ANEURYSMS AND DISSECTIONS

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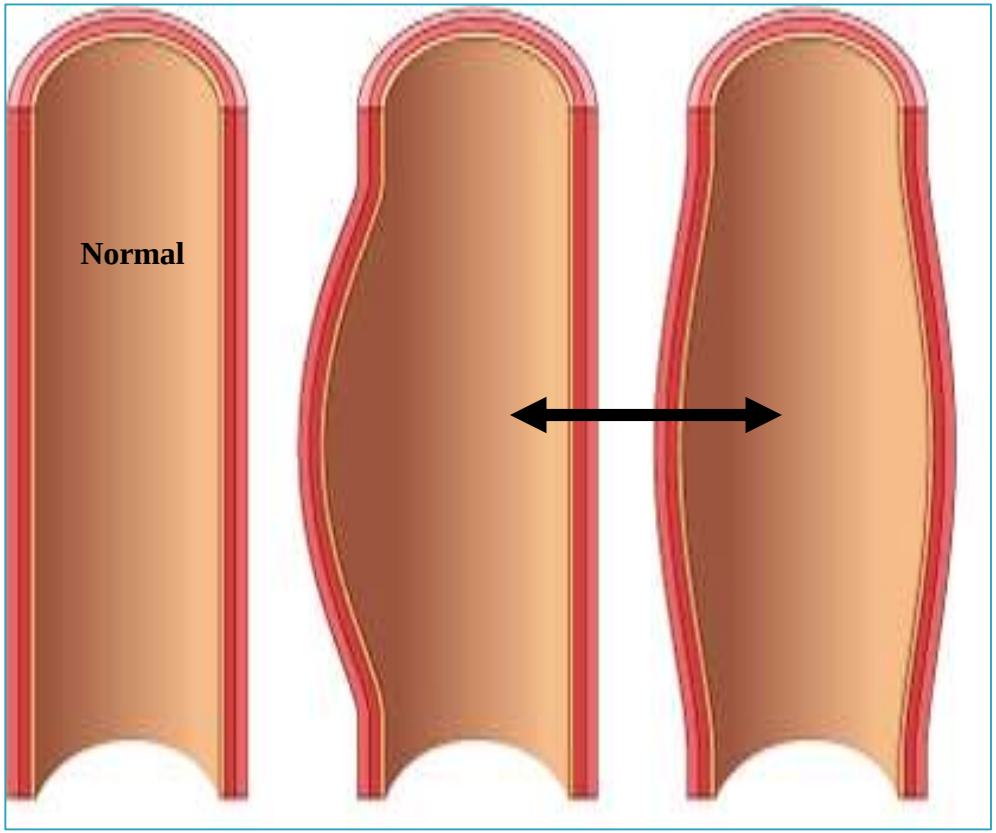
Aneurysm

- **localized abnormal dilation of artery or heart**

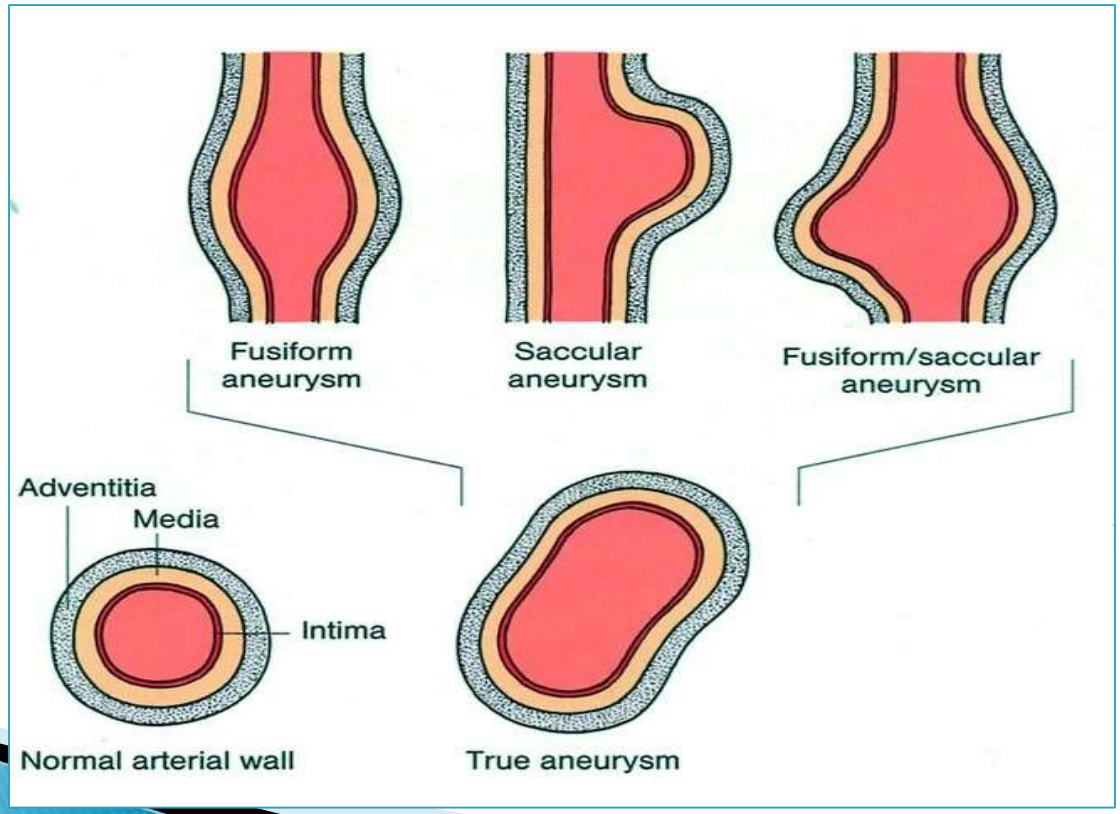


- **Types:**

1-"true" aneurysm

- all three layers of arterial wall or heart

→ e.g. Atherosclerotic, syphilitic, congenital aneurysms, ventricular aneurysms following transmural MI

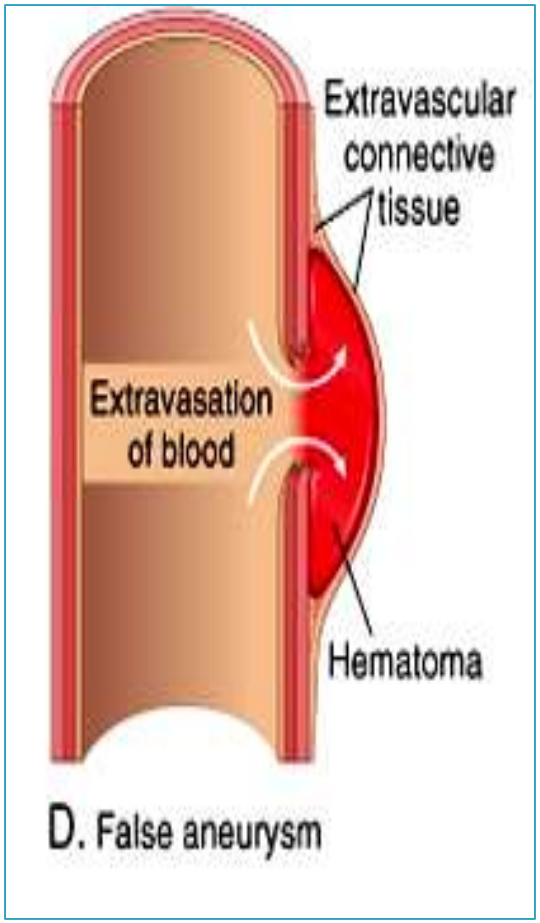


2- “false” aneurysm

- (a.k.a. pseudo-aneurysm)

- **a breach in vascular wall leading to hematoma communicating with intravascular space ("pulsating hematoma")**

- E.g. ventricular rupture after MI contained by pericardial adhesion
- E.g. a leak at the junction of a vascular graft with a natural artery.



- **aneurysms are classified according to macroscopic shape into:**

1- saccular

2- fusiform

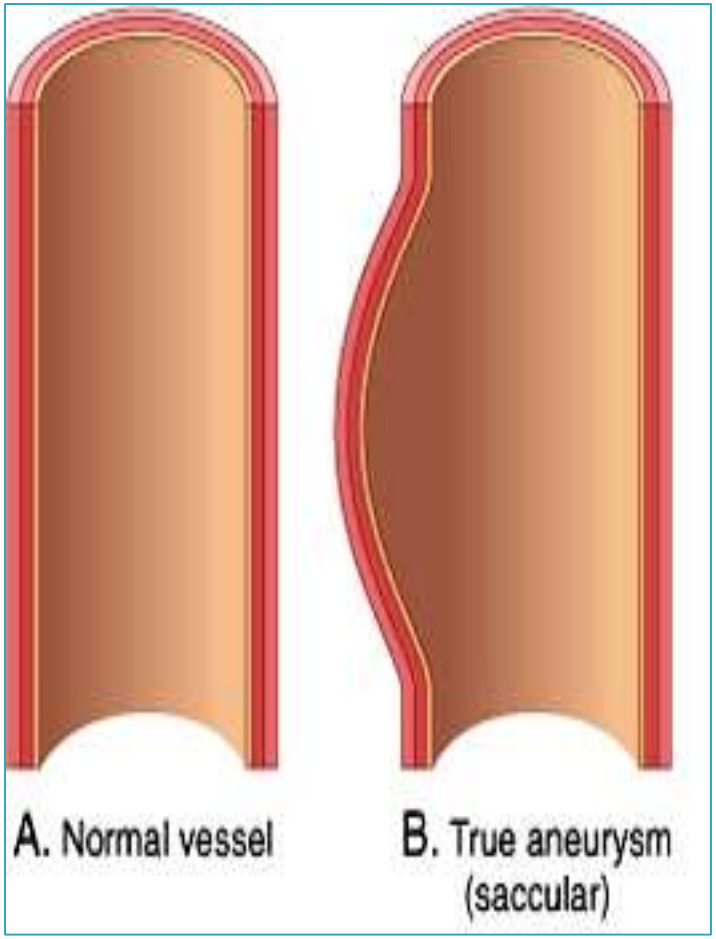
- Note: shape and size are not specific for any disease or clinical manifestations

1- Saccular aneurysms

- spherical outpouchings

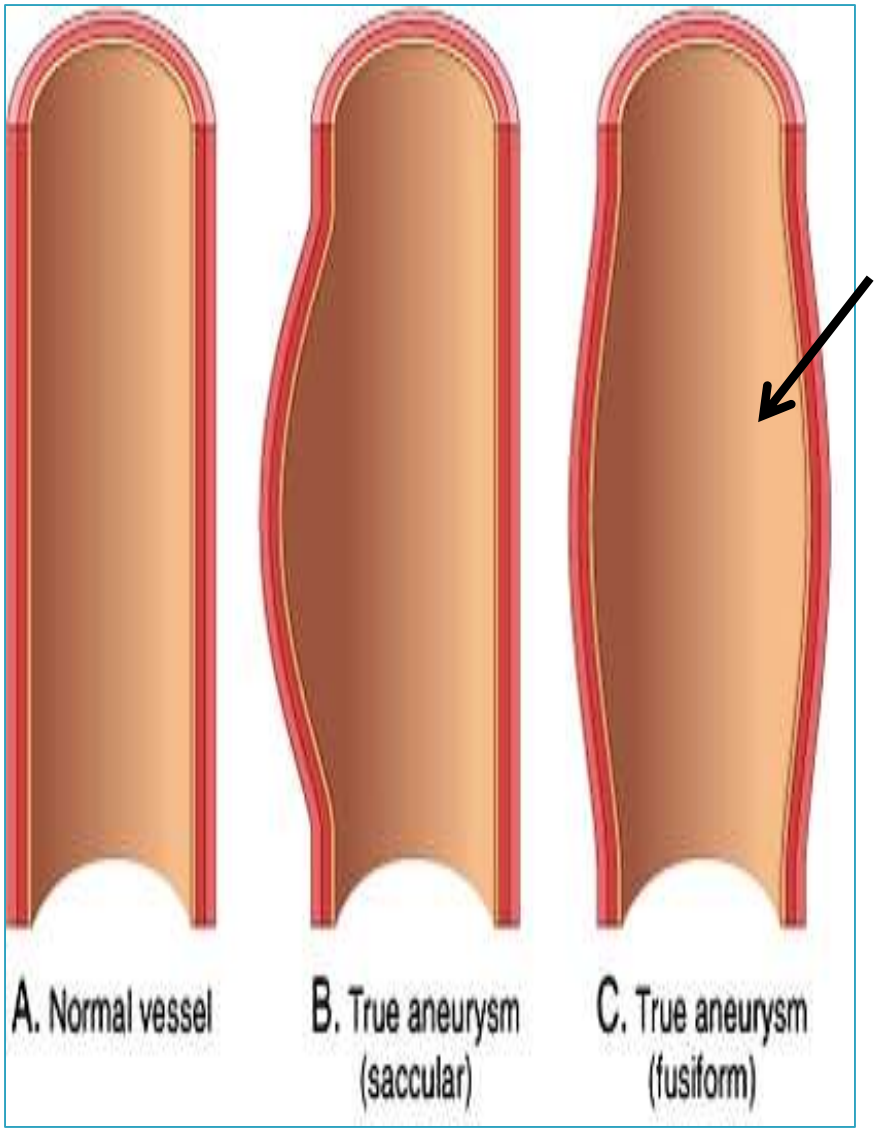
-involving only a portion of vessel wall

- may contain thrombi

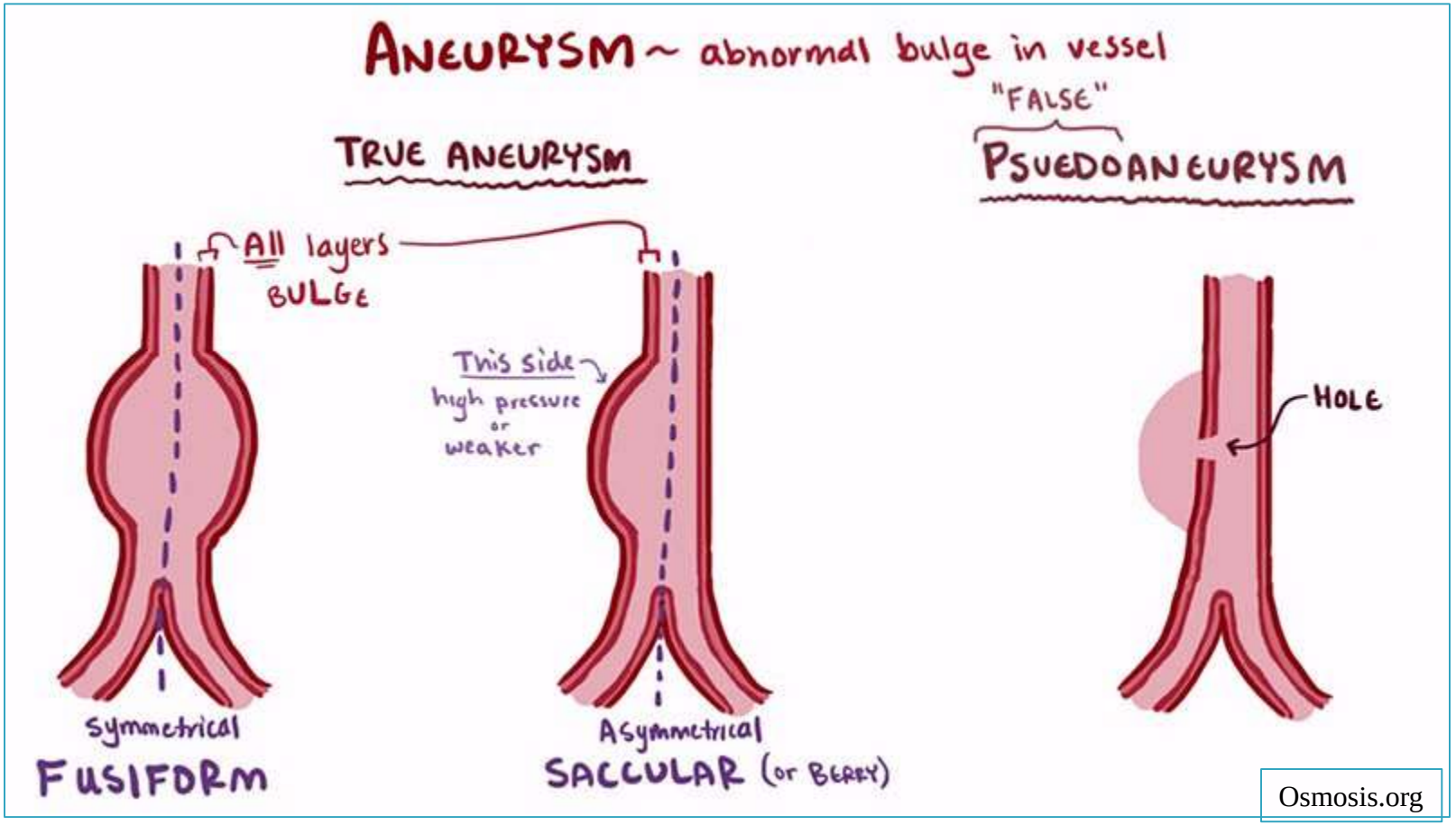


2- Fusiform aneurysms

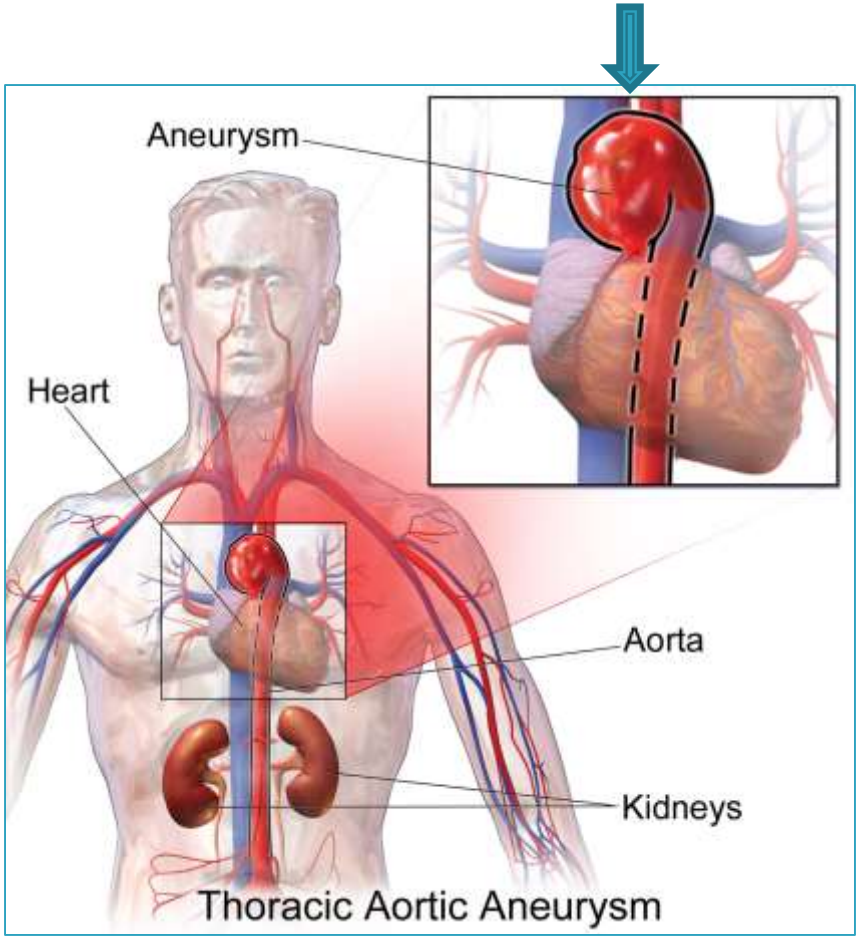
- **diffuse, circumferential dilation of a long vascular segment**

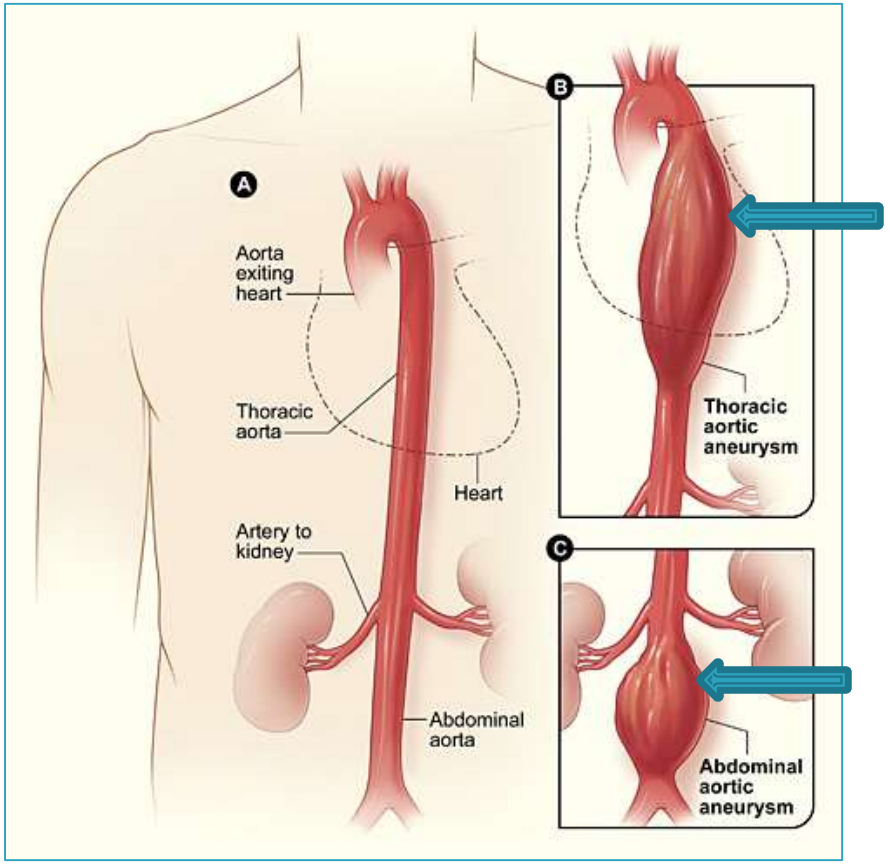


To summarize…



Aortic aneurysms





Aortic aneurysms

- ***The two most important causes are:***

1- **Atherosclerosis :**

- most common cause

→intimal plaques compress underlying media

→compromise nutrient and waste diffusion into arterial wall

→media degeneration and necrosis

→ thinning and weakening of media

→dilation of vessel

2- Degeneration of arterial media

- causes include: hypertension; trauma; congenital defects (e.g., *berry* aneurysms); hereditary defects in structural components (Marfan); infections (*mycotic* aneurysms); vasculitis; immune-mediated….

Abdominal Aortic Aneurysm

- Atherosclerotic aneurysms occur most frequently in **abdominal** aorta (= AAA)
- common iliacs, arch, and descending parts of thoracic aorta can also be involved
- **Pathogenesis**
- **m/c in men**
- **rarely < age 50**
- **Atherosclerosis is a major cause of AAA**

Abdominal Aortic Aneurysm

- other contributors include:

1- Hereditary defects in structural components of the aorta:

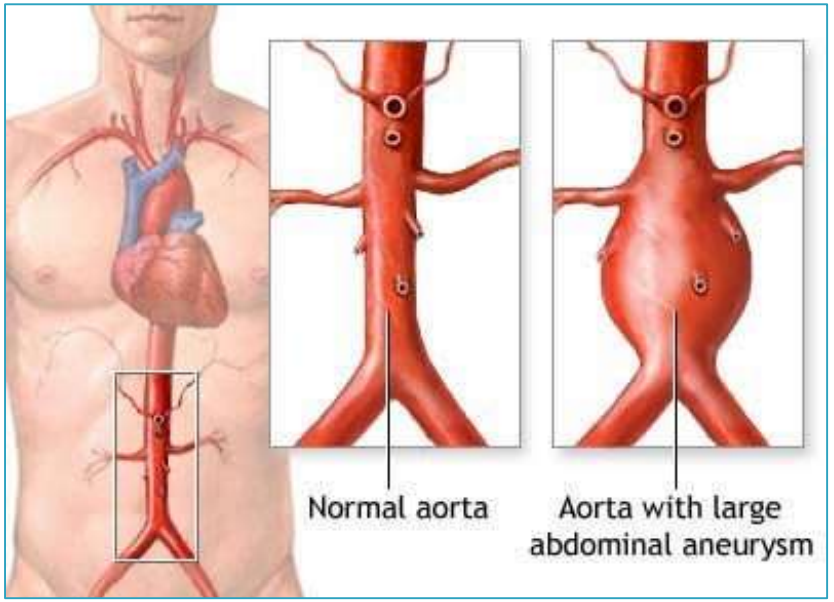
(e.g., **Marfan disease** **by** defective fibrillin production affects elastic tissue synthesis)

2- An altered balance of collagen degradation and synthesis mediated by local inflammation and the destructive proteolytic enzymes

- (e.g. vasculitis)

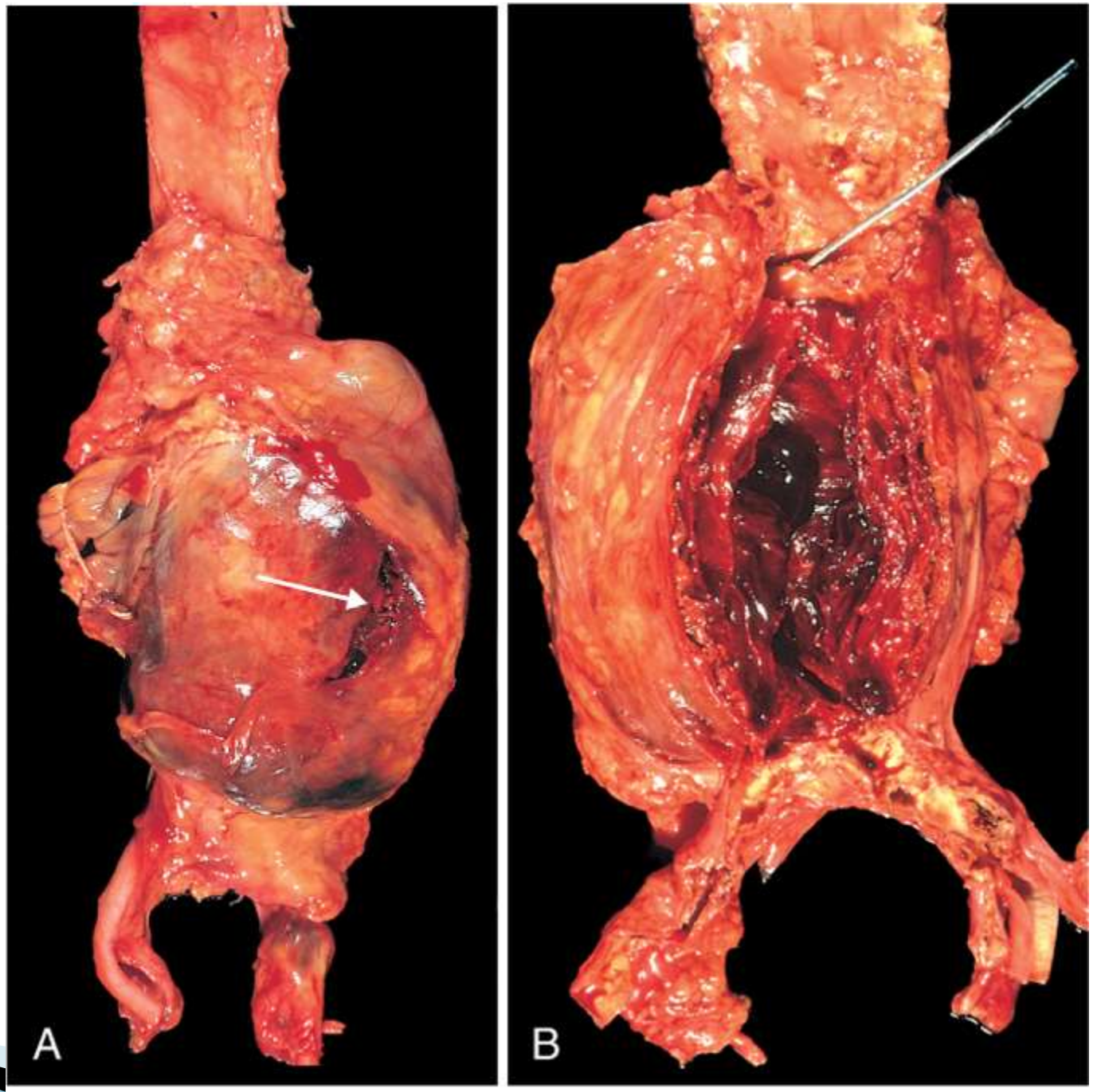
AAA- Morphology

- Usually below renal arteries and above bifurcation of aorta
- can be saccular or fusiform
- may be as large as 15 cm in diameter, and as long as 25 cm
- Microscopically: atherosclerosis; thinning of media
- frequently contains a laminated mural thrombus

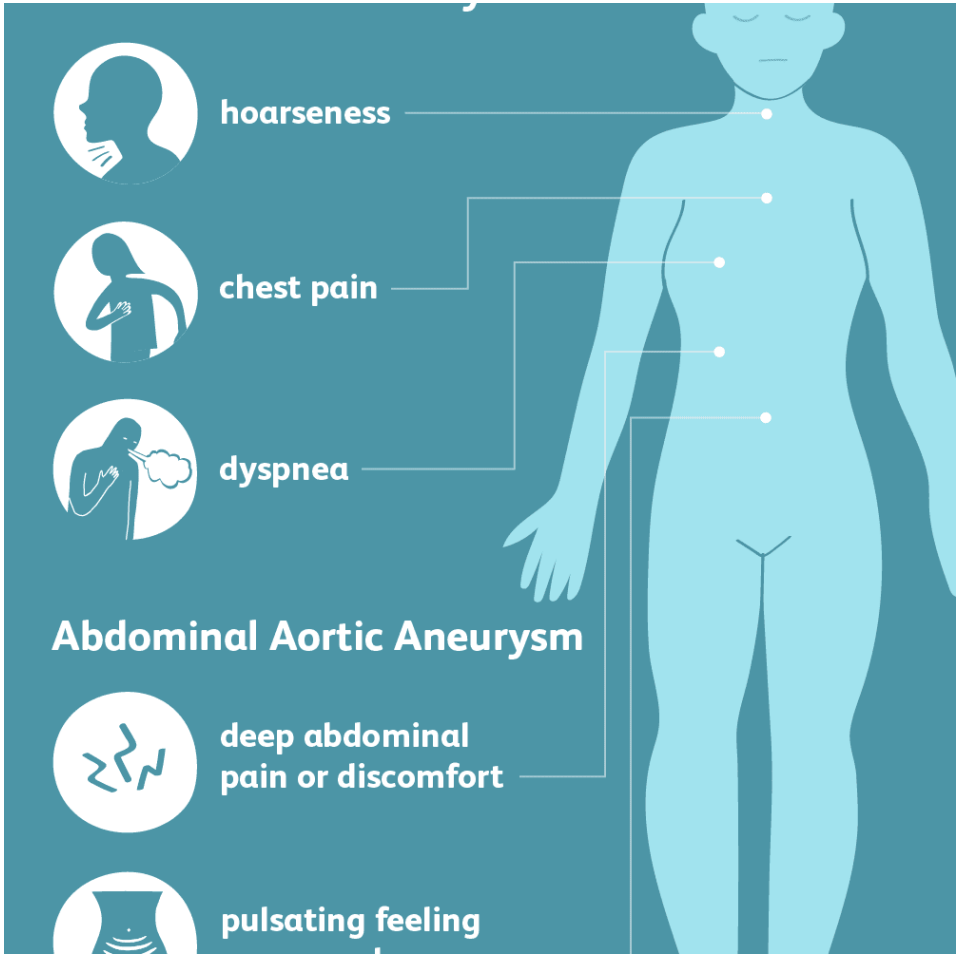


Abdominal aortic aneurysm and complications

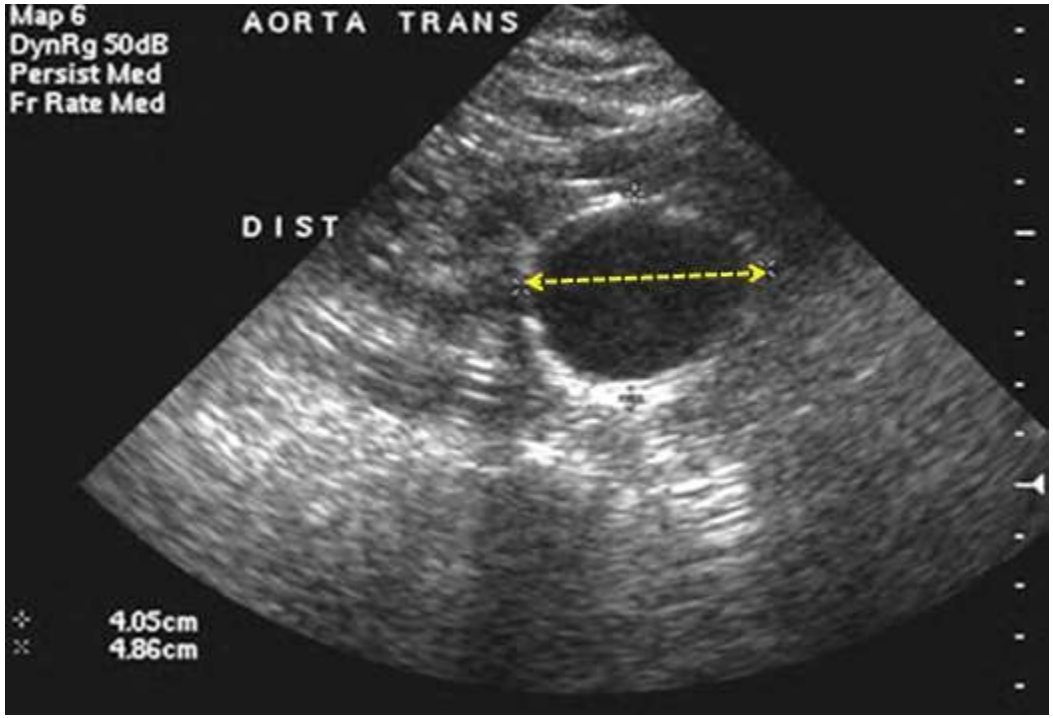
A: rupture
B: thrombosis



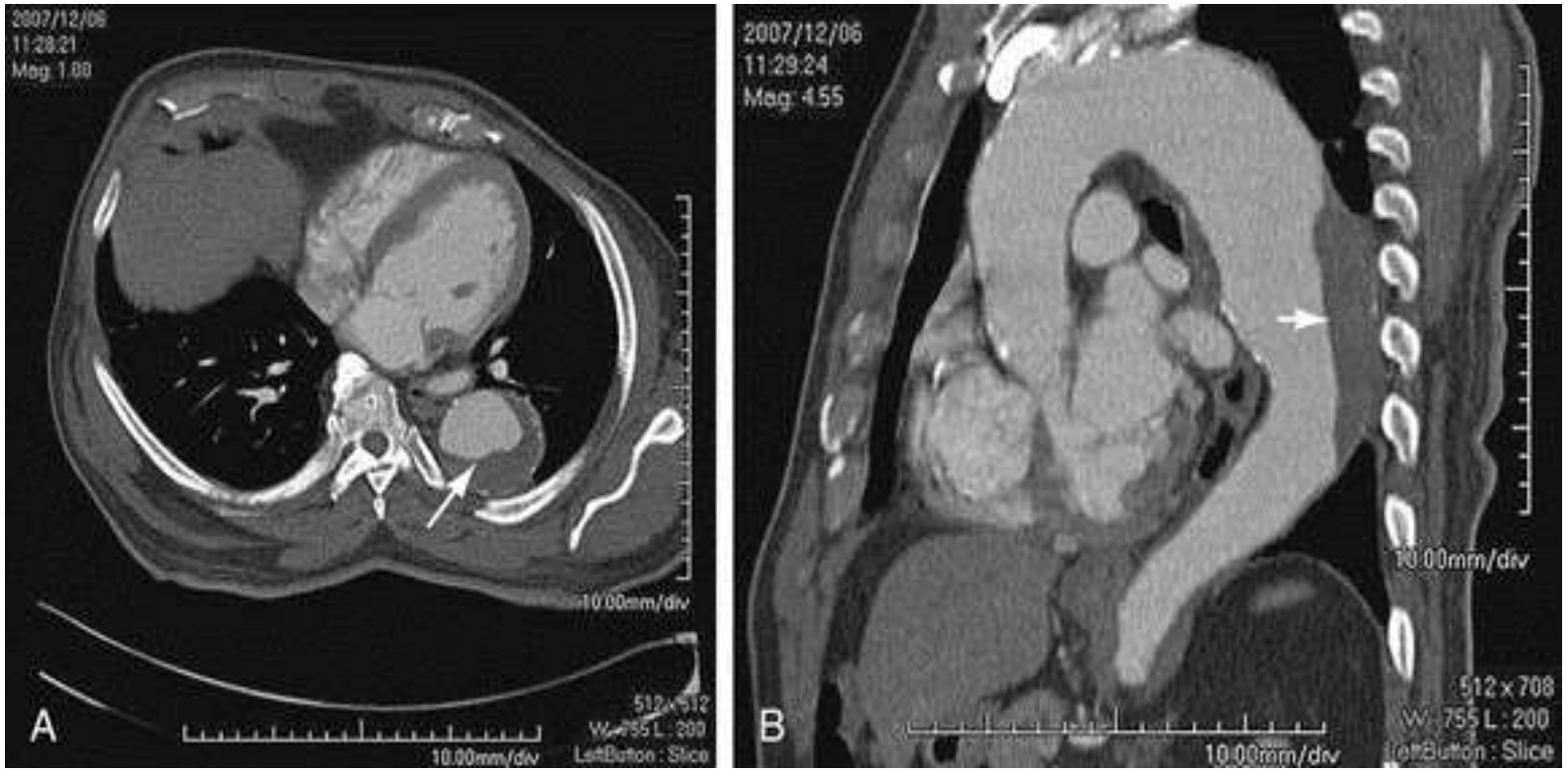
Symptoms of aortic aneurysm



Clinical assessment of AAA

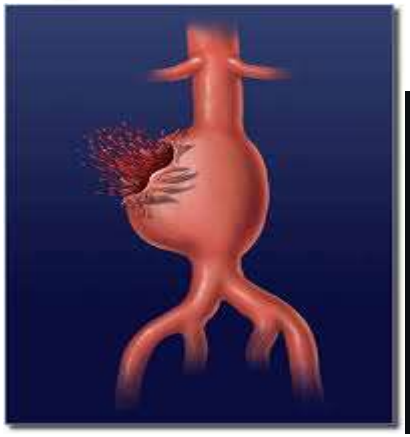


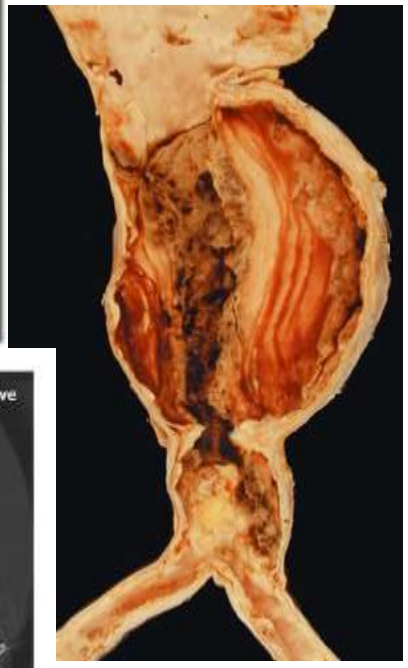
Maximum intensity projection CT angiographic images show an aneurysmal descending thoracic aorta with considerable mural thrombus (*arrow*)

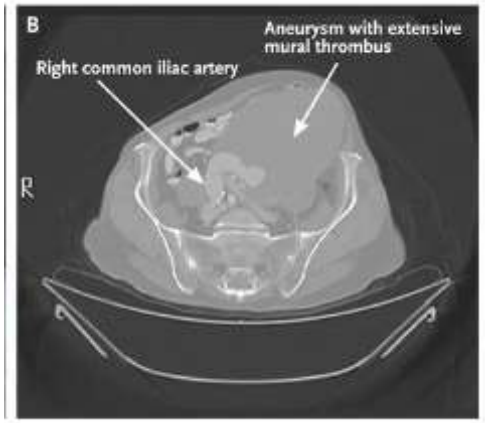


The clinical consequences of AAA

- **Rupture** →massive hemorrhage
  - risk is directly related to size (≥5 cm)
  - mortality for **un**ruptured aneurysms =5%
  - if rupture mortality rate > 50%
- **Obstruction** of downstream vessel→ **ischemic** injury
- **Embolism** → mural thrombus
- **compression** on adjacent structures (e.g. ureter or vertebrae)
- **abdominal mass** (often pulsating)







Mycotic aneurysms

- **Infection of an artery that weakens its wall is called a *mycotic aneurysm***
- **can originate from:**

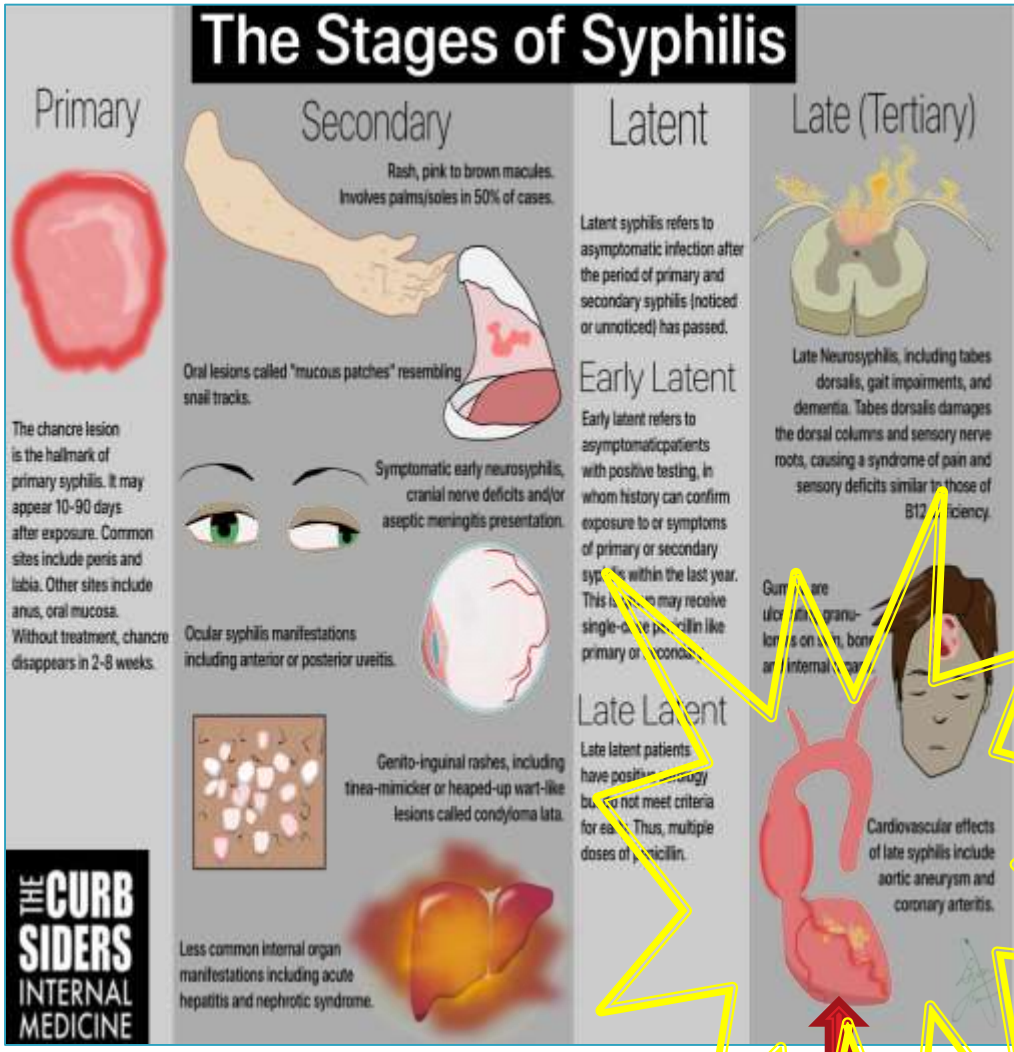
(1) **embolization of a septic thrombus (infective endocarditis)**

(2) **extension of adjacent suppurative process**

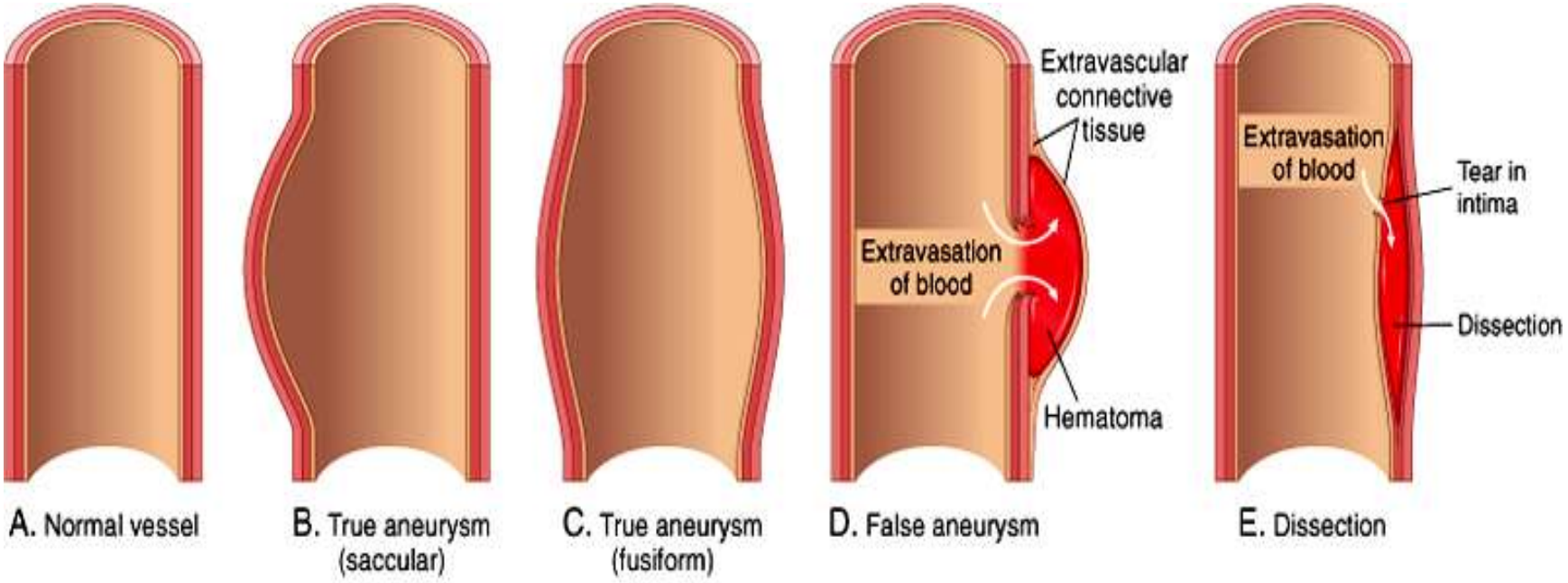
(3) **circulating organisms infecting arterial wall**

Syphilitic Aneurysm

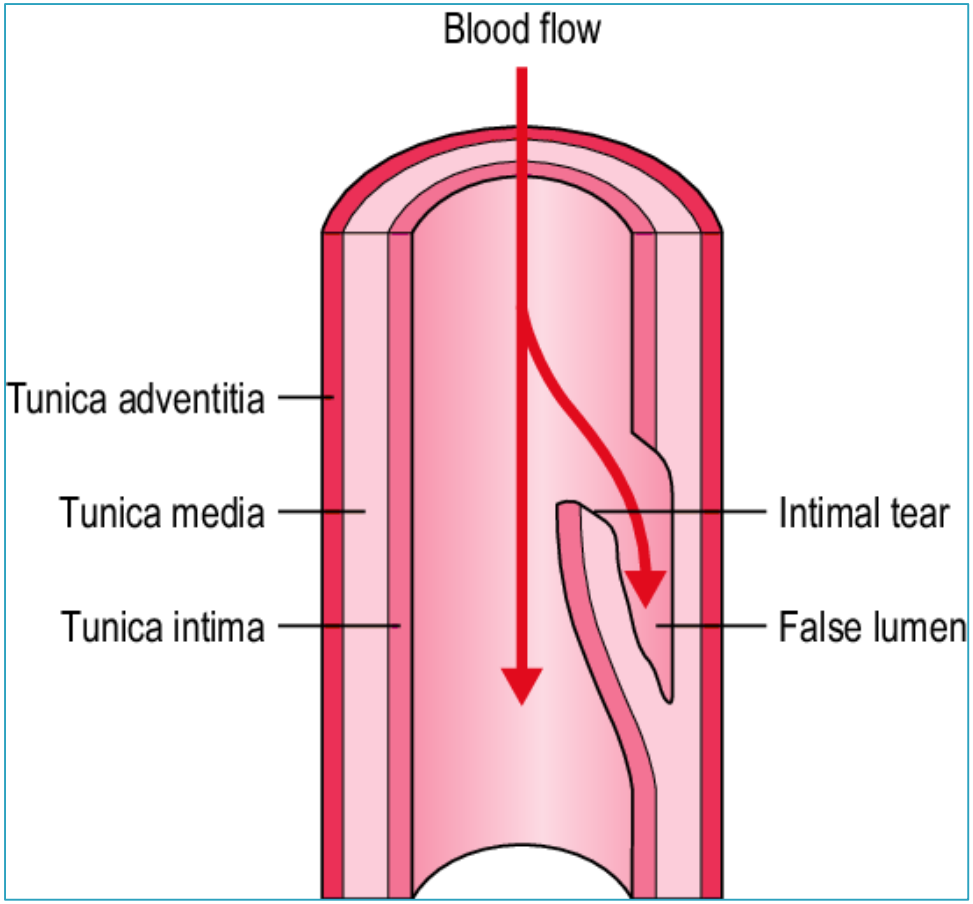
- *SYPHILIS is caused by* spirochetes *T. pallidum*
- Syphilitic Aneurysm : A rare complication of the tertiary stage of syphilis
- Rare thanks to early recognition and treatment of syphilis
- Tertiary stage of syphilis can cause *obliterative endarteritis* of vasa vasorum of aorta
- Consequences:
- ischemic medial injury
- aneurysmal dilation of aorta and aortic annulus
- eventually valvular insufficiency



Aneurysm versus dissection …



Arterial dissection



Arterial *dissection*

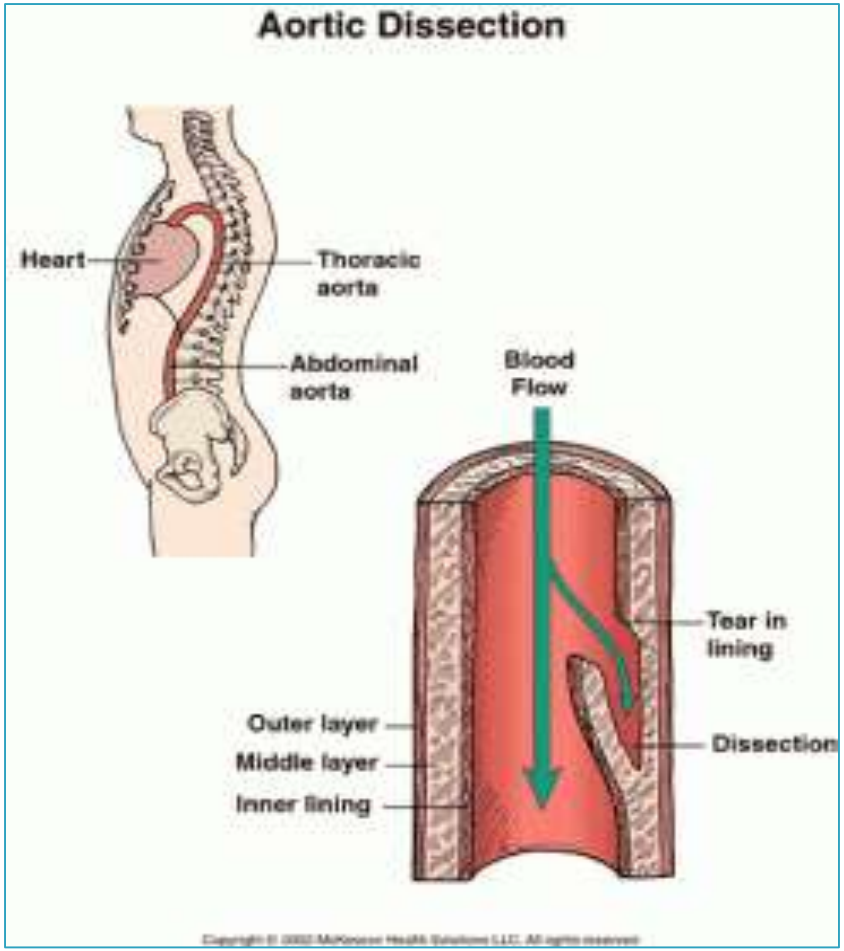
- Extravasation of blood that enters the wall of artery through an intimal tear, as a hematoma dissecting between its layers.
- often but not always aneurysmal
- Both true and false aneurysms as well as dissections can rupture, often with catastrophic consequences

Aortic dissection

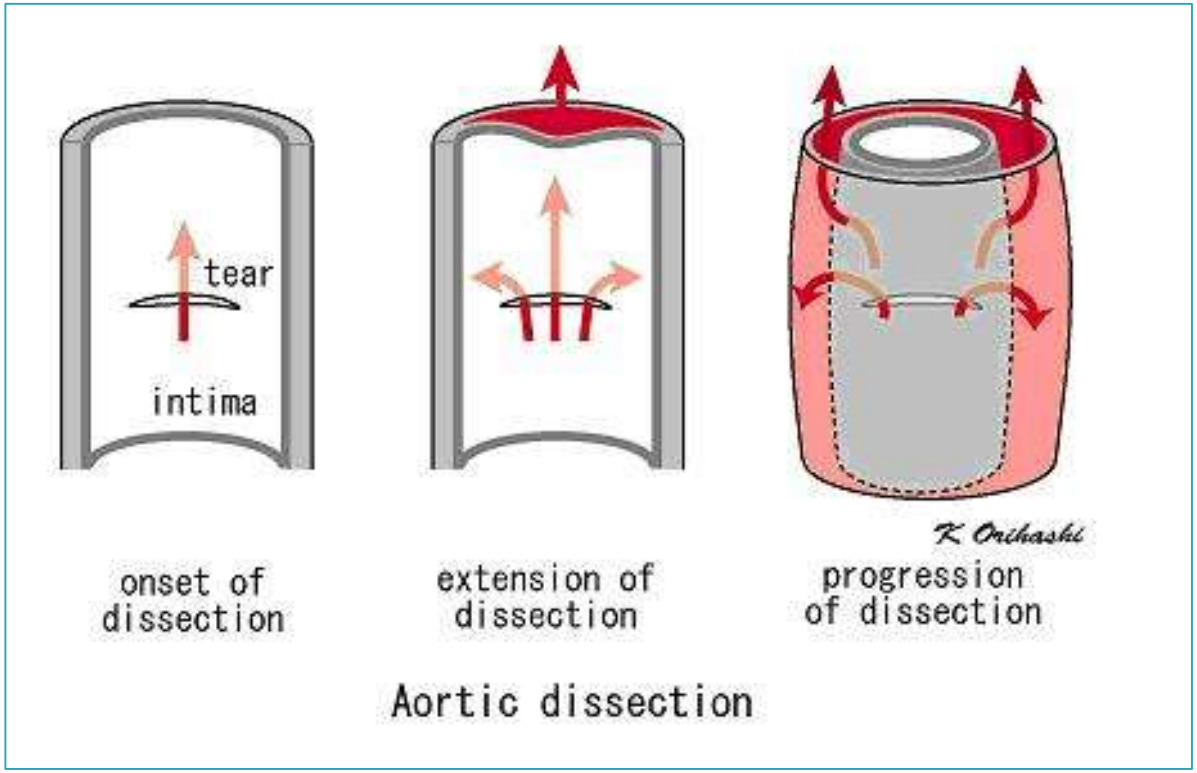
- A catastrophic event whereby blood dissects apart the media to form a blood-filled channel within aortic wall
- Complications are :

  - massive hemorrhage

  - cardiac tamponade (hemorrhage due to rupture into the pericardial sac)



Consequences…



Pathogenesis of Aortic dissection

- 1- Hypertension is *the* major risk factor
- pressure-related mechanical injury and/or ischemic injury.
- 2- Atherosclerosis complications
- 3- Inherited or acquired connective tissue disorders causing abnormal vascular ECM
- (e.g., Marfan syndrome, Ehlers-Danlos syndrome, vitamin C deficiency, copper metabolic defects)

Marfan syndrome

- The most common among inherited or acquired connective tissue disorders assosiated with aortic dissection
- Autosomal dominant disease of **fibrillin**, an ECM scaffolding protein required for normal elastic tissue synthesis
- Manifestations include:
- skeletal abnormalities (elongated axial bones)
- ocular findings (lens subluxation)
- cardiovascular manifestations (aortic aneurysms and dissections)

Manifestations of aortic dissection

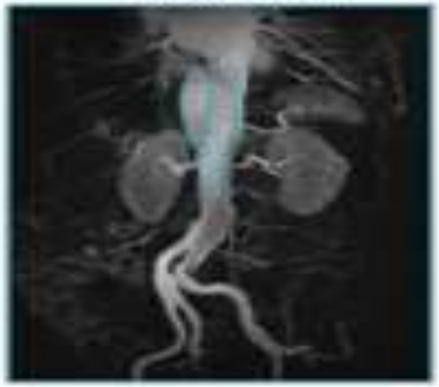
- Sharp chest/ back pain
- Weak pulses in downstream arteries
- If ruptures into pericardium → cardiac tamponade
- Hypotension
- Shock
- Death

Diagnosis & clinical assessment

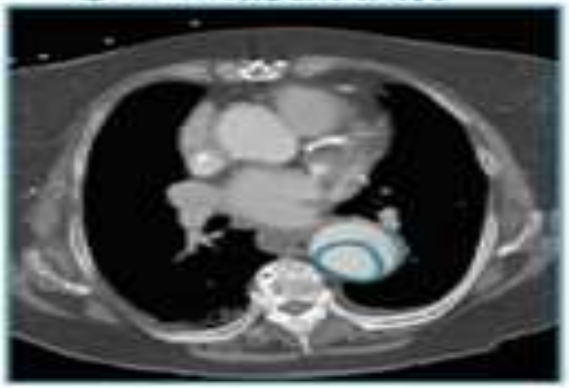
Chest X-ray

Transesophageal Echocardiogram

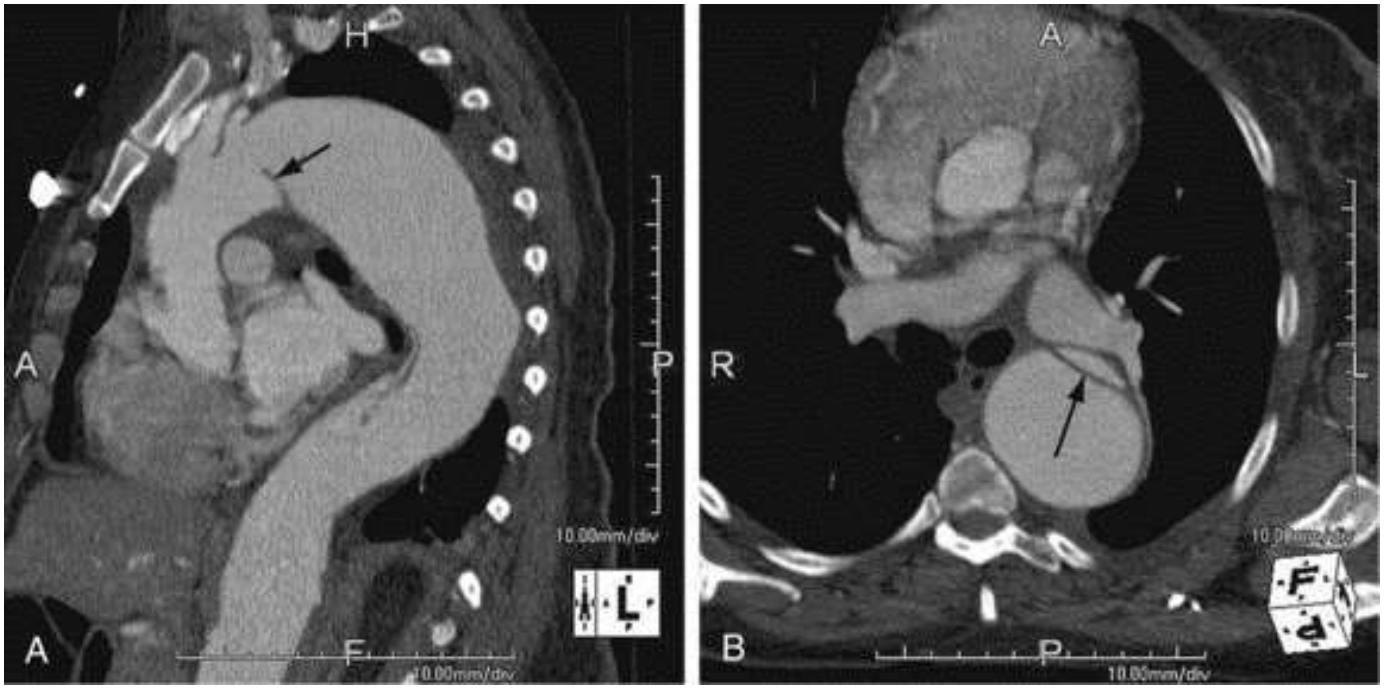
Magnetic Resonance Angiography



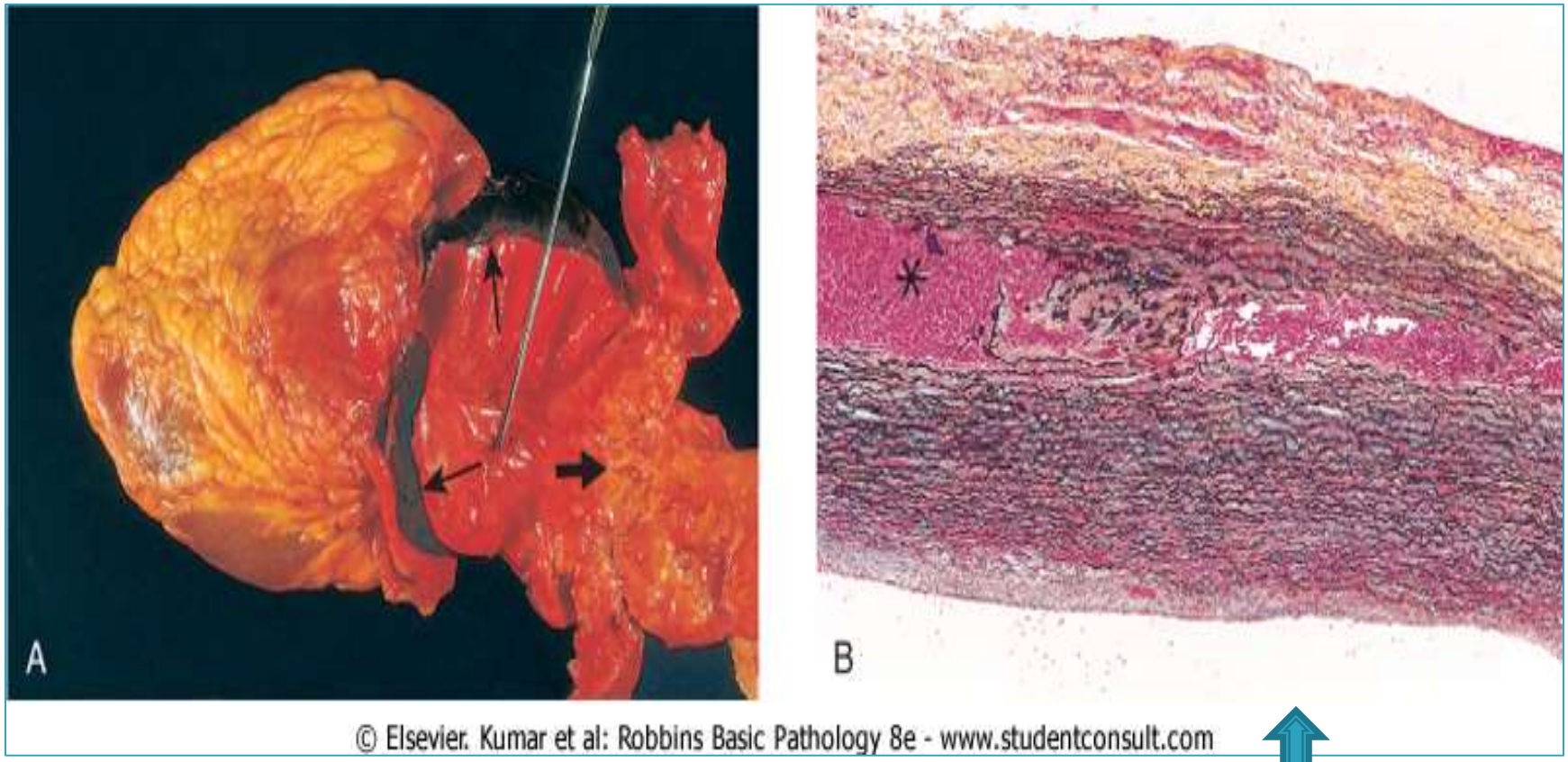
CT Angiography



Sagittal (A) and axial (B) contrast-enhanced CT images show a type B dissection (*arrow*) and aneurysm of the descending aorta



Aortic dissection

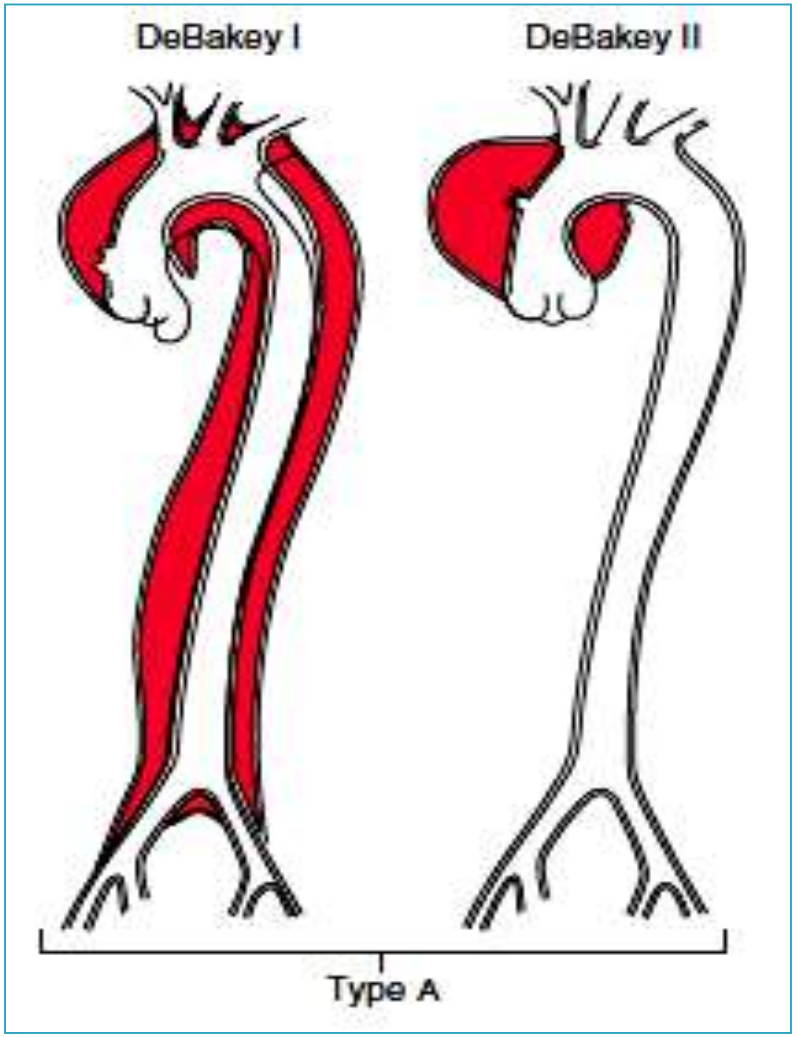


Silver stain: display elastic fibers in black color

Aortic dissections are generally classified into two types:

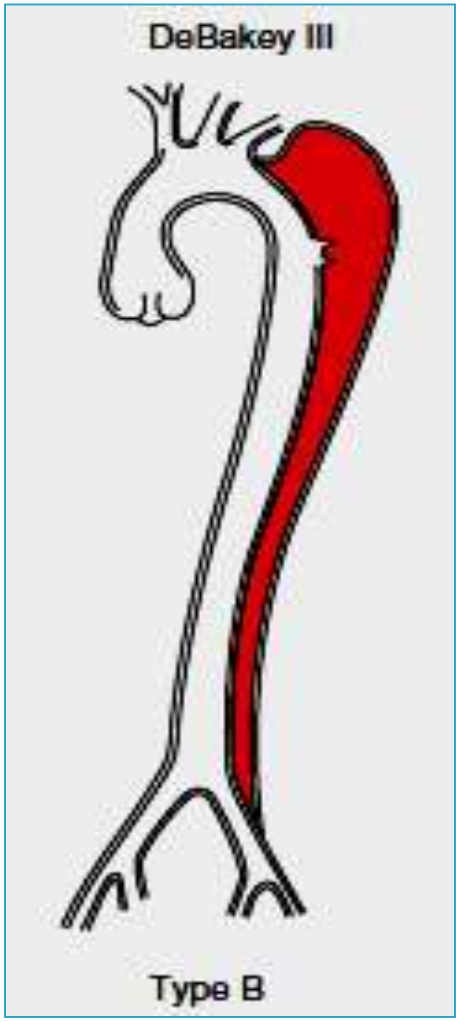
1- *Type A dissections:*

- More common
- More dangerous
- Proximal to takeoff of major aortic branches
- involve either ascending aorta only or both ascending and descending aorta (types I and II of the DeBakey classification)



2- type B dissections:

- *Distal to take off of major aortic branches*
- *Does not involve ascending aorta*
- usually beginning distal to subclavian artery
- Also called DeBakey type III



Clinical course

- Previously, aortic dissection was typically fatal, but prognosis has markedly improved Rapid diagnosis and institution of:

1- antihypertensive therapy

2 - surgical procedures involving plication of aorta, wall reconstruction with synthetic graft