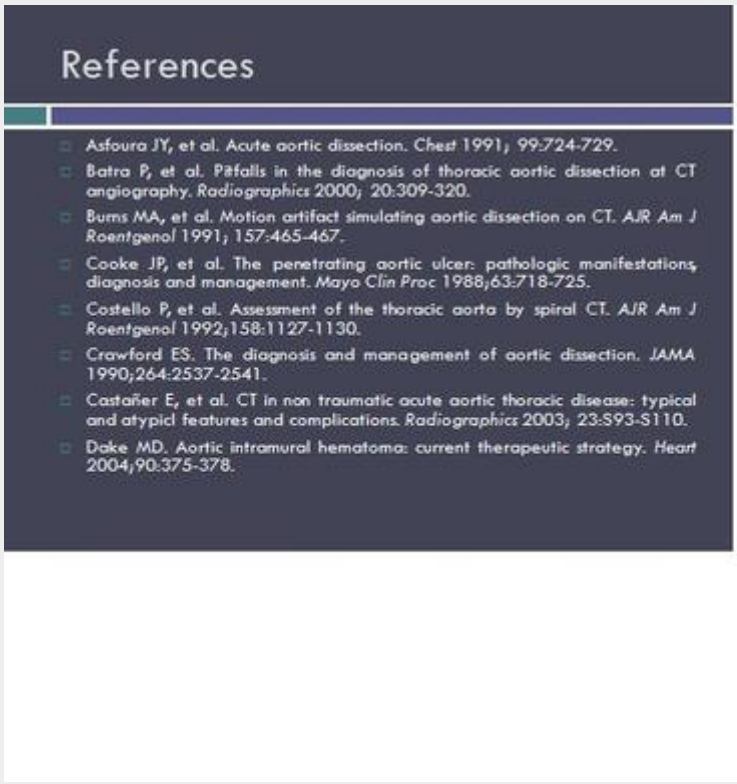
82.jpg


Conclusions
Patients presenting with acute aortic syndromes usually have a similar clinical profile: "aortic pain" with coexisting history of hypertension.
However the pathophysiology and appearance of these syndromes differ in many ways.
The classic aortic dissection involves an intimomedial flap, which traverses the aortic lumen.

83.jpg


Conclusions
Intramural hematoma and penetrating aortic ulcer are nonflap lesions.
Intramural hematoma showing no intimal disruption.
Penetrating aortic ulcer showing an ulcer at the atherosclerotic plaque burrowing through the aortic intima and media.
Multirow CT, with its improved multiplanar and three-dimensional postprocessing techniques, has revolutionized the imaging evaluation of the acute aortic syndromes, working as a "one-stop shop" strategy (it should aim both to diagnose the condition and to characterize the underlying pathology).

84.jpg


References
Asfoura JY, et al. Acute aortic dissection. Chest 1991; 99:724-729.
Batra P, et al. Pitfalls in the diagnosis of thoracic aortic dissection at CT angiography. Radiographics 2000; 20:309-320.
Burns MA, et al. Motion artifact simulating aortic dissection on CT. AJR Am J Roentgenol 1991; 157:465-467.
Cooke JP, et al. The penetrating aortic ulcer: pathologic manifestations, diagnosis and management. Mayo Clin Proc 1988;63:718-725.
Costello P, et al. Assessment of the thoracic aorta by spiral CT. AJR Am J Roentgenol 1992;158:1127-1130.
Crawford ES. The diagnosis and management of aortic dissection. JAMA 1990;264:2537-2541.
Castañer E, et al. CT in non traumatic acute aortic thoracic disease: typical and atypicl features and complications. Radiographics 2003; 23:S93-S110.
Dake MD. Aortic intramural hematoma: current therapeutic strategy. Heart 2004;90:375-378.

85.jpg


References
DeBakey ME, et al. Dissection and dissecting aneurysms of the aorta: twenty-year follow-up of five hundred twenty-seven patients treated surgically. Surgery 1982; 92:1118-1134.
Demos TC, et al. Detection of the intimal flap of aortic dissection on unenhanced CT images. AJR Am J Roentgenol 1986;146:601-603.
Duvernoy O, et al. Aortic motion: a potential pitfall in CT imaging of dissection in the ascending aorta. J Comput Assist Tomogr 1995;19:569-572.
Erbel R, et al. Diagnosis and management of aortic dissection. Recommendations of the task force on aortic dissection, European Society of Cardiology. Eur Heart J 2001;22:1642-1681.
Evangelista A, et al. Prognostic value of clinical and morphologic findings in short-term evolution of aortic intramural hematoma. Therapeutic implications. Eur Heart J 2004;25:81-87.
Fisher ER, et al. Acute aortic dissecton: typical and atypical imaging features. Radiographics 1994;14:1263-1271.

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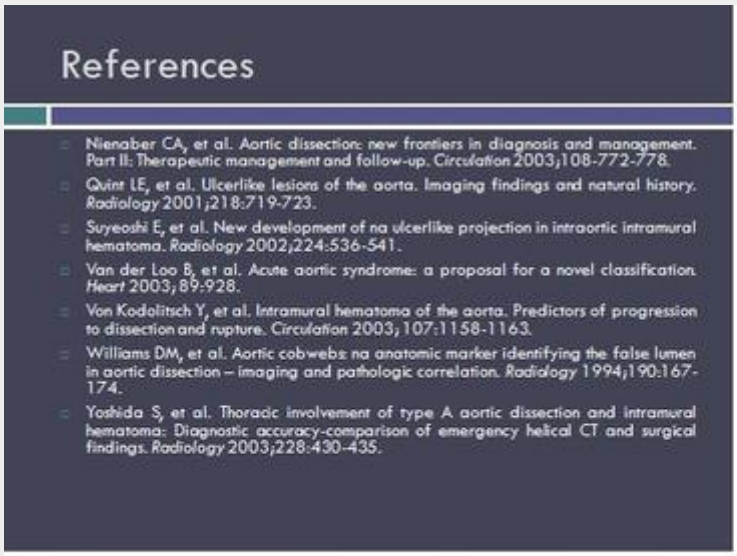
References
Gallagher S, et al. Streak artefacts of the thoracic aorta: pseudodissection. J Comput Assist Tomogr 1984;8:688-693.
Godwin JD, et al. Problems and pitfalls in the evaluation of thoracic aortic dissection by computed tomography. J Comput Assist Tomogr 1982;6:750-756.
Gotway MB, et al. Thoracic aorta imaging with multislice CT. Radiol Clin North Am 2003;41:521-543.
Harris JA, et al. Penetrating atherosclerotic ulcers of the aorta. J Vasc Surg 1994;19:619-626.
Hayashi H, et al. Penetrating atherosclerotic ulcer of the aorta: imaginf features and disease concept. Radiographics 2000;20:995-1005.
Heiberg E, et al. CT findings in thoracic aortic dissection. AJR am J Roentgenol 1981;136:13-17.
Kapoor V, et al. Intimomedial rupture: a new CT finding to distinguish true from false lumen in aortic dissection. AJR am J Roentgenol 2004;183:109-112.
Kastan DJ, et al. Intimo-intimal intussusception: an unusual presentation of aortic dissection. AJR am J Roentgenol 1988;151:603-604.

87.jpg


References
Kazerooni EA, et al. Penetrating atherosclerotic ulcers of the descending thoracic aorta: evaluation with CT and distinction from aortic dissection. Radiology 1992;183:759-765.
Landay MJ, et al. "Hyperdense" aortic wall: potential pitfall in CT screening for aortic dissection. J Comput Assist Tomogr 1991;15:561-564.
LePage MA, et al. Aortic dissection: CT features that distinguishe true lumen from false lumen. Ajr Am J Roentgenol 2001;177:207-211.
Levy JR, et al. Imaging of penetrating atherosclerotic ulcers of the aorta. Ajr Am J Roentgenol 1999;173:151-154.
Macura KJ, et al. Pathogenesis in acute aortic syndromes: aortic dissection, intramural hematoma and penetrating atherosclerotic ulcer. Ajr Am J Roentgenol 2003;181:309-316.
Macura KJ, et al. Role of computed tomography and magnetic resonance imaging in assessment of acute aortic syndromes. Semin Ultrasound CT MR 2003;24:232-254.
Nienaber CA, et al. Aortic dissection: new frontiers in diagnosis and management. Part I: From etiology to diagnostic strategies. Circulation 2003;108:628-635.

88.jpg


References
Nienaber CA, et al. Aortic dissection: new frontiers in diagnosis and management. Part II: Therapeutic management and follow-up. Circulation 2003;108:772-778.
Quint LE, et al. Ulcerlike lesions of the aorta. Imaging findings and natural history. Radiology 2001;218:719-723.
Suyeoshi E, et al. New development of na ulcerlike projection in intraortic intramural hematoma. Radiology 2002;224:536-541.
Van der Loo B, et al. Acute aortic syndrome: a proposal for a novel classification. Heart 2003; 89:928.
Von Kodolitsch Y, et al. Intramural hematoma of the aorta. Predictors of progression to dissection and rupture. Circulation 2003; 107:1158-1163.
Williams DM, et al. Aortic cobwebs: na anatomic marker identifying the false lumen in aortic dissection – imaging and pathologic correlation. Radiology 1994;190:167-174.
Yoshida S, et al. Thoracic involvement of type A aortic dissection and intramural hematoma: Diagnostic accuracy-comparison of emergency helical CT and surgical findings. Radiology 2003;228:430-435.

89.jpg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22.jpg

Aneurysm of the ascending aorta with dissection – Type A aortic dissection. An intimal flap (arrow) is present only in ascending aorta (beginning at aortic root and ending before the aortic arch), separating the smaller true (T) from the larger false lumina. There is excentric partial thrombosis of the false lumen (arrowheads).

21.jpg

Aneurysm of the ascending aorta with dissection – Type A aortic dissection. An intimal flap (arrow) is present only in ascending aorta (beginning at aortic root and ending before the aortic arch), separating the smaller true (T) from the larger false lumina. There is excentric partial thrombosis of the false lumen (arrowheads).

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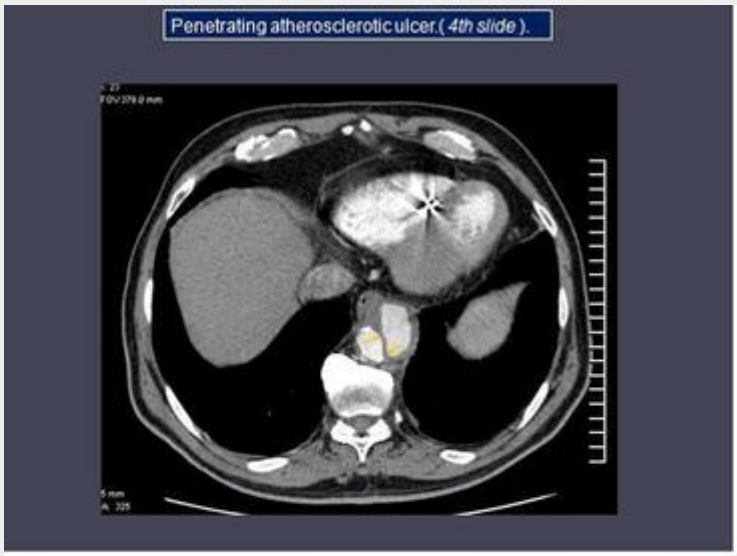
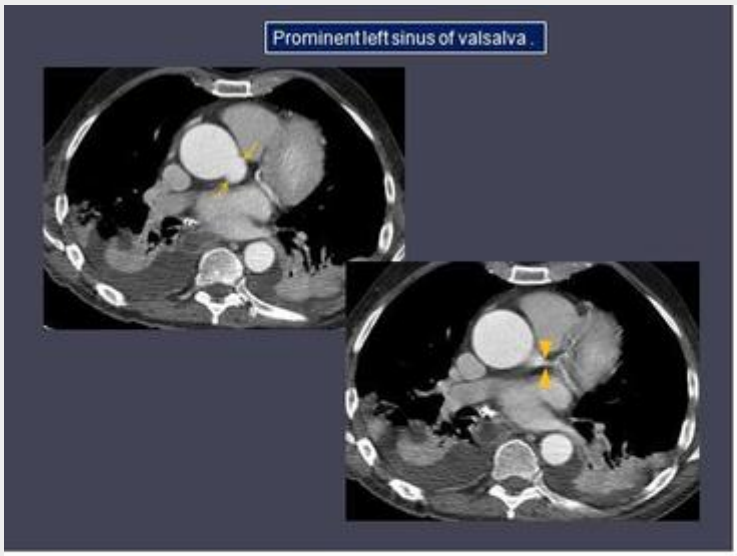


Apparent short segment intimal flap, which is the tomographic correlate of the ulcer border separating an elongated intramural niche from the vascular lumen - pseudointimal flap (arrows).

42.jpg

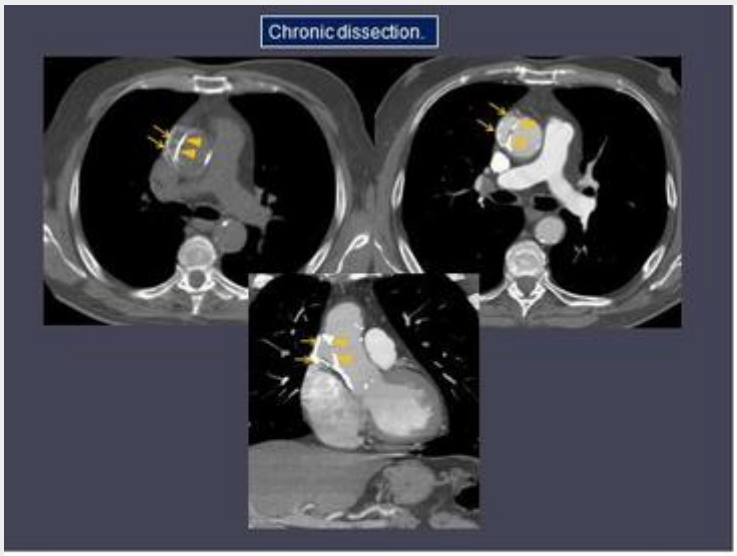


A prominent left sinus of valsalva (arrows) may mimic a dissection or a penetrating ulcer. Identification of the left coronary artery (arrowheads) arising from this structure is the key to avoid this pitfall.

35.jpg

Calcification of the aortic wall acts like glue and may induce atypical shapes of the dissecting membrane.

40.jpg

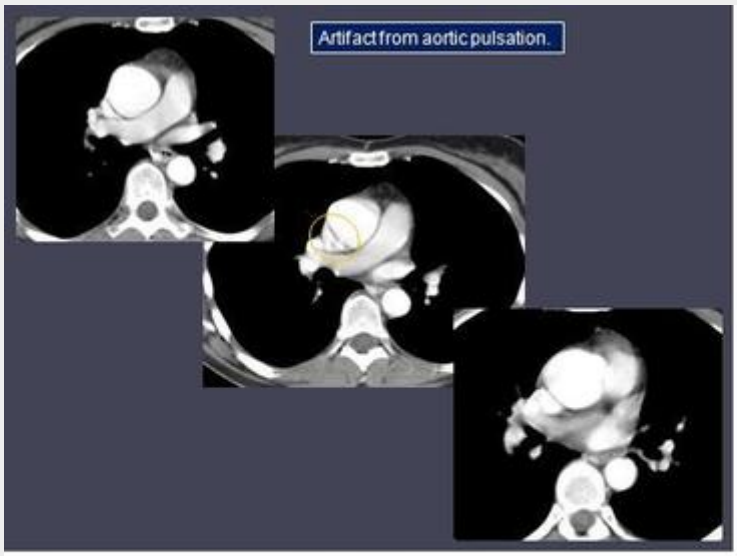


Chronic dissection – This patient had acute chest pain, however CT demonstrated wall calcifications in the false channel (arrows) indicative of a chronic process and aortic dissection could be excluded as the cause of acute chest pain. Intima (arrowheads).

79.jpg

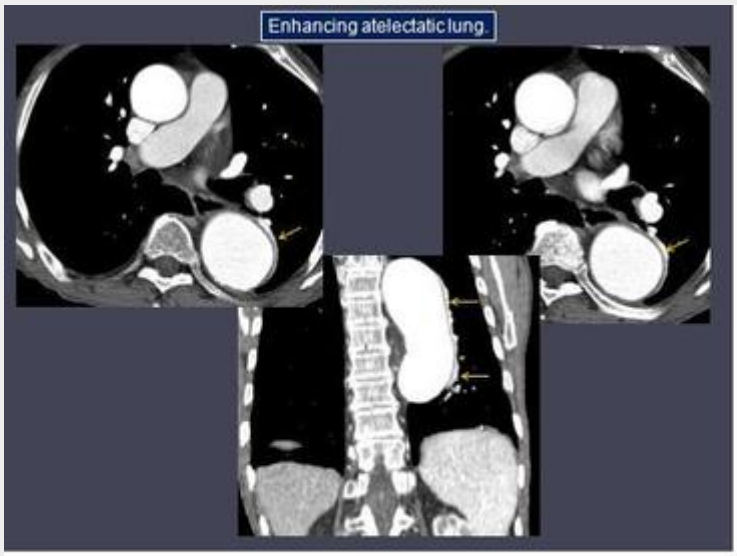
Contained rupture of ascending aorta characterized by acute pseudoaneurysm formation (circle).

41.jpg



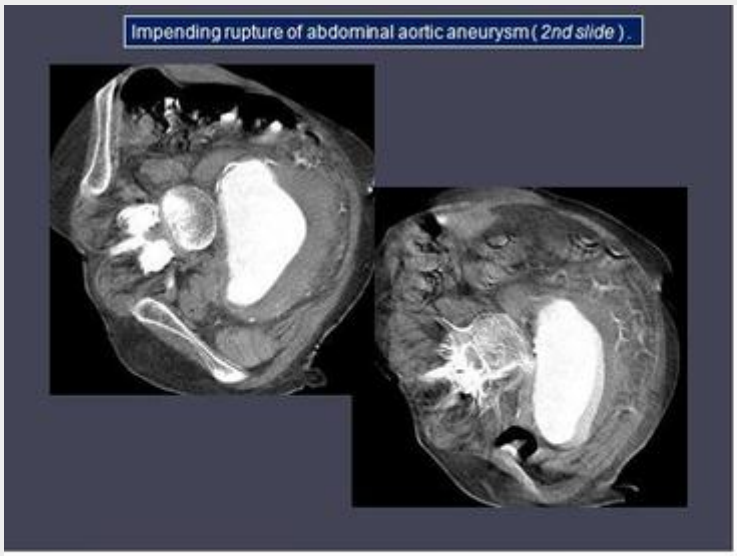
Curvilinear artifact from aortic pulsation mimetizing intimal flap (circle). It is tipically seen in the ascending aorta. Note that it is absent on contiguous sections which helps to avoid this common pitfall.

43.jpg



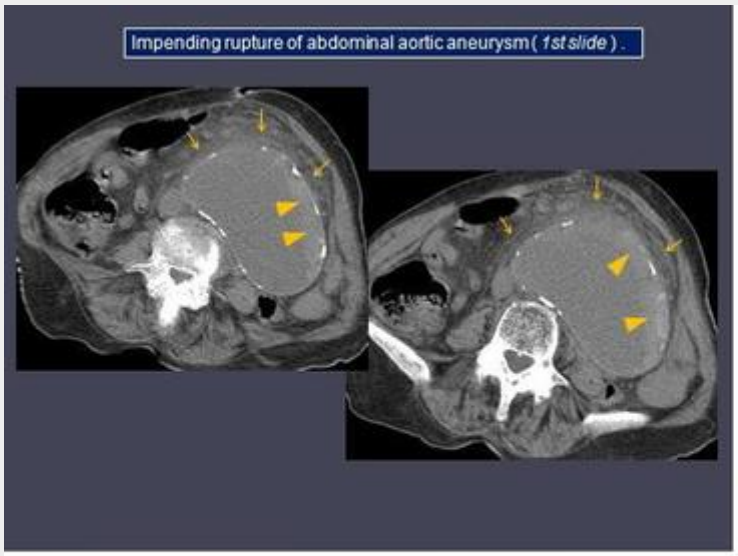
Enhancing atelectatic lung (arrows) is commonly seen adjacent to the aorta and may mimic a false lumen.

81.jpg



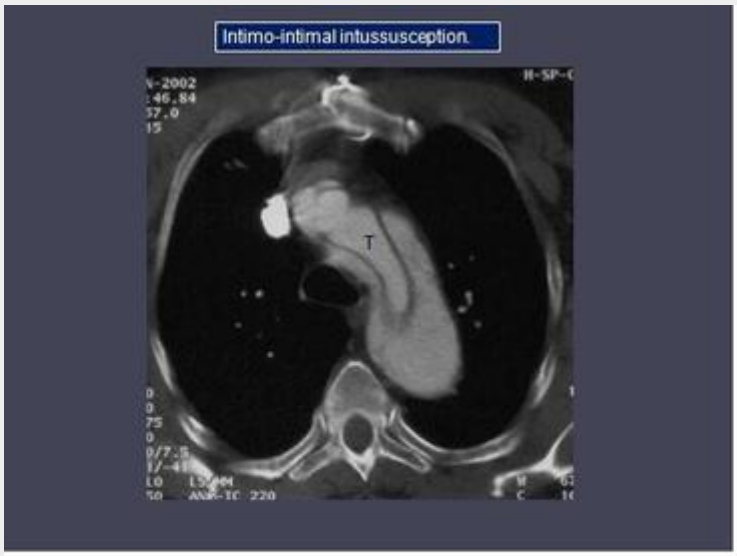
Impending rupture of abdominal aortic aneurysm. After CIV the patient moved a loted with marked motion artifacts. Apparently there was no active contrast extravasation.

80.jpg



Impending rupture of abdominal aortic aneurysm. Hyperdense portions (arrowheads) within a pre-existing hypodense mural thrombus are an indicator of fresh thrombus formation and thus recent growth of an aneurysm. There is also stranding (arrows) around the aneurysm obscuring the vascular margins, an important sign that can indicate minor hemorrhage.

36.jpg

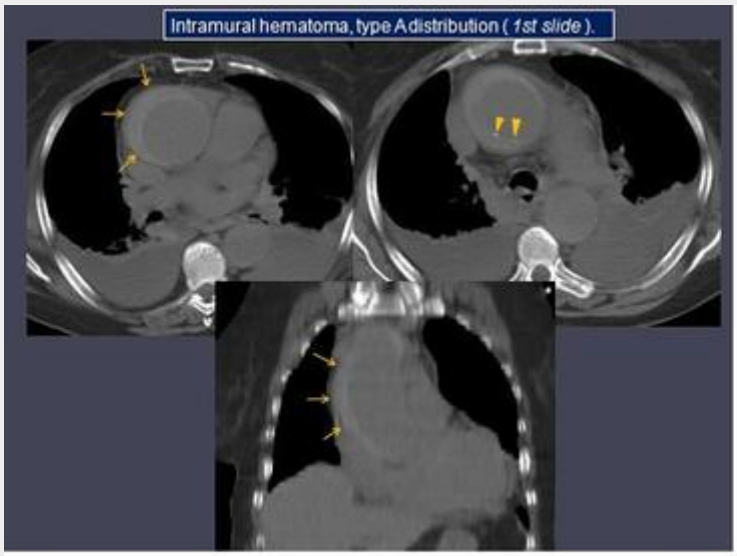


Intimo-intimal intussusception. CT demonstrates aortic dissection with complete separation of the intimomedial flap from the aortic wall. The inner lumen is invariably the true lumen (T).

51.jpg

Intramural hematoma, type A distribution. Intramural hematoma is harder to appreciate after contrast material injection (endoluminal thrombus can also have this appearance). There is also bilateral pleural effusion.

50.jpg

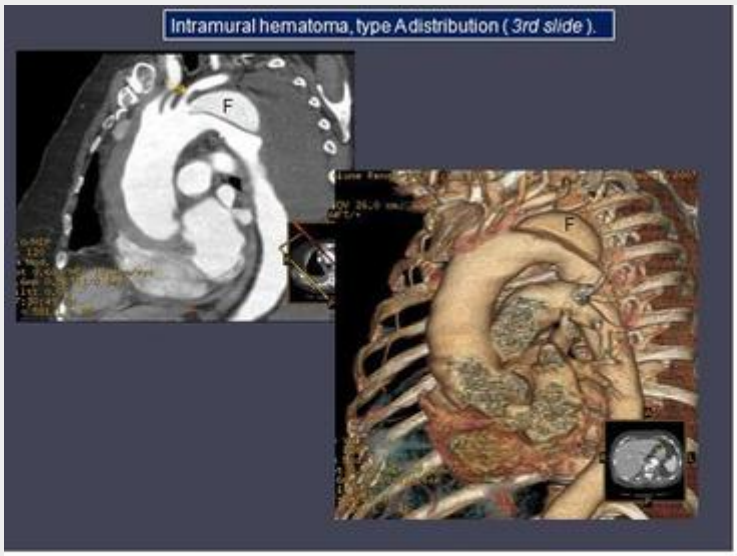


Intramural hematoma, type A distribution. Non-contrast enhanced CT demonstrates a hyperdense crescentic area in the lateral and anterior wall of the ascending aorta (arrows), with concomitant displacement of intimal calcifications (arrowheads).

53.jpg

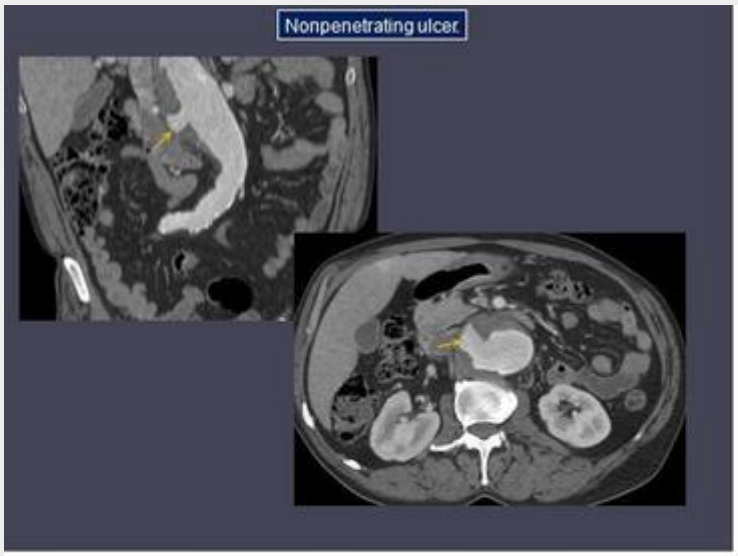
Intramural hematoma, type A distribution. Ten days later (right image), the false (F) lumen has acutely thrombosed (high attenuation material inside it), with exclusive enhancement of the true lumen.

52.jpg



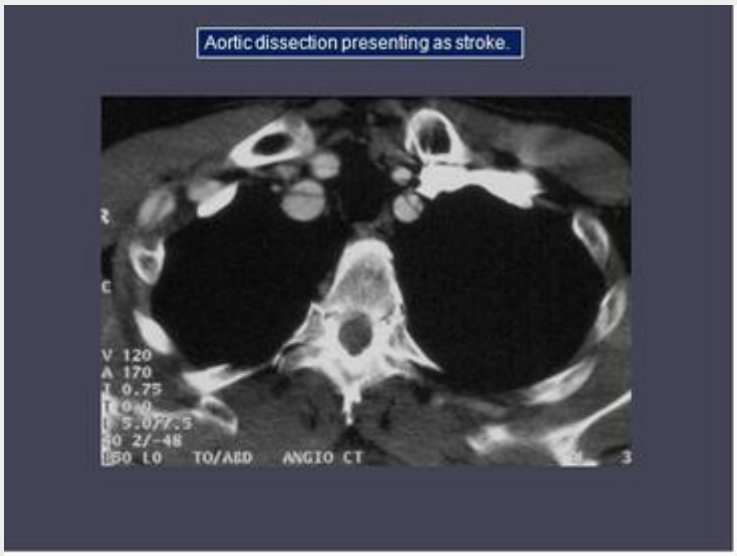
Intramural hematoma, type A distribution. This intramural hematoma has progressed into a small dissection, that starts just after the origin of the left subclavian artery (arrow). F = False lumen.

67.jpg



Nonpenetrating ulcer. There is a thrombus with focal ulceration (arrows), but no contrast material is extending beyond level of intima and no intramural hematoma is present. The patient was assymptomatic.

37.jpg

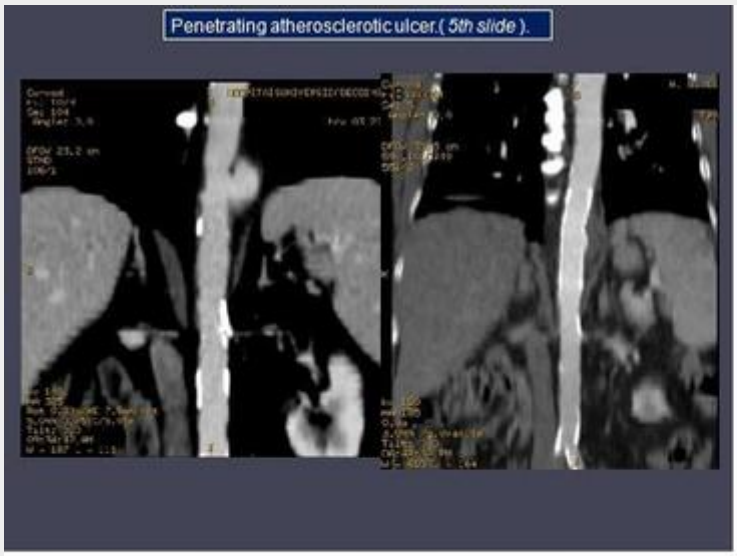


Patient with chest pain followed by stroke. There was a aortic dissection (not shown) that extended into the major aortic branches in the neck.

62.jpg

Penetrating atherosclerotic ulcer. Conventional angiography shows saccular aneurysm in the distal third of the descending thoracic aorta.

65.jpg



Penetrating atherosclerotic ulcer. Curved-MIP. Saccular aneurysm before (A) and after (B) stenting. MDCT with high quality multiplanar and volumetric projections can be very useful in demonstrating ulcer morphology when transaxial images are confusing.

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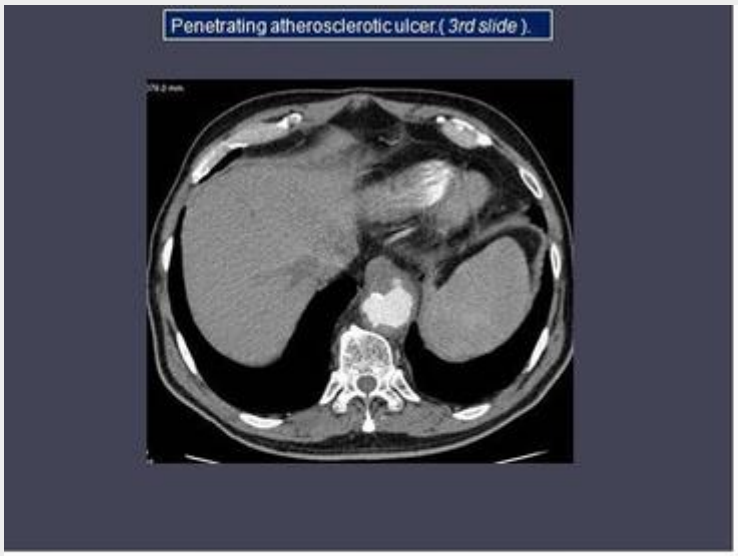
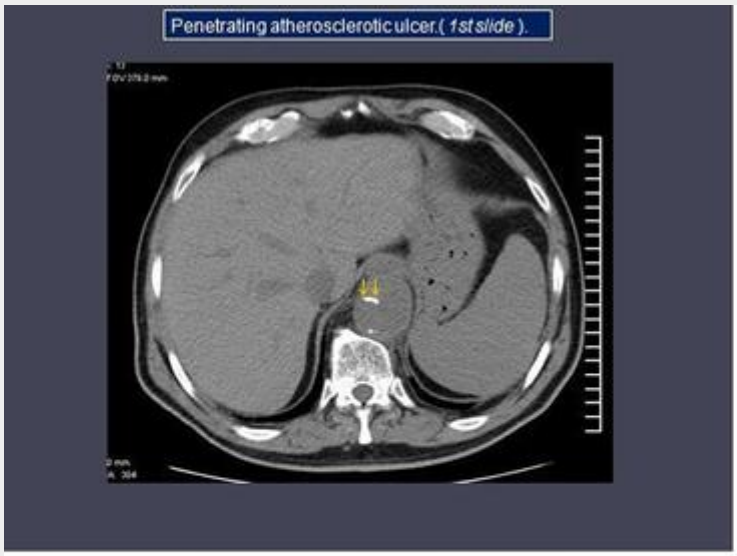


Penetrating atherosclerotic ulcer. Enhanced CT shows sacular aneurysm caused by penetrating atherosclerotic ulcer, associated with enhanced thickening of the aortic wall.

61.jpg



Penetrating atherosclerotic ulcer. Unenhanced CT shows bulge of the left antero-lateral aspect of the distal descending thoracic aorta and intima calcification (arrows).

66.jpg

Penetrating atherosclerotic ulcer. VRT. Saccular aneurysm before (A) and after (B) stenting. MDCT with high quality multiplanar and volumetric projections can be very useful in demonstrating ulcer morphology when transaxial images are confusing.

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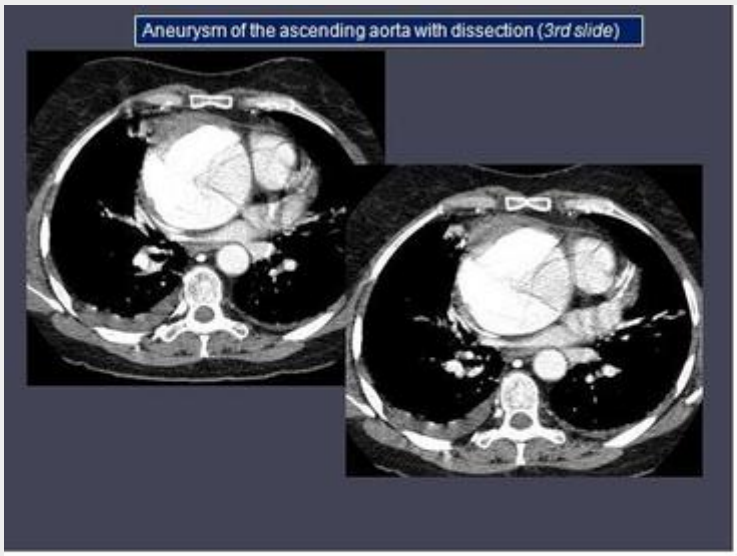
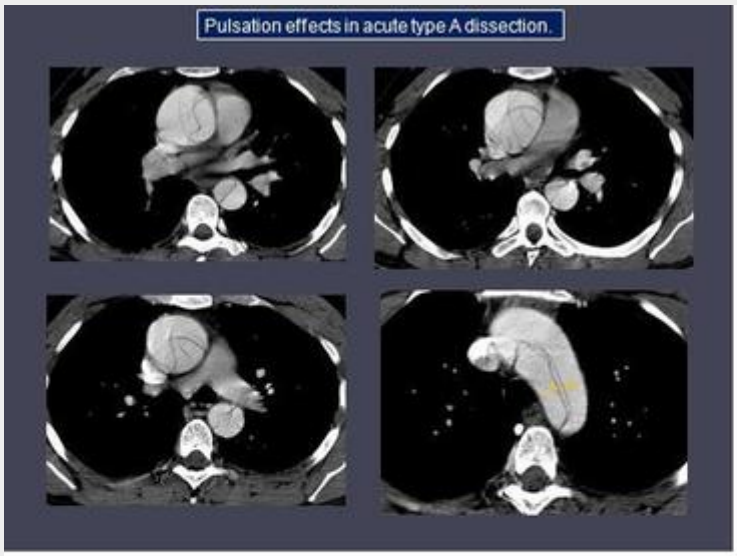


Pulsation effects in acute type-A dissection. Rapidly moving membranes in ascending aorta lead to multiple contours and may make identification of intimal flap difficult. This is usually seen only in acute dissections because the thickness of the intimal flap increases in chronic dissection.

34.jpg



Pulsation effects in acute type A dissection. Rapidly moving membranes in ascending aorta lead to multiple contours and may make identification of intimal flap difficult. Pulsation in the aortic arch leads to double contours of the flap (arrows).

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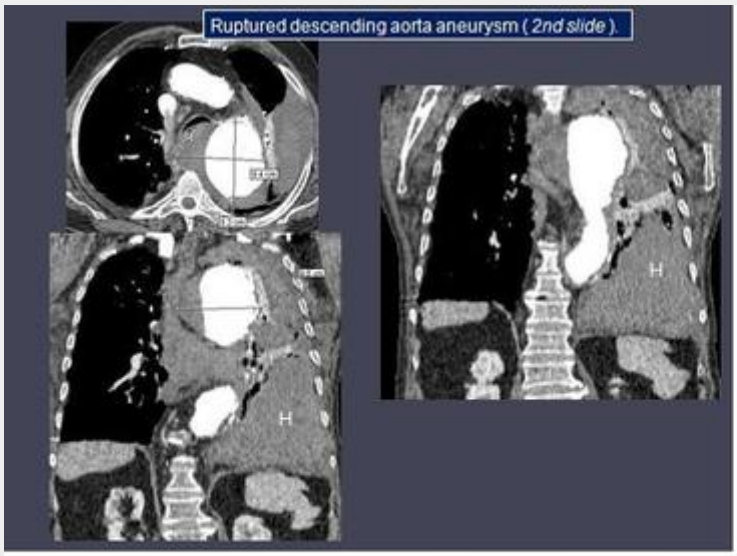
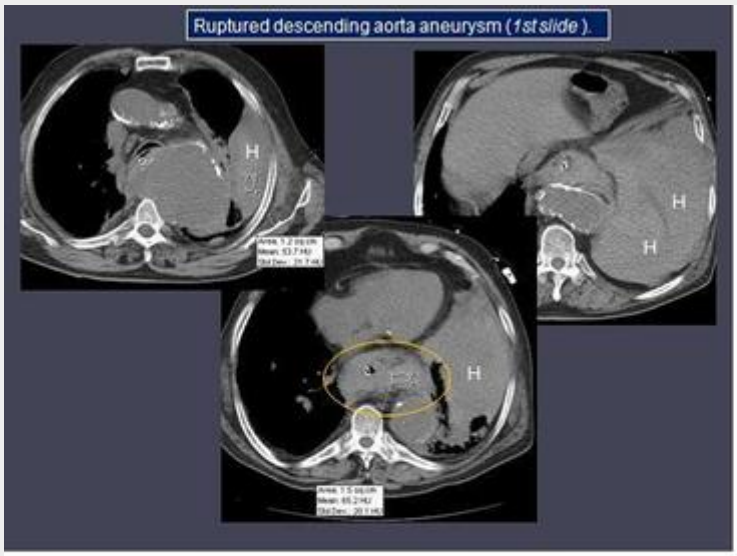


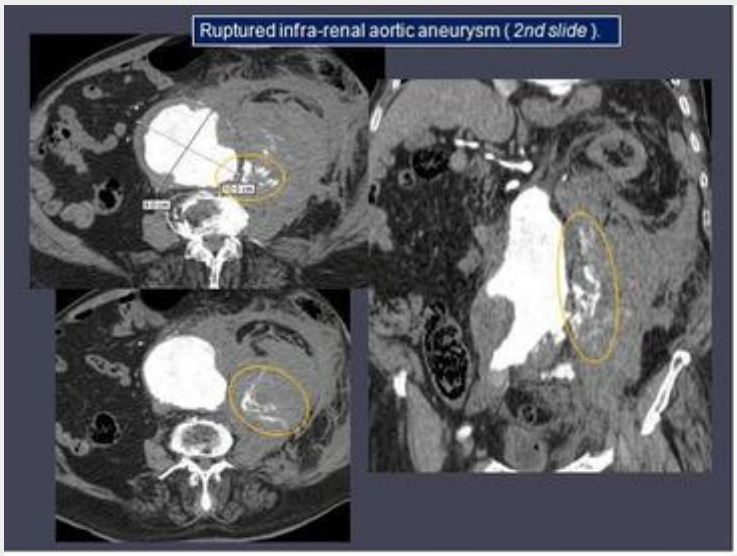
Ruptured descending aorta aneurysm. After CIV there was no active contrast extravasation. Note that the left hemidiaphragm is somewhat lower than normal due to the volumous left hemothorax (H).

74.jpg



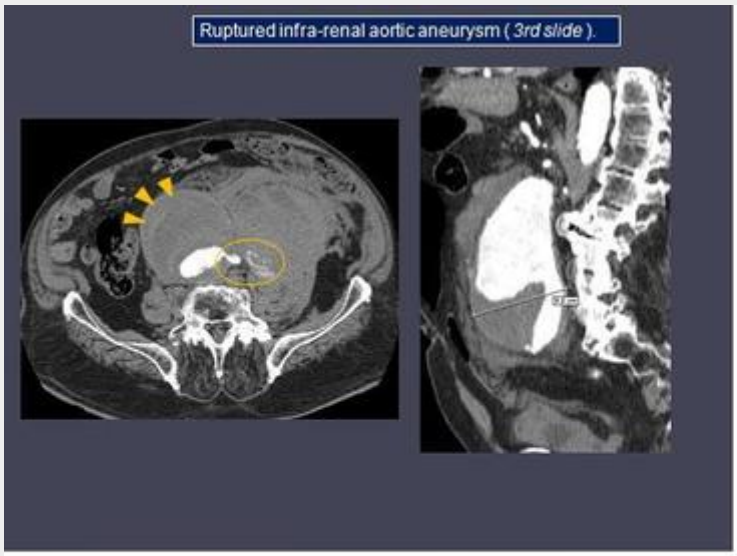
Ruptured descending aorta aneurysm. There is a large left hemothorax (H) (HU > to 50) and hematoma in posterior mediastinum (circle).

77.jpg



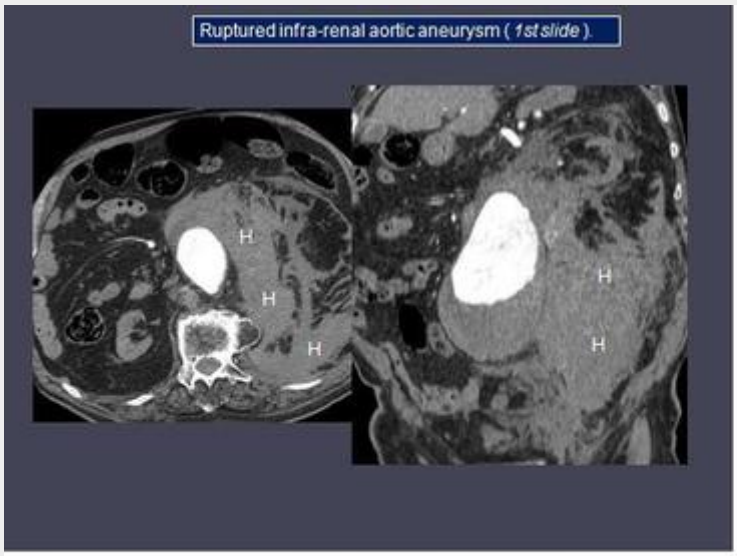
Ruptured infra-renal aortic aneurysm. Active bleeding is present indicated by active contrast extravasation (circles).

78.jpg



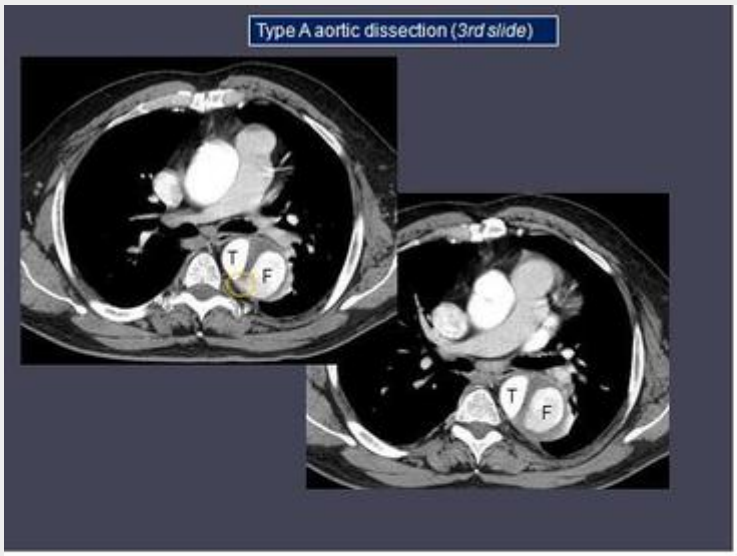
Ruptured infra-renal aortic aneurysm. Note the high attenuation portions within the mural thrombus of the aneurysm indicating fresh thrombotic material (arrowheads). There is also focal area of wall rupture and active contrast extravasation.

76.jpg



Ruptured infra-renal aortic aneurysm. Volumous left para-aortic hematoma (H).

27.jpg



The beak sign (circle) identifies the false lumen (F) and refers to the cross-sectional manifestation of the propagating wedge hematoma in the false channel as it cleaves a space and separates the intima. The true lumen (T) may be recognized from the false lumen by its intense early opacification.

38.jpg

Thrombosis of false lumen (arrows) with exclusive enhancement of true lumen (T).

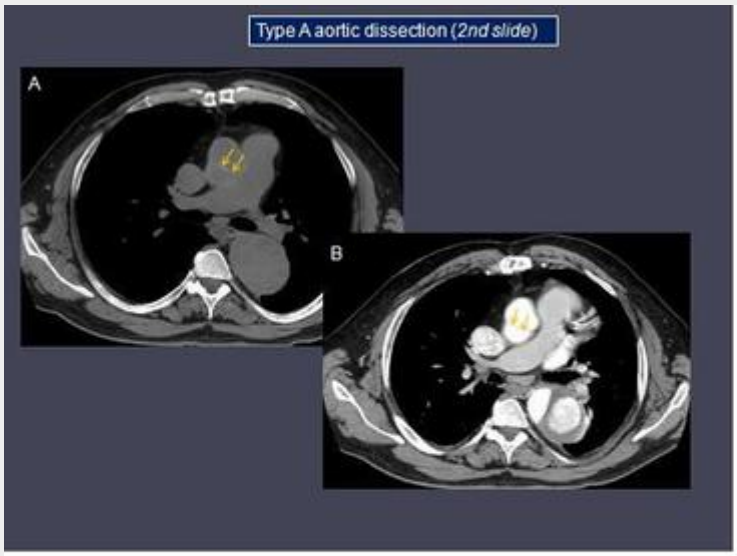
28.jpg

True lumen coarctation. There is thrombosis (THR) of the false lumen with compression and stenosis of the true lumen (arrows).

25.jpg

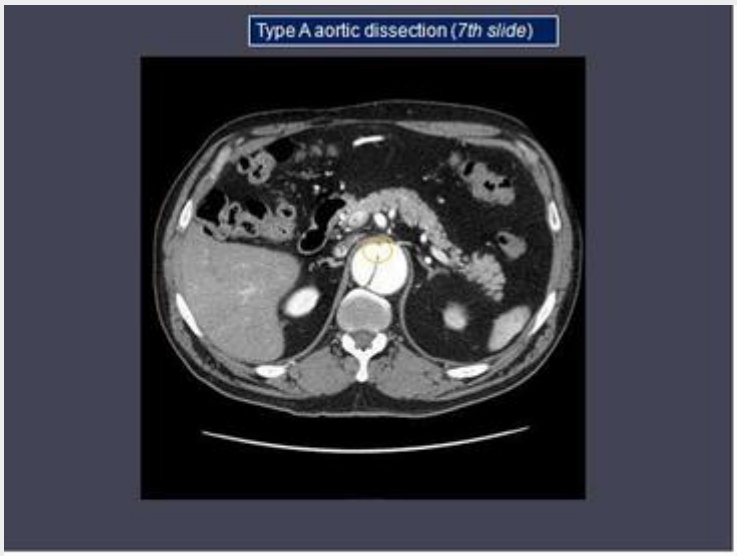
Type A aortic dissection, that stops just before the aortic bifurcation (arrow).

26.jpg



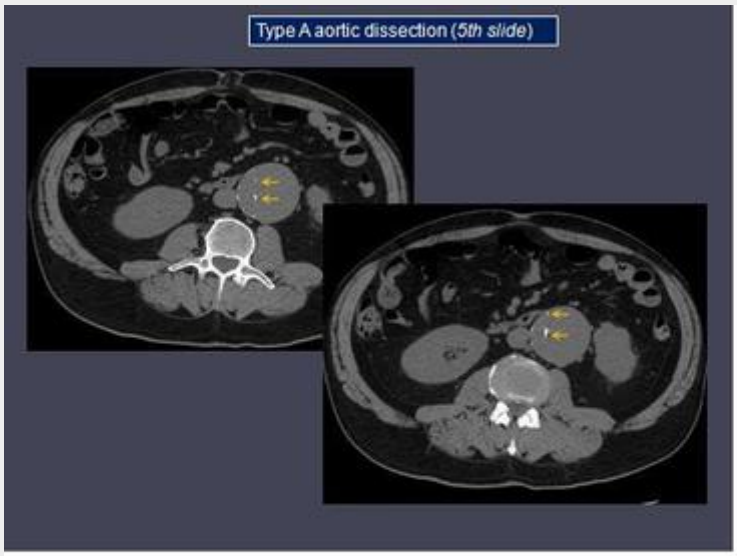
Type A aortic dissection, that stops just before the aortic bifurcation. A. Precontrast image. Visible intimal flap (arrows) as linear structure slightly higher in attenuation than surrounding blood (anemia? Microcalcifications within flap?). B. After CIV the intimal flap (arrows) is easily seen.

31.jpg



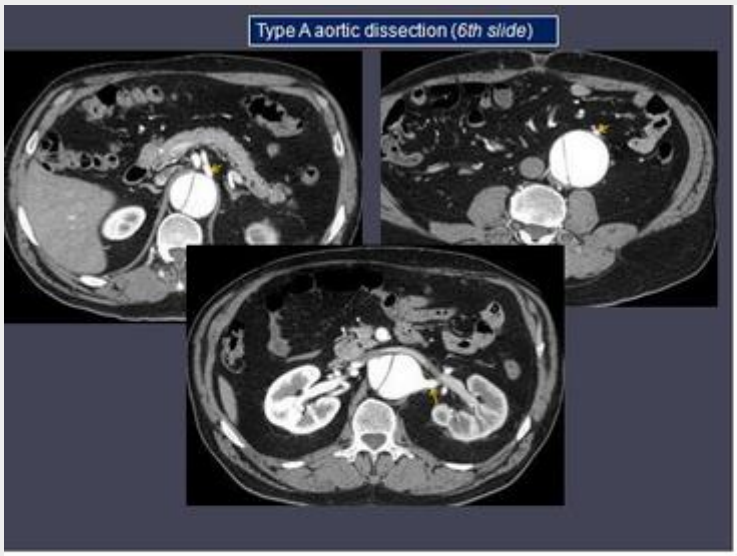
Type A aortic dissection, that stops just before the aortic bifurcation. Intimal tear (reentry site) visualized as intimal fenestration (circle) communicating true and false lumen.

29.jpg



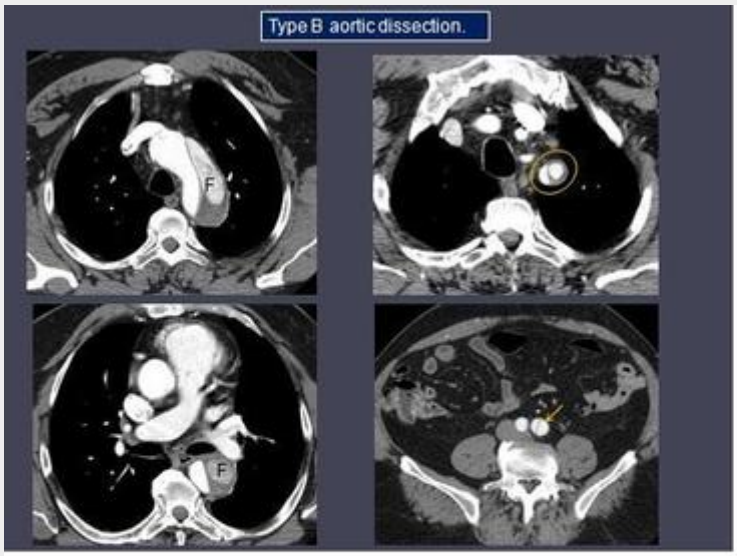
Type A aortic dissection, that stops just before the aortic bifurcation. Noncontrast scan demonstrates displaced intimal calcifications (arrows), signaling the presence of an intimal flap.

30.jpg



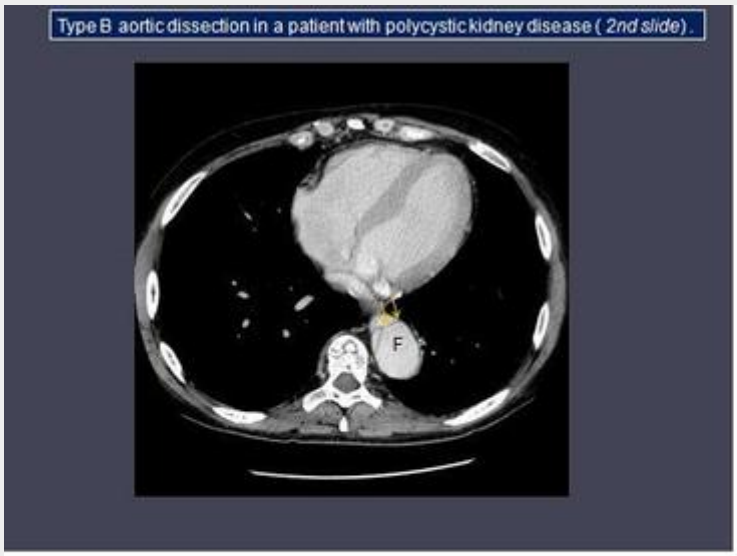
Type A aortic dissection, that stops just before the aortic bifurcation. Splenic, left renal and mesenteric inferior arteries (arrows) have origin in the false lumen. Note that there is less enhancement of the left kidney compared to the contralateral, suggestive of renal ischemia.

39.jpg



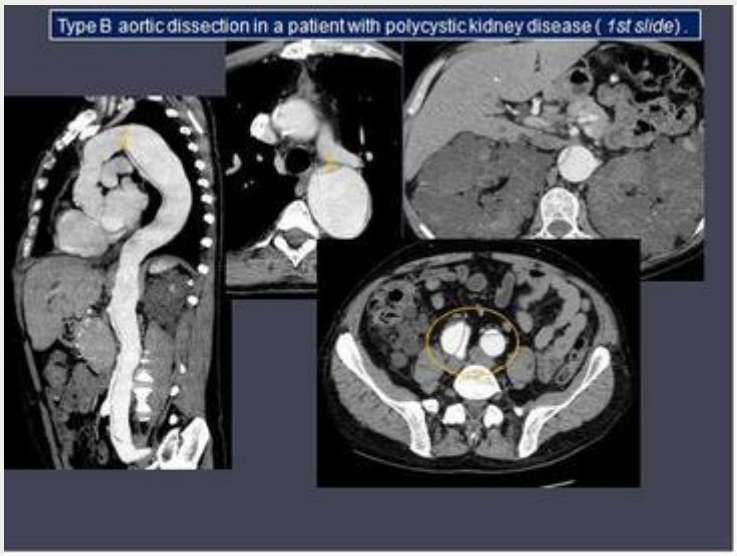
Type B aortic dissection. The dissection begins in the aortic arch and envolves also the left subclavian artery (circle). The false lumen (F) is typically seen in the outer curvature of aorta, has delayed enhancement (slower flow) and has a greater area. The dissection extends into the left iliac artery (arrow). Note partial thrombosis in the false lumen.

33.jpg



Type B aortic dissection in a patient with polycystic kidney disease. Aortic cobwebs (arrows) are strands of tissue from the aortic media that indicate the false channel (F).

32.jpg



Type B aortic dissection in a patient with polycystic kidney disease. The dissection begins in distal half of aortic arch (arrow) and extends to both common iliac arteries (circle). There are no signs of thrombosis in any of the lumens (true and false).

24.jpg

Volumous left-sided hemorrhagic pleural effusion (CT attenuation of 62 HU) secondary to rupture of an ascending aorta dissection (not shown). There is also a small pleural effusion on the right side.