



*modified by Lynn Alhamaideh*

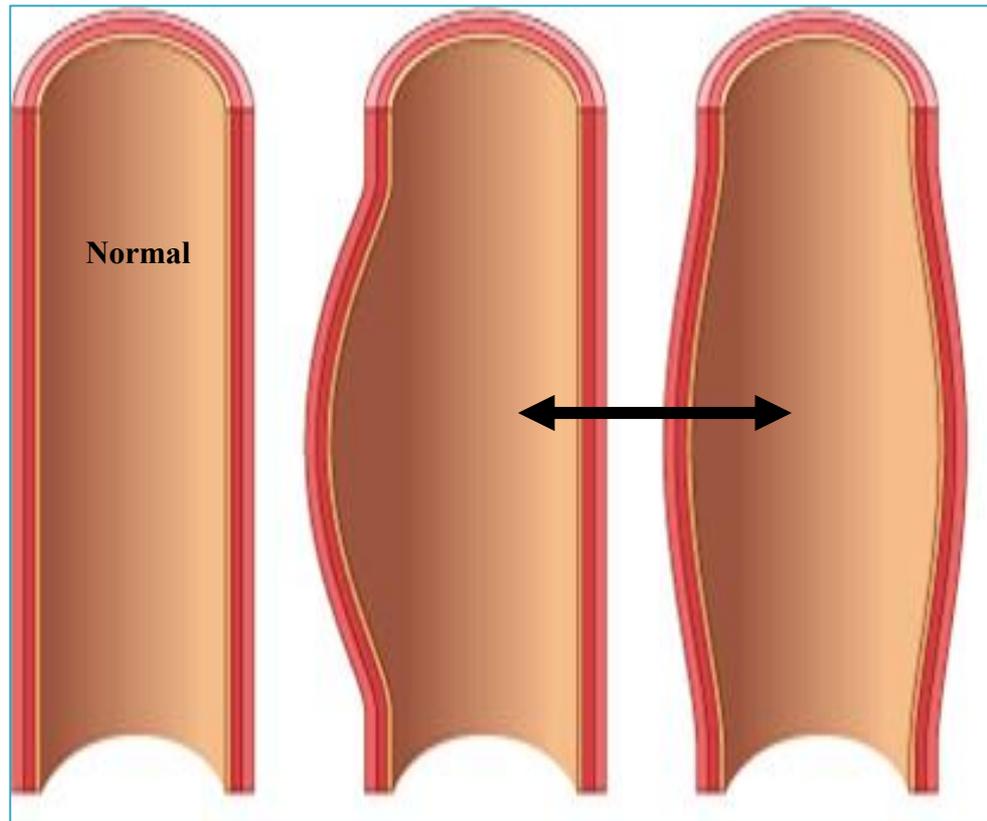
# **ANEURYSMS AND DISSECTIONS**

→ *Changes in the vessels (mostly arteries) and the heart.*

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# Aneurysm

- ▶ localized abnormal dilation of artery or heart



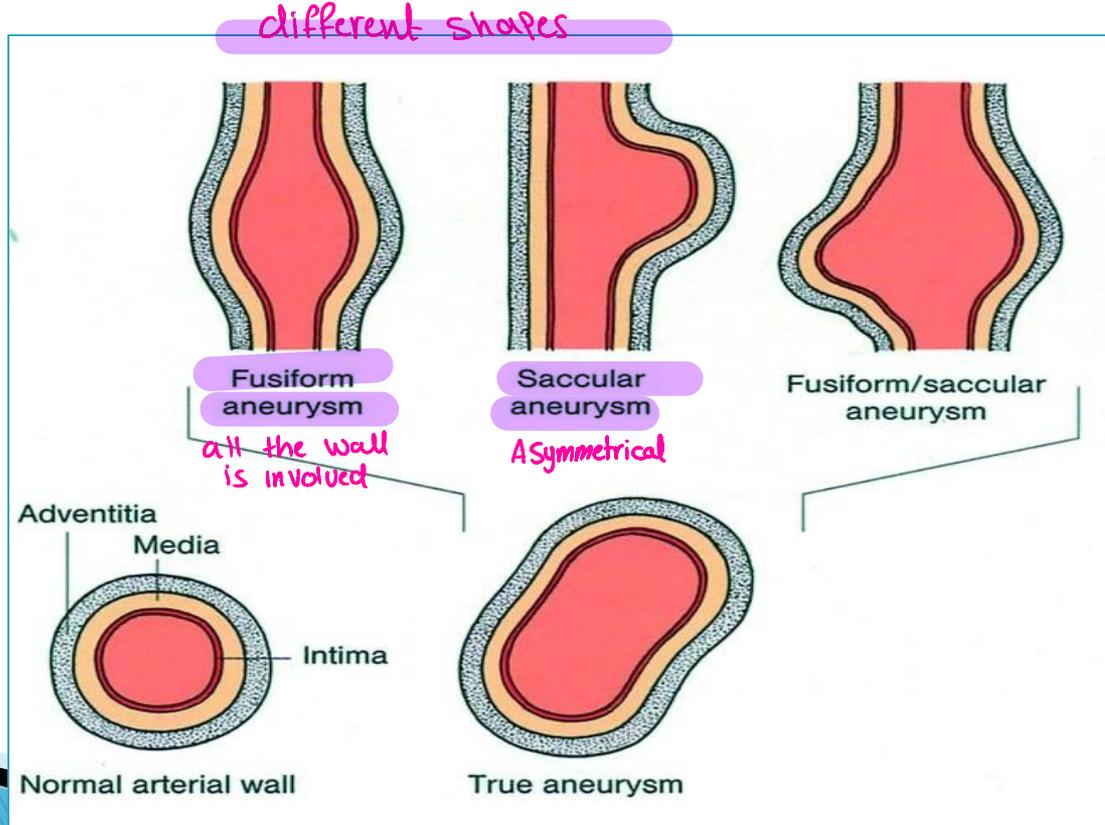
results in bulge  
in the wall  
that may be  
asymmetrical or  
Circumferential  
(all the diameter  
is involved in the  
bulge)

# Types:

## 1-"true" aneurysm

- all three layers of arterial wall or heart <sup>→ Intima, media, adventitia</sup> <sup>Indicates that the wall is intact but the wall is weaker than normal</sup>

<sup>Conditions that leads to true aneurysm.</sup> e.g. Atherosclerotic, <sup>related to syphilis</sup> syphilitic, <sup>since birth there's weakness in the wall</sup> congenital aneurysms, <sup>leads to loss of pumping function of the heart and leads to dilatation of that part of the heart (ventricle)</sup> ventricular aneurysms following transmural MI



Walls are not intact = loss of blood to CT outside the vessels.

## 2- "false" aneurysm

⇒ tear or defect in the wall of the vessel so the blood starts to leave the vascular space to the outside and being confined by some connective tissue = hematoma "تجمع دموي"

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

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

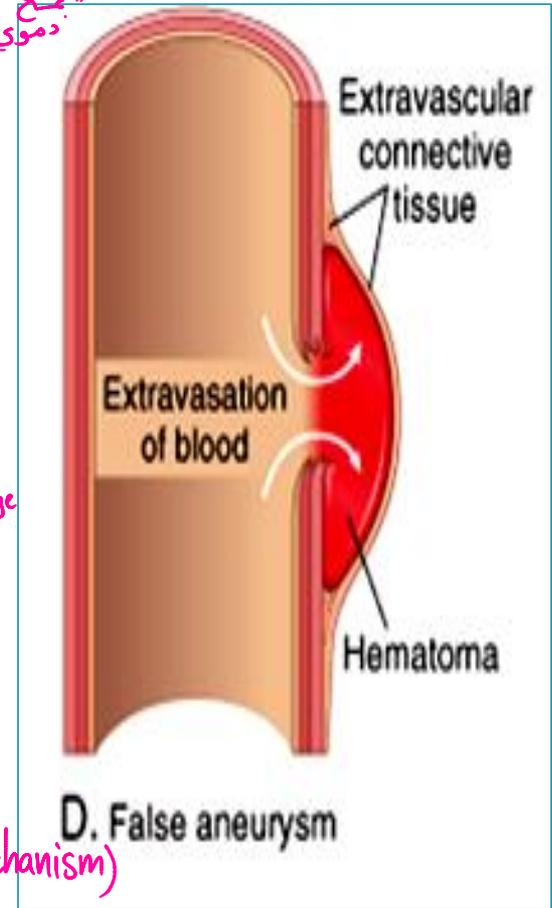
→ E.g. ventricular rupture after MI contained by pericardial adhesion

Very massive rupture in ventricle which leads to blood leakage

→ E.g. a leak at the junction of a vascular graft with a natural artery.

transplant

→ taking segment from a blood vessel to another one (therapeutic mechanism)



▶ **aneurysms are classified according to macroscopic shape and size into:**

**1- saccular**

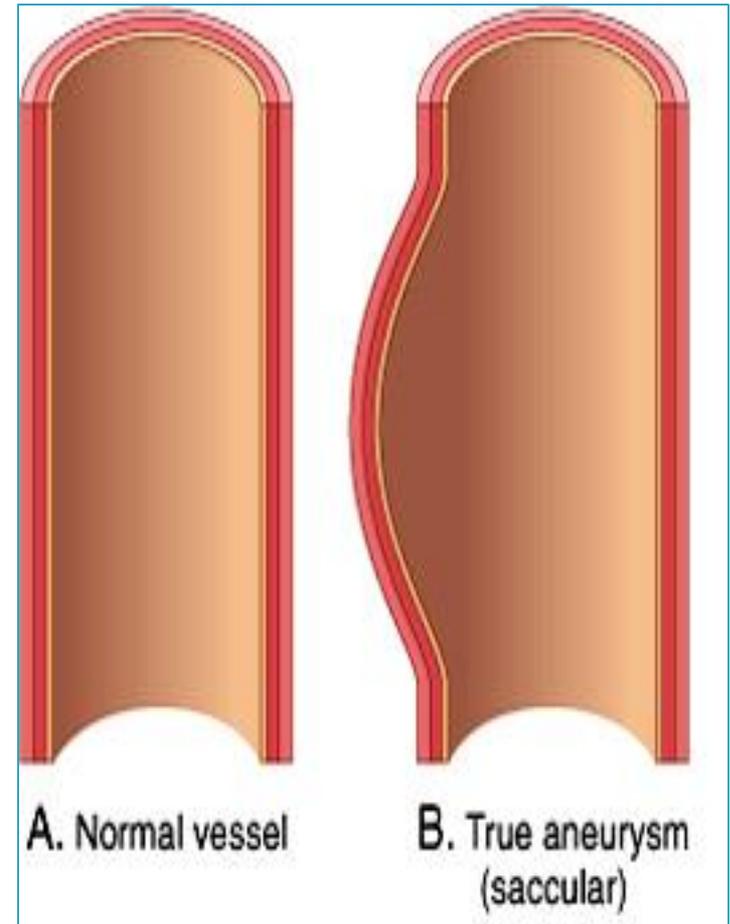
**2- fusiform**

*Shape description not related to the underlying cause of clinical importance.*

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

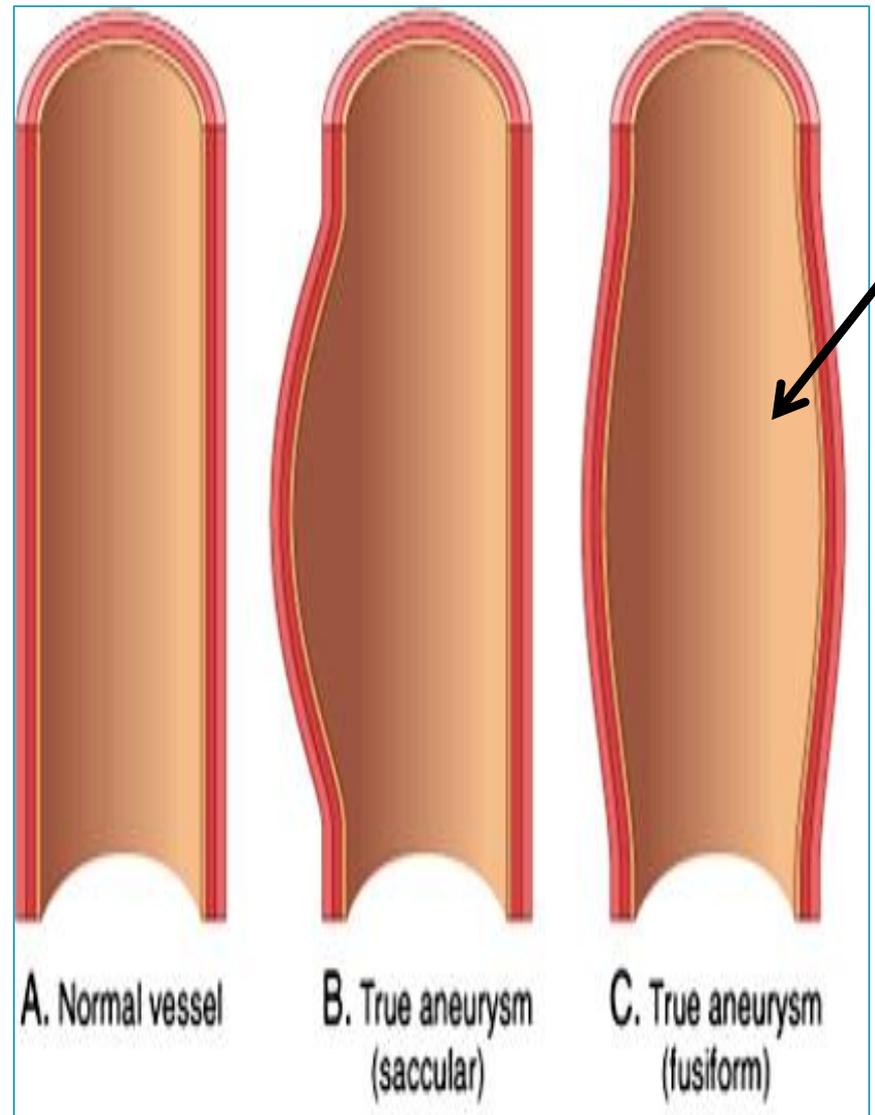
## *1- Sacular aneurysms*

- spherical outpouchings
- involving only a portion of vessel wall
- may contain thrombi

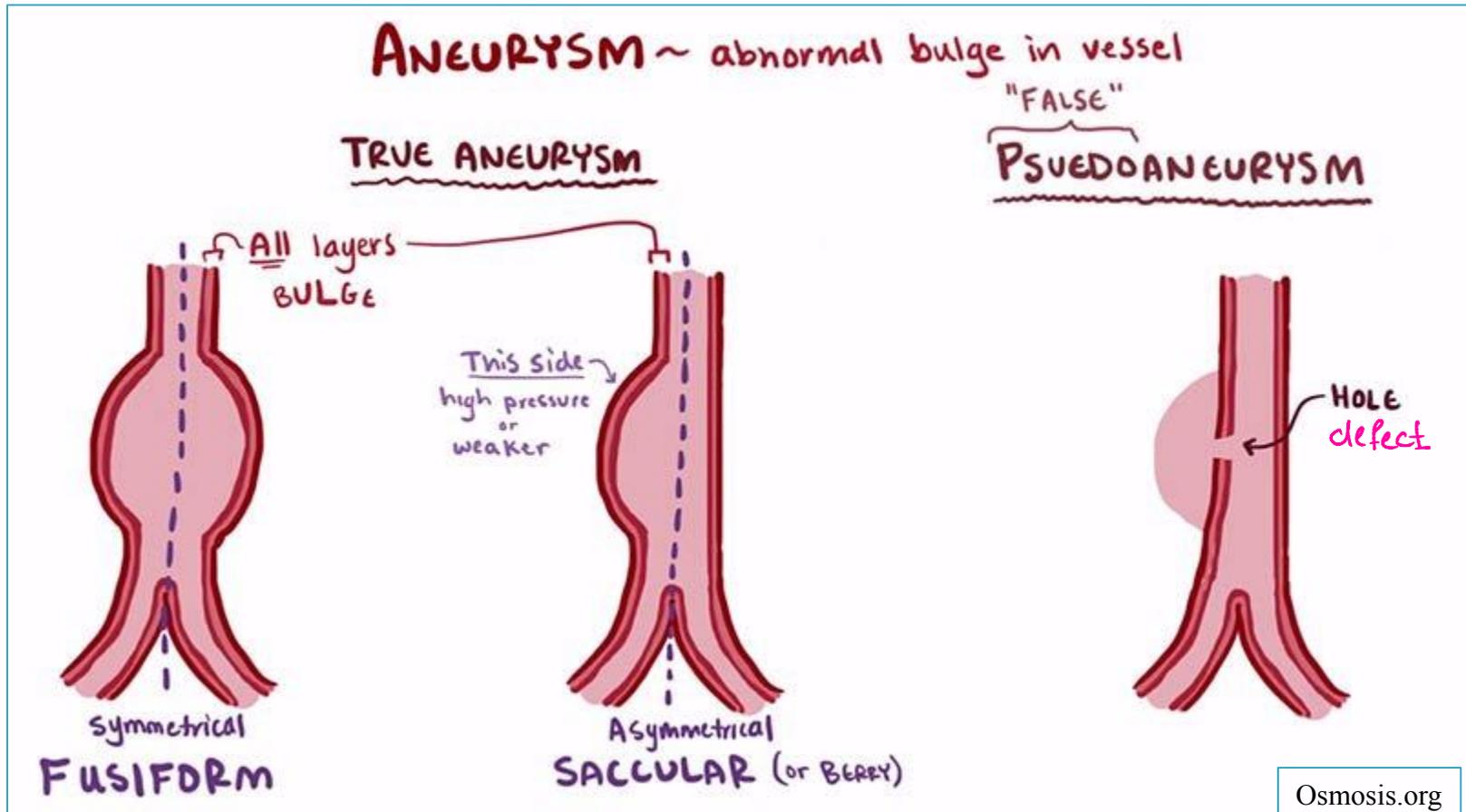


## 2- Fusiform aneurysms

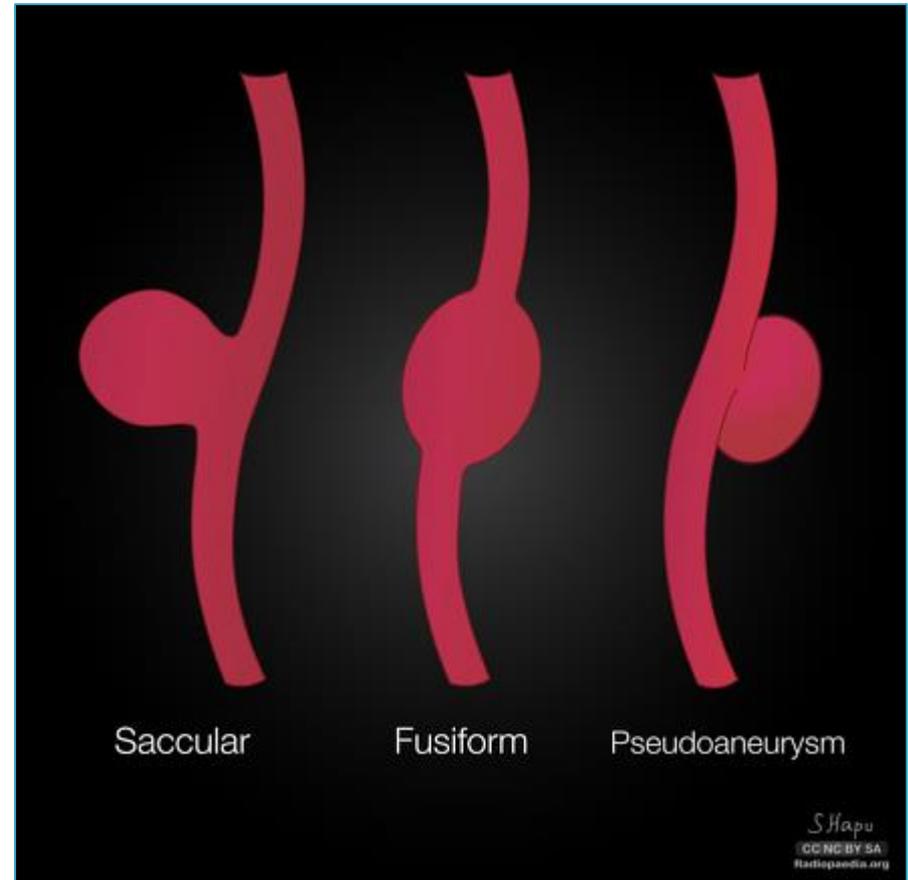
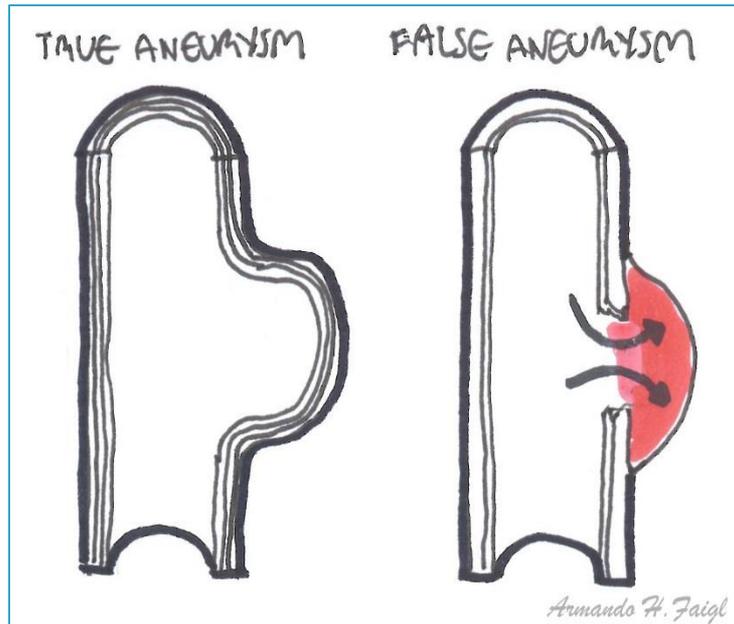
- ▶ **diffuse, circumferential dilation of a long vascular segment**
- ▶ **they vary in diameter and length and can involve extensive portions of artery**



# To summarize...



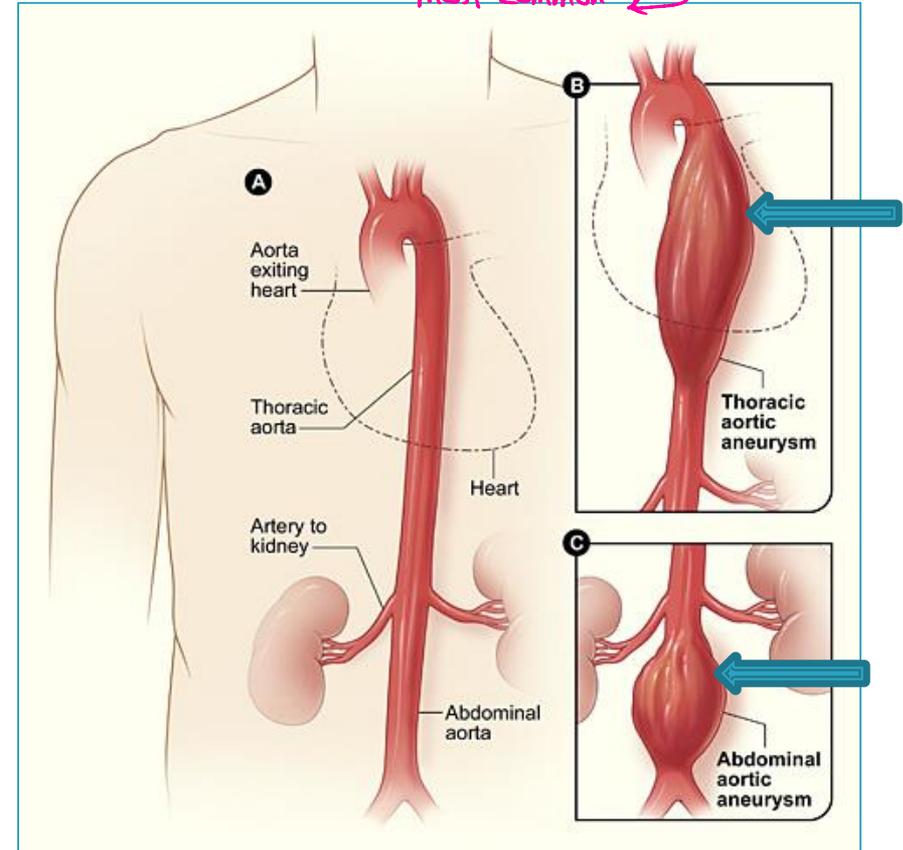
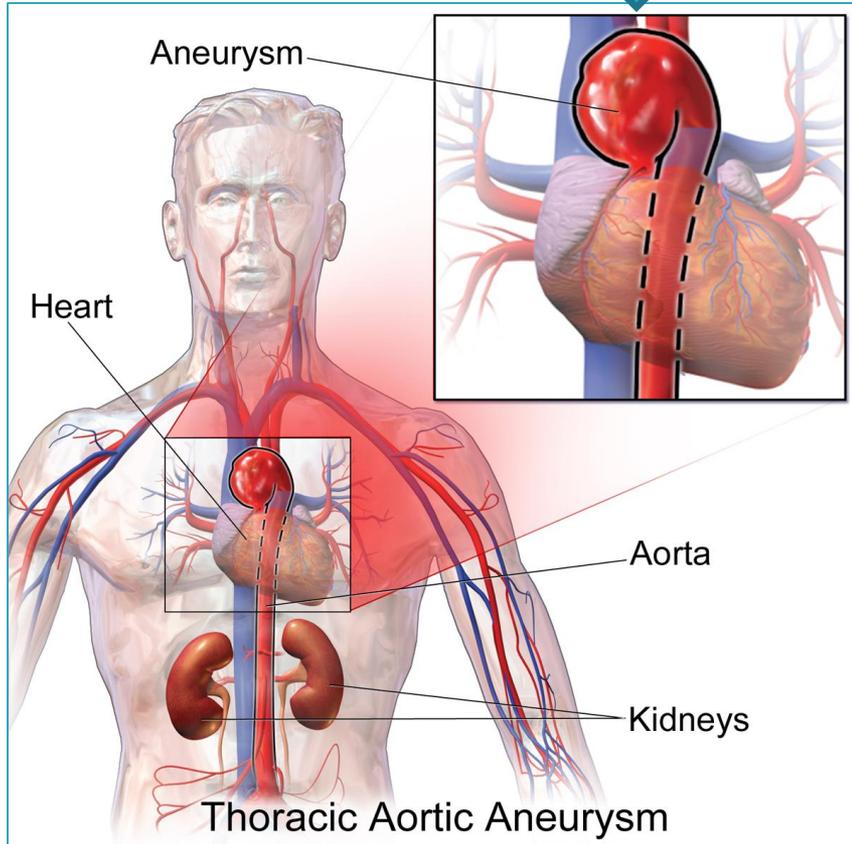
# To summarize...



Very high Pressure (major artery gives supply to everywhere)  
So most common aneurysms are aortic aneurysms.

# Aortic aneurysms

It may involve the arch, thoracic or abdominal segment  
*below renal arteries*  
*most common*



# *Aortic aneurysms*

▶ *The two most important causes are:*

- 1- Atherosclerosis** : ⇒ thickening in the intima due to Atheroma = weakness in the wall  
When it triggers the intima it may induce changes in the media + compression and inflammation of media affects smooth muscle and elastic fiber ⇒ loss contractility ⇒ dilation.
- **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- Cystic medial degeneration of arterial media

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



They induce inflammation or weakness in media  $\Rightarrow$  dilatation  $\Rightarrow$  Turbulence or stasis



Thrombosis



Ischemia  
distal to  
thrombosis



Rupture  
of the  
Wall

# 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** *Adults and males*
- ▶ **m/c in men**
- ▶ **rarely < age 50**
- ▶ **Atherosclerosis is a major cause of AAA**

▶ other contributors include:

## 1- Hereditary defects in structural components of the aorta:

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

ECM protein

defective elastic synth. → affects media specially  
the Aorta → loss of contractility  
↓  
dilatation

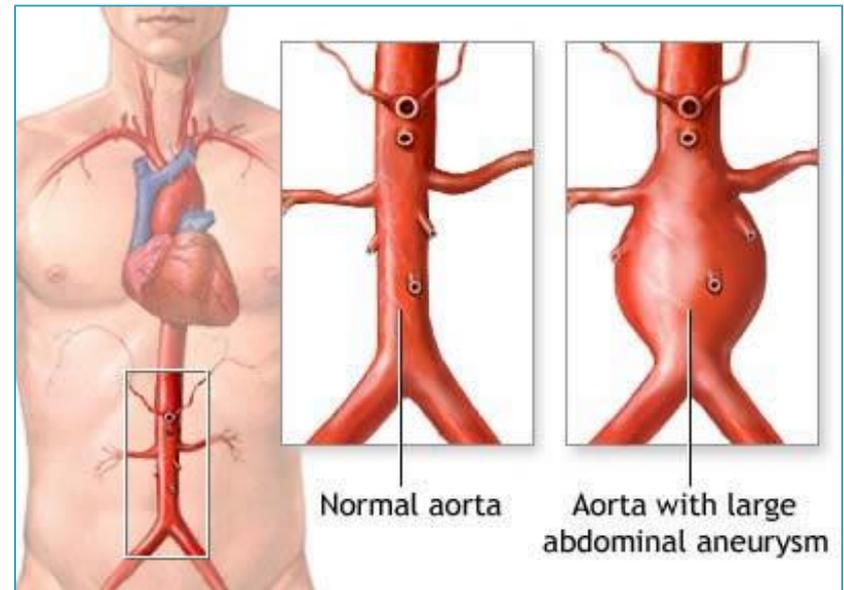
## 2- An altered balance of collagen degradation and synthesis mediated by local inflammatory infiltrates and the destructive proteolytic enzymes

- (e.g. **vasculitis**)

# AAA- Morphology

- normal Aortic diameter (3cm - 4.5cm) → depends on the segment
- x 1.5 diameter = Aneurysmal Aortic

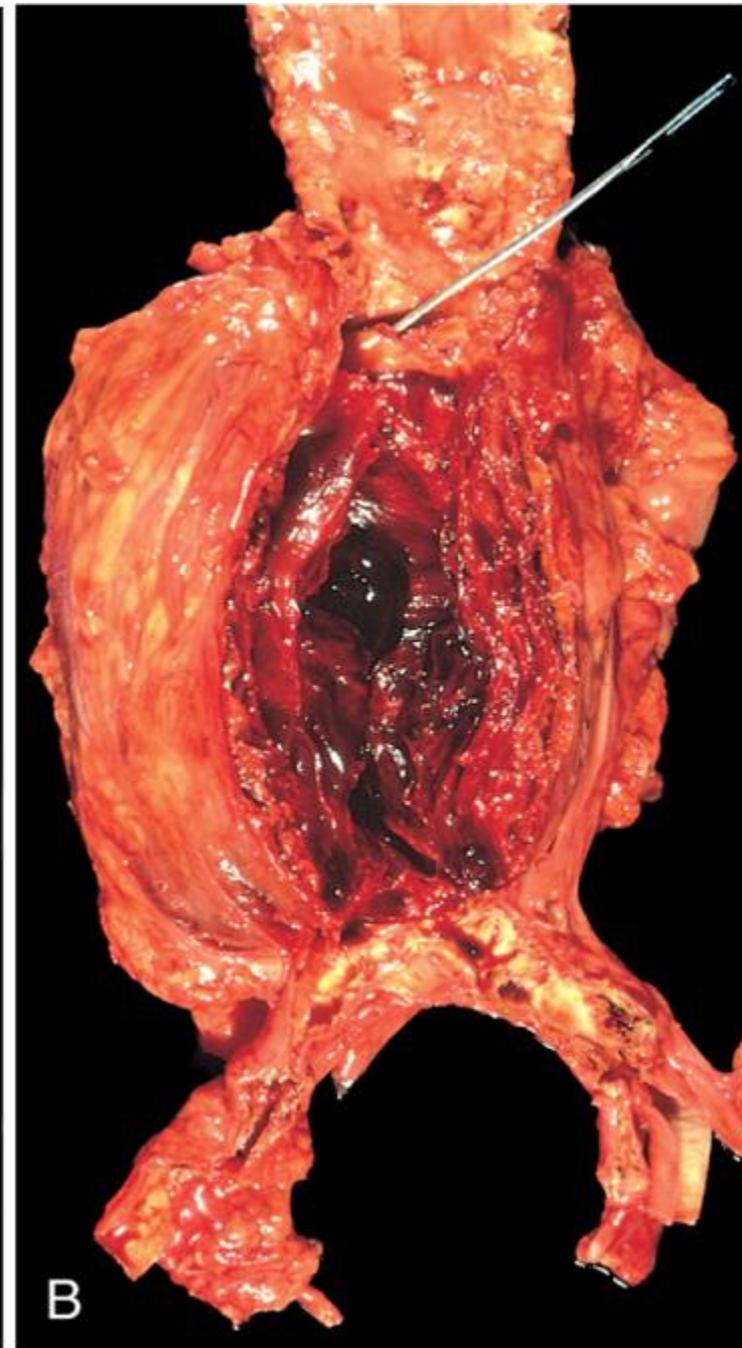
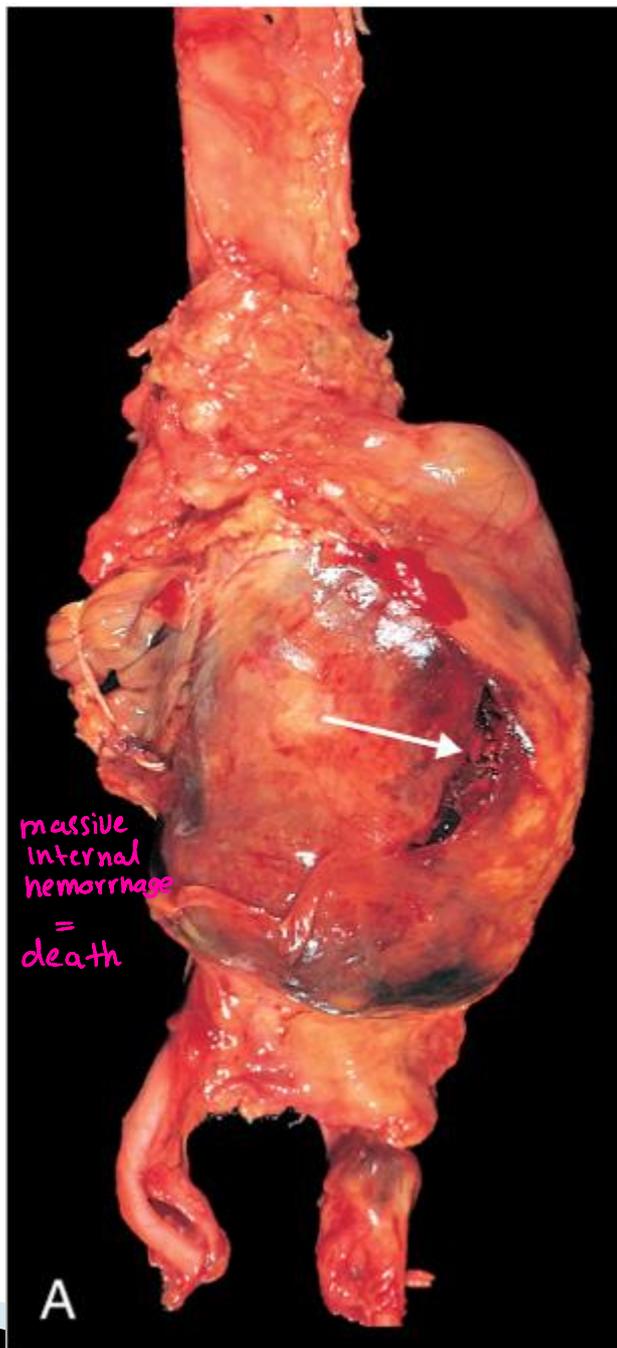
- ▶ Usually below renal arteries and above bifurcation of aorta
- ▶ can be saccular or fusiform
- ▶ may be as large as 15 cm in diameter, and as long as 25 cm
- ▶ Microscopically: atherosclerosis; thinning of media
- ▶ frequently contains a laminated mural thrombus



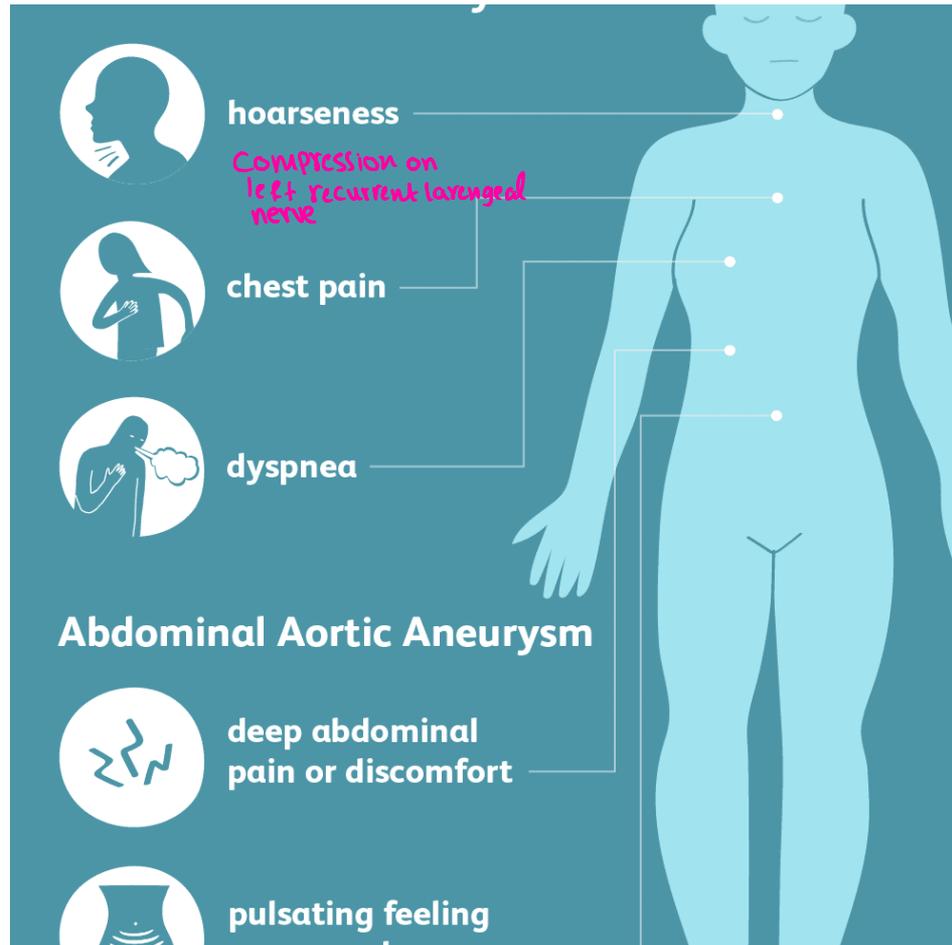
## Abdominal aortic aneurysm and complications

**A:** rupture

**B:** thrombosis



# Symptoms of aortic aneurysm *according to the location*

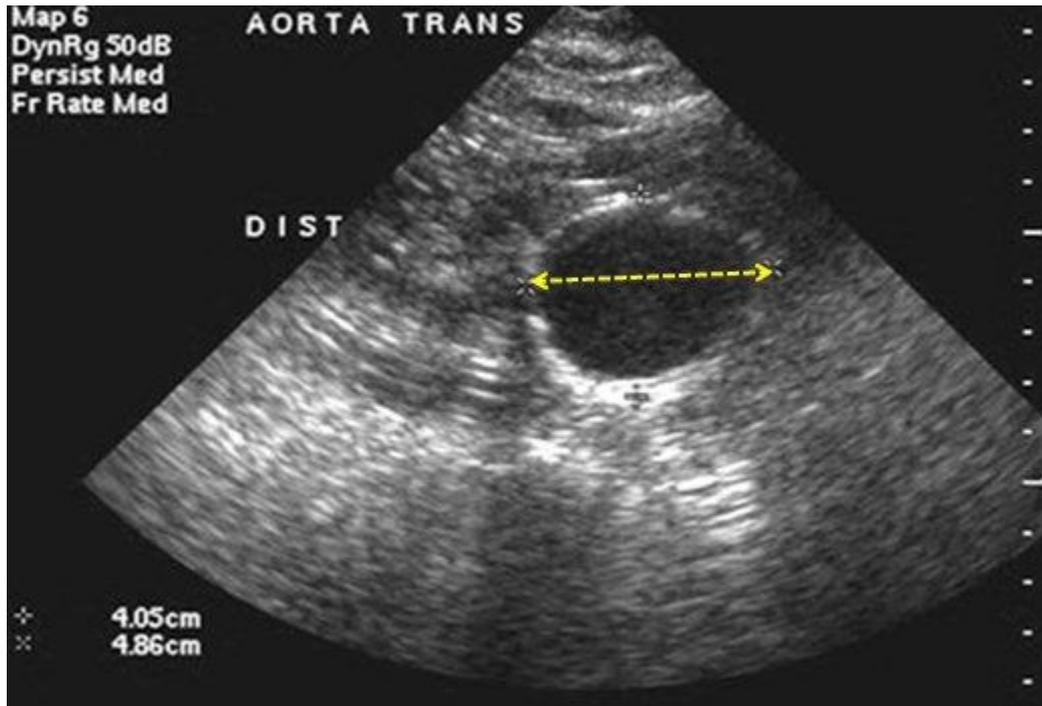


# Clinical assessment of AAA

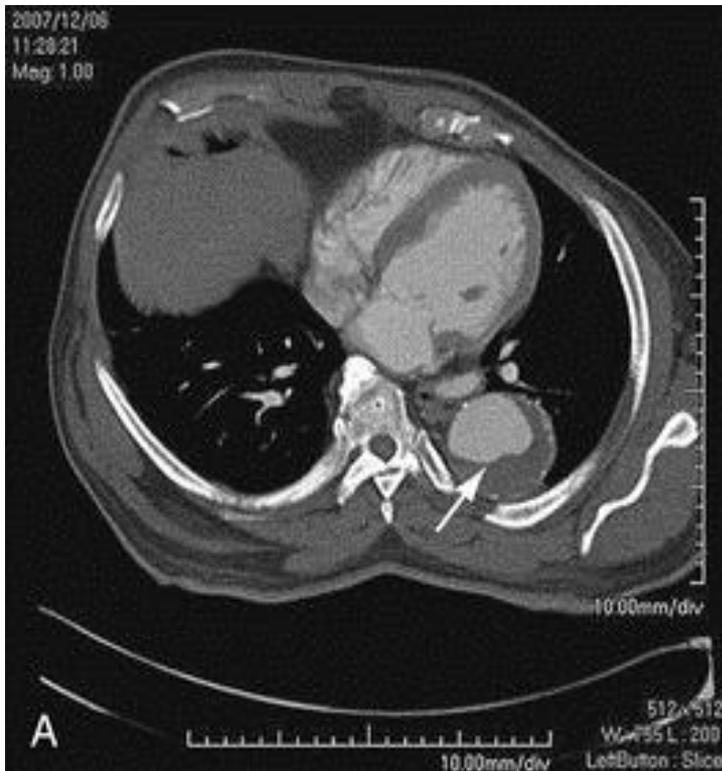
assessment of AAA

- Angiogram
- CT
- ECO

by ECO

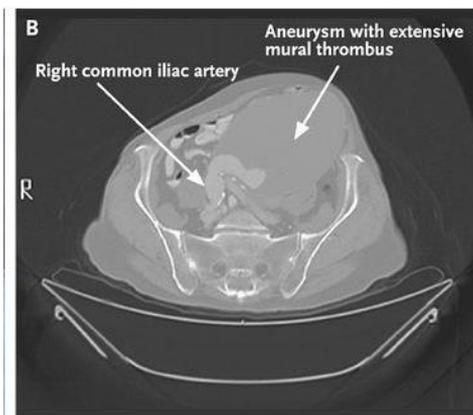
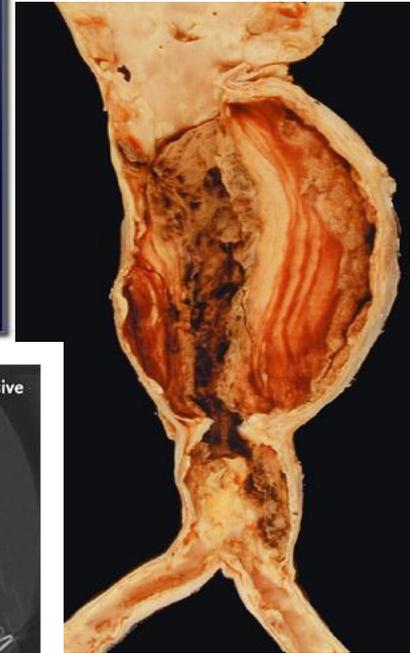
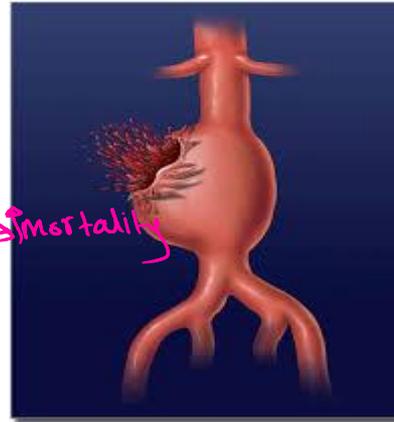


**Maximum intensity projection CT angiographic images show an aneurysmal descending thoracic aorta with considerable mural thrombus (*arrow*)**



# The clinical consequences of AAA

- ▶ **Rupture** → massive hemorrhage
  - risk is directly related to size ( $\geq 5$  cm) *larger the diameter → more risk to rupture → mortality*
  - mortality for unruptured 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) *if it was large and long it acts as if it's a mass*
- ▶ **abdominal mass** (often pulsating)



# **Mycotic aneurysms** ⇒ microorganism in the wall = weakness of the wall = dilatation

- ▶ **Infection of a major 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

- ▶ Caused by The spirochetes *T. pallidum*
- ▶ A rare complication (early recognition and treatment of syphilis)

Tertiary stage  
Immune  
reaction  
not actual  
microorganism  
[Chronic Consequences  
of a previous  
infection]

▶ Tertiary stage of syphilis can cause obliterative endarteritis

→ Inflammation of Vaso Vasorum = occlusion

of vasa vasorum of aorta

- ▶ ischemic medial injury
- ▶ aneurysmal dilation of aorta and aortic annulus
- ▶ eventually valvular insufficiency

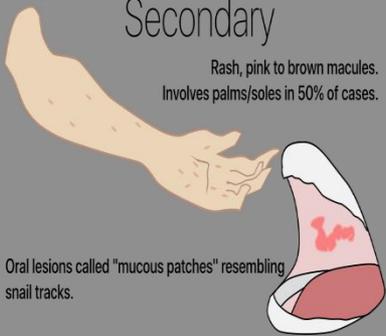
## The Stages of Syphilis

### Primary



The chancre lesion is the hallmark of primary syphilis. It may appear 10-90 days after exposure. Common sites include penis and labia. Other sites include anus, oral mucosa. Without treatment, chancre disappears in 2-8 weeks.

### Secondary



Rash, pink to brown macules. Involves palms/soles in 50% of cases.

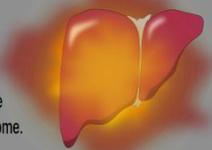
Oral lesions called "mucous patches" resembling snail tracks.



Ocular syphilis manifestations including anterior or posterior uveitis.



Genito-inguinal rashes, including tinea-mimicker or heaped-up wart-like lesions called condyroma lata.



Less common internal organ manifestations including acute hepatitis and nephrotic syndrome.

### Latent

Latent syphilis refers to asymptomatic infection after the period of primary and secondary syphilis (noticed or unnoticed) has passed.

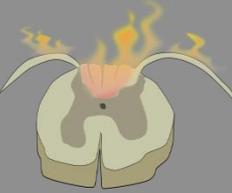
#### Early Latent

Early latent refers to asymptomatic patients with positive testing, in whom history can confirm exposure to or symptoms of primary or secondary syphilis within the last year. This is group may receive single-dose penicillin like primary or secondary.

#### Late Latent

Late latent patients have positive serology but do not meet criteria for early. Thus, multiple doses of penicillin.

### Late (Tertiary)



Late Neurosyphilis, including tabes dorsalis, gait impairments, and dementia. Tabes dorsalis damages the dorsal columns and sensory nerve roots, causing a syndrome of pain and sensory deficits similar to those of B12 deficiency.



Gumma are ulcerating granulomas on skin, bone, and internal organs.

Cardiovascular effects of late syphilis include aortic aneurysm and coronary arteritis.

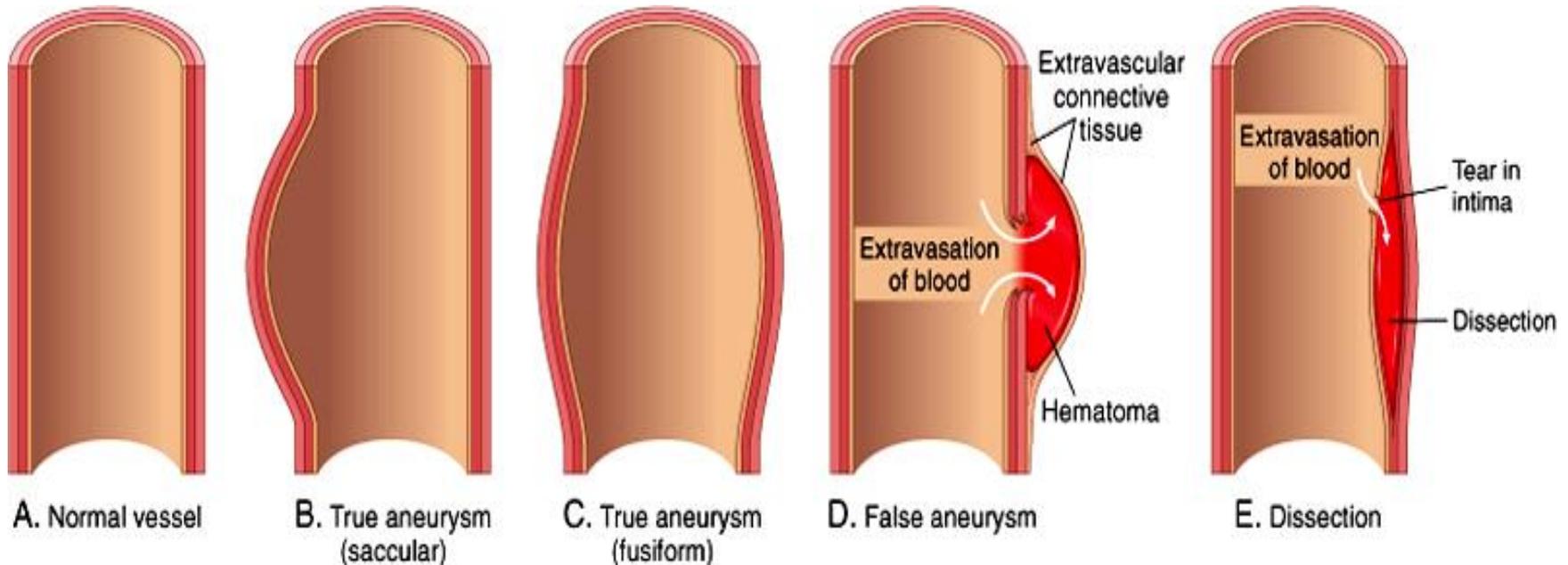
THE CURB  
SIDERS  
INTERNAL  
MEDICINE

# Aneurysm versus dissection ...

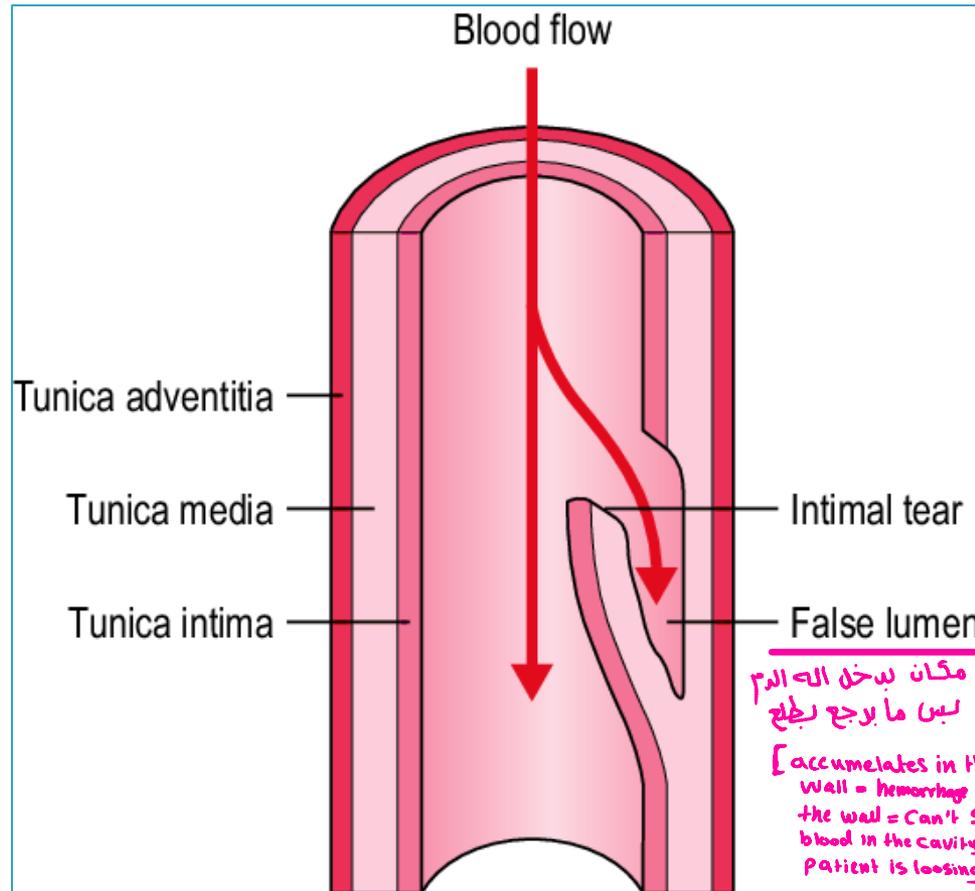
→ defects in all layers of the wall  
blood accumulated in the extravascular tissue (hematoma)

→ defect in intima  
blood accumulates in the media leading to dissection in the media

→ happens usually in large artery with high pressure = blood moves rapidly - bulge increase rapidly.



# Arterial dissection



\*hypertension is the most risk factor especially malignant hypertension

مكان يدخل الدم ليس ما يرجع لطبع

[accumulates in the wall = hemorrhage in the wall = Can't see the blood in the cavity but still patient is losing

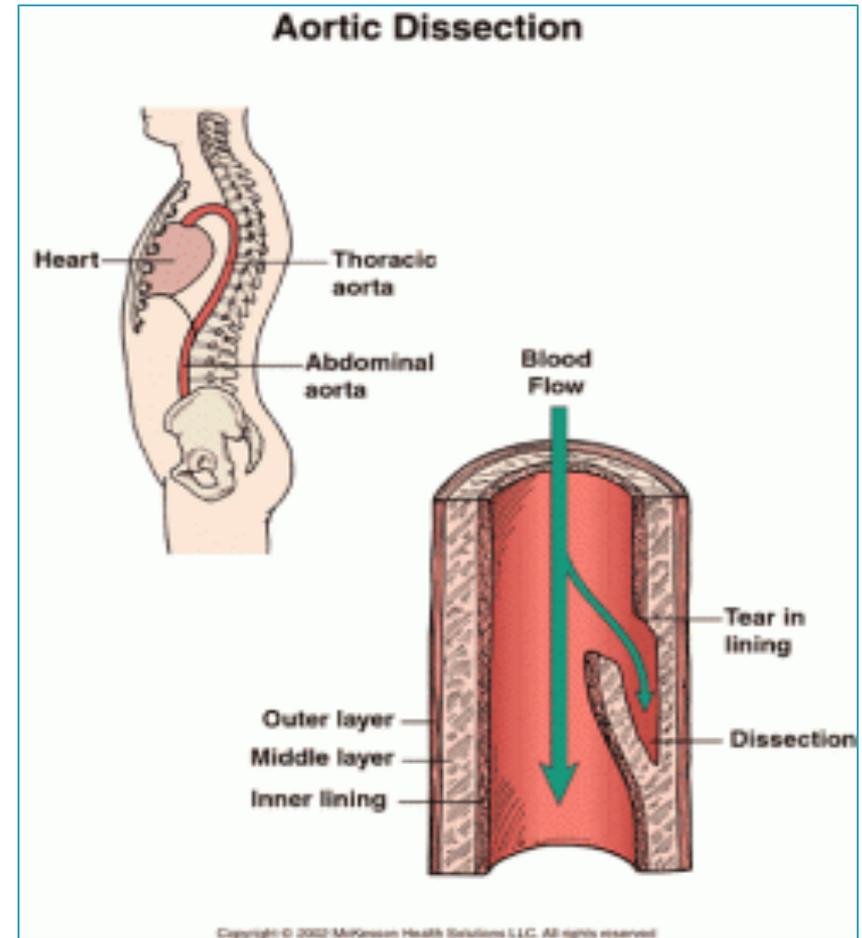
Vascular Volume = hypotension + hypovolemia + turbulence and thrombus + Rapture]

# Arterial *dissection*

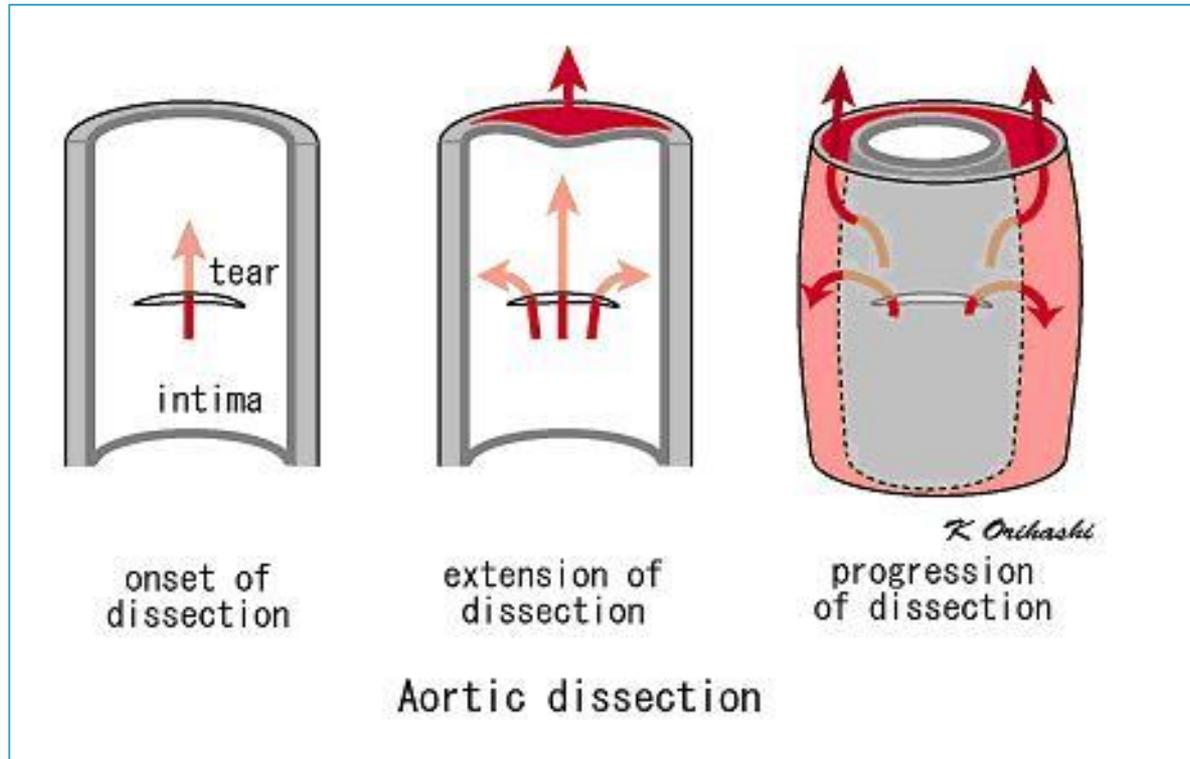
- ▶ Extravasation of blood that enters the wall of artery through an intimal tear, as a hematoma dissecting between its layers.
- ▶ often but not always aneurysmal
- ▶ Both true and false aneurysms as well as dissections can rupture, often with catastrophic consequences

# 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 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- 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 associated 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

# Manifestations of aortic dissection

- ▶ Sharp chest/ back pain
  - ▶ Weak pulses in downstream arteries
  - ▶ If ruptures into pericardium → cardiac tamponade
  - ▶ Blood pressure difference between Rt & Lt arms
  - ▶ Hypotension
  - ▶ shock
- 

# Diagnosis & clinical assessment

CHEST X-RAY



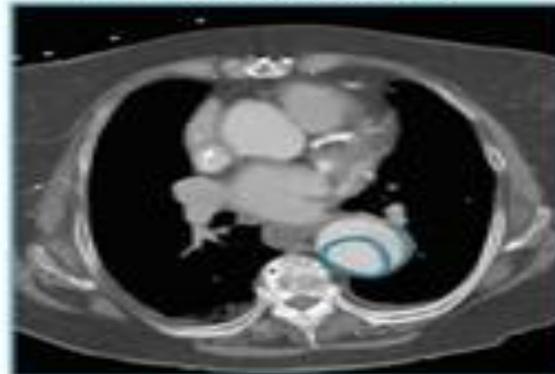
TRANSESOPHAGEAL  
ECHOCARDIOGRAM



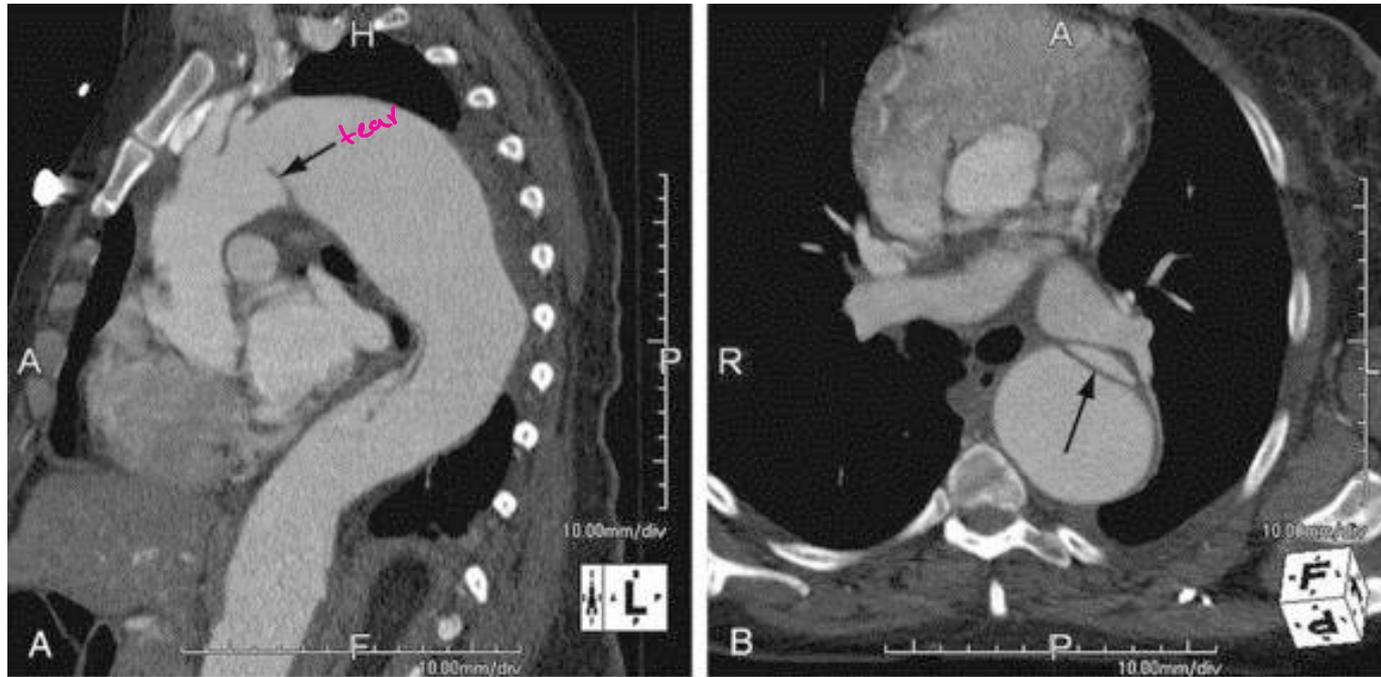
MAGNETIC RESONANCE  
ANGIOGRAPHY



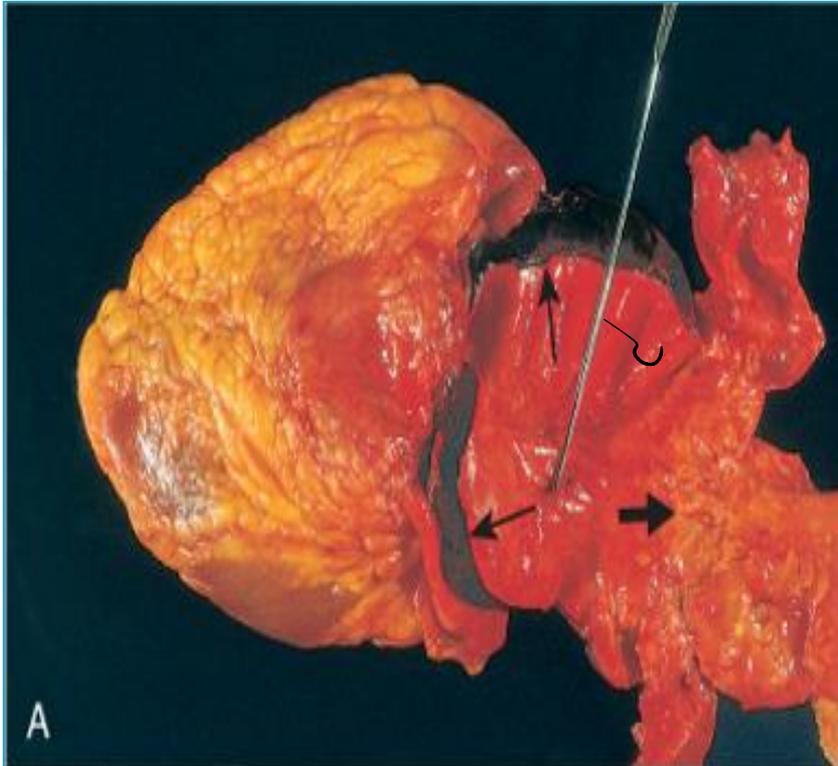
CT ANGIOGRAPHY



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



# Aortic dissection



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Silver stain: display elastic fibers in black color

Severe condition

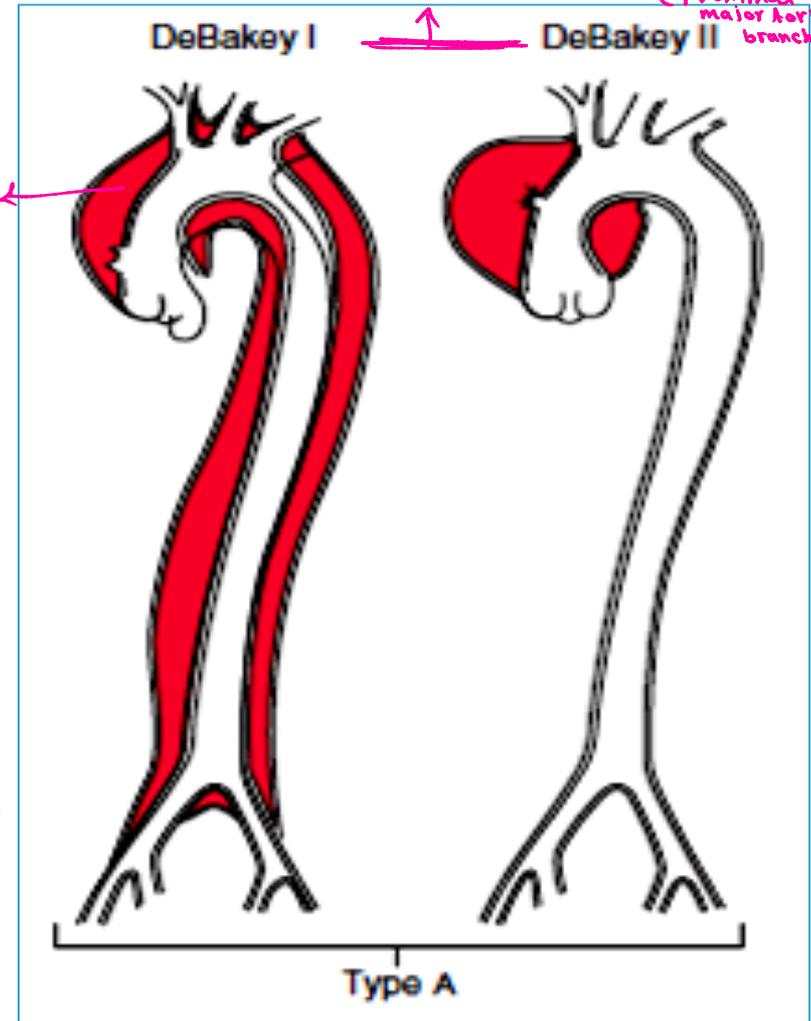
# Aortic dissections are generally classified into two types:

Usually dissection starts at a point and continues distally

## 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)

• Both started from the same point (proximal to major aortic branches)



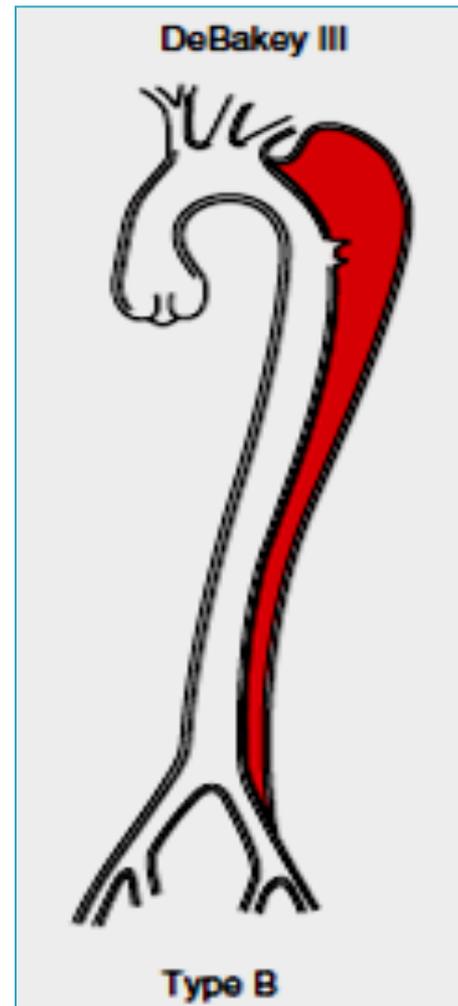
- Older classification = DeBakey classification (type I, II, III)
- newer classification = Type A + Type B → DeBakey III

• Severe  
It may lead to loss of blood supply to the brain and heart.

↳ DeBakey I  
↳ DeBakey II

## 2- type B dissections:

- ▶ *Distal to take off of major aortic branches* → less frequent and less dangerous.
- ▶ *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

+  
Supportive care  
+  
Oxygen

