ANEURYSMS AND DISSECTIONS

Dr. Nisreen Abu Shahin
Associate Professor of Pathology
Pathology Department
University of Jordan
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 and size 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
- they vary in diameter and length and can involve extensive portions of artery
To summarize...

**Aneurysm** - abnormal bulge in vessel

- **True Aneurysm**:
  - All layers bulge
  - Symmetrical fusiform
  - This side high pressure or weaker

- **Pseudoaneurysm**:
  - Asymmetrical saccular (or berry)
  - Hole

"False"
To summarize...

![True Aneurysm vs False Aneurysm](image1)

![Classification of Aneurysms](image2)

- Saccular
- Fusiform
- Pseudoaneurysm
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- 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.
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
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 inflammatory infiltrates and the destructive proteolytic enzymes
- (e.g. *vasculitis*)
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

- Hoarseness
- Chest pain
- Dyspnea

Abdominal Aortic Aneurysm

- Deep abdominal pain or discomfort
- Pulsating feeling
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 **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)

- **Abdominal mass** (often pulsating)
Mycotic aneurysms

- 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 of syphilis can cause *obliterative endarteritis* of vasa vasorum of aorta
- ischemic medial injury
- aneurysmal dilation of aorta and aortic annulus
- eventually valvular insufficiency
Aneurysm versus dissection...

- A. Normal vessel
- B. True aneurysm (saccular)
- C. True aneurysm (fusiform)
- D. False aneurysm
- E. Dissection

© Elsevier. Kumar et al: Robbins Basic Pathology 8e - www.studentconsult.com
Arterial dissection

Blood flow

Tunica adventitia

Tunica media

Intimal tear

Tunica intima

False lumen
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...

onset of dissection

extension of dissection

progression of dissection

Aortic dissection
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
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