

Clinical Atherosclerosis

● **Important**

● Notes (Doctors'/students')

431

SURGERY TEAM

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Atherosclerosis?

Clogging, narrowing, and hardening of large and medium-sized arteries.

What are the risk factors for Atherosclerosis?

- **Non-Modifiable Risk Factors:**
 - Male gender
 - Family history
 - Advanced age
- **Modifiable Risk Factors:**
 - Major: **Smoking, Diabetes, Hyperlipidemia** and **Hypertension**.
 - Minor: Obesity, Physical inactivity, Hypercoagulable state and Homocystenemia.

“Important in the exam to differentiate between Modifiable and non-Modifiable”

Pathogenesis?

- Fat deposits accumulate and will cause endothelial injury that will initiate the inflammatory process
- Formation of fibrous plaque by platelets
- Calcification of the arterial wall (this is the cause of atherosclerosis)
- Fat by itself is NOT harmful
- Rupture of the wall will cause clotting (atherothrombosis) >> this what we are worrying about.

What is the Clinical Spectrum of Atherosclerosis?

Atherosclerosis can affect any artery in the body and cause: Cerebrovascular disease, coronary artery disease, renal artery diseases, visceral artery (mesenteric artery) diseases and peripheral artery disease, So Atherosclerosis in a generalized disease.

What is the burden of Atherosclerosis?

Atherosclerosis is the leading cause of death worldwide, represent 22% mortality.

Peripheral Artery Disease

Why it is important to recognize patient with Peripheral Artery Disease?

- PAD is a marker for systemic atherosclerosis, patient with symptomatic or asymptomatic PAD generally have widespread arterial disease:
 - 35% to 92% of PAD patient have coronary artery disease association.
 - 25% to 50% of PAD patient have cerebrovascular disease association.
- Causes of death throughout the world:
 - 40% to 60% → CAD
 - 10% to 20% → CVD
 - Only 20% to 30% non cardiovascular disease.
- Patient with PAD have **a 6 fold** increased risk of cardiovascular disease mortality compared to patient without PAD.

Natural history?

A patient with PAD will have an annual risk of 6.8% mortality, non fatal MI 2%, they will require intervention by rang of 1%, the amputation risk is 0.4%.

How do patients with PAD present?

- Symptomatic: 10%

1- **Intermittent claudication** which is pain in a group of muscle because they all get supply by the same artery. Usually it is aggravated by exercise and relieved by rest. The most common location is the lower limb and the most common group of muscles are the calf muscles which are supply by the popliteal artery which is a continuation of superficial femoral artery which is the most common site for arterial atherosclerosis :P

2-**Critical Limb Ischemia**: Rest Pain → tissue loss or gangrene mostly of the toe or chronic arterial ulcer.

* Only 10% to 20% of PAD comes with critical limb ischemia, they need to be admitted immediately to get intervention.

Also, PAD patient may present with loss of hair and decrease of sensation especially in diabetic patients.



1- Rest pain, no tissue lost yet.

2- Arterial ulceration, long history of nonhealing ulceration may affect pressure area or toes.

3-Advanced case ☹ too late!

4-Heal ulceration, in advanced disease also ☹

* Types of Gangrene:

1- wet gangrene →infected and can spread, mainly seen in diabetic patients.

2- Dry gangrene → non infected limited to the site where there is no blood supply.

- Asymptomatic:
90% of PAD patients are asymptomatic

How do we diagnose PAD?

- History
- Physical Examination **most important PALPITATION** to recognise the site of pulse.
- Non invasive methods (1- **ABI**, 2- Arterial Duplex, 3- CTA, 4- MRA)
- Invasive test (conventional angiogram)

1-Ankle Brachial Index:



We inflate a cuff over the brachial artery, we use Doppler Probe *ultra sound machine to pick up the sound*, you inflate like when you're taking blood pressure until the sound disappear. And then you deflate the cuff, the first sound that appears is your systolic pressure you record it. You take the brachial pressure in both arms and you take the highest result. You do the same in the ankle level you inflate the cuff over the two pulsable arteries which are **Dorsalis Pedis { between the first and the second metatarsal bones}** and **Posterior tibialis { runs behind media malleoli}** .

In normal people the ABI should be one or above, **if it's equal or less than nine that's abnormal.**

0.8 - 0.9 → mild

0.5 - 0.8 → moderate

<0.5 → severe

<0.25 → very severe

2-Duplex machine = just like the ultra sound

3-CT Angio = a bit invasive, contrast then take a picture of the blood vessel.

4-Angiogram = you put a needle in the femoral artery and then you go a catheter it could be for a diagnostic or intervention purposes. If you found stenosis you could pass a wire and inflate a balloon → Angioplasty, or you could put a stent → Stenting SFA.

What are the Goals of treating patients with PAD?

- Relief symptoms
- Improve quality of life
- Limb salvage
- Prolong survival

How we treat Patient with PAD if they have ABI less or equal to 0.9%?

- 1) Risk factors modifications:
 - Diet an exercise, smoking cessation, diabetes control.

- Three main group of medications we give to PAD Pts:
 - 1- Anti platlets: Aspirin
 - 2- Statins: Zocor, Crestor, Lipitor.
 - 3- ACE inhibitors, regardless of blood pressure we give it for the anti inflammatory effect. **Except in patient with renal artery stenosis!!! Because it decrease creatinine clearance.**

2) Improve lower limb circulation

only in patients with critical limb ischemia or short claudication distance.

* Claudication distance?

from they start walking until the pain of claudication starts. If the claudication distance is 500 meters → no need for intervention. **Less or equal 100 meters claudication distance needs for intervention because its affect quality of life.**

- Intervention (Revascularization) methods?
 - 1- Percutaneous Transluminal Angioplasty
 - 2- Surgical Bypass
- Major amputation is the last strategy in treating patient with PAD
 - 1- Primary “ 1st time pt comes to the hospital we do angiogram no evidence for any blood vessel to bypass” vs. secondary “ the Pt used to have bypass but the vessel got occluded and there is evidence for ischemia, gangrene” .
 - 2- Minor “below the Ankle level” VS. Major “below or above Knee level”.

Carotid Artery stenosis (CAS):

Why it is important to recognize patients with CAS?

- Stroke is the third leading cause of death and a principal cause of long-term disability in much of the western countries

How do patients with CAS present?

- Symptomatic:
 - 1-Transient ischemic Attack just like the stroke but with lesser duration, less than 24 hours =TIA, more than 24 hours = Stroke.
 - 2-Amurosis Fugax = Transient visual lost.
 - 3- Stroke
- Asymptomatic:

the majority of patients.

How do we diagnose CAS?

- Symptomatic:
 - 1- History
 - 2- Physical Examination (**only in 30% of patient we hear carotid Bruit, so its not very sensitive**)
 - 3- non-invasive tests (**Arterial Duplex**, CTA and MRA)
 - 4- Invasive Tests (Conventional Angiogram)

* **Arterial Duplex : Stenosis is determined by measuring Velocities NOT anatomical diameter.**

- Asymptomatic

What are the Goals of treating patients with CAD?

- Prevent Stroke
- Prolong survival

Strategies in treating patients with CAD:

- Risk factors modifications:
 - Diet and weight control
 - Antiplatelets
 - Exercise
 - Hypertension control
 - Diabetes control
 - lipid control
 - Smoking Cessation
- Improve Brain circulation:
 - **Carotid Endarterectomy → first choice.**
 - Angioplasty +/- stenting → much higher risk for stroke during the surgery.
Relative indications: Hostile Neck, Hostile carotid disease, as part of Randomised clinical trial.

What are the indications to intervene?

- In symptomatic patients:
 - above 70% stenosis → benefit highly from surgery, decrease stroke at 2 years from 26% - 9%.
 - 50% - 69 % stenosis → benefit marginally from surgery.
 - Bellow 50% stenosis → we don't perform surgery, we give only medication.
- The bottom line above 50% will benefit, and fewer than 50% will not.**
- In asymptomatic patients:
 - which you discover accidentally usually we wait until the stenosis become 70% - 80% then we do surgery.

What is an Acute Limb Ischemia?

A **Sudden** decrease or worsening of the limb perfusion causing a positional threat to the limb viability resulting from a sudden obstruction of the arterial system.

What are the causes of acute arterial occlusion?

- **Embolus, 80% - 85% of the cases.**
- Thrombosis, 10 % - 15%
- Others: Trauma, Iatrogenic and arterial dissection.

What is the possible source for an embolus?

- Spontaneous [80%]:

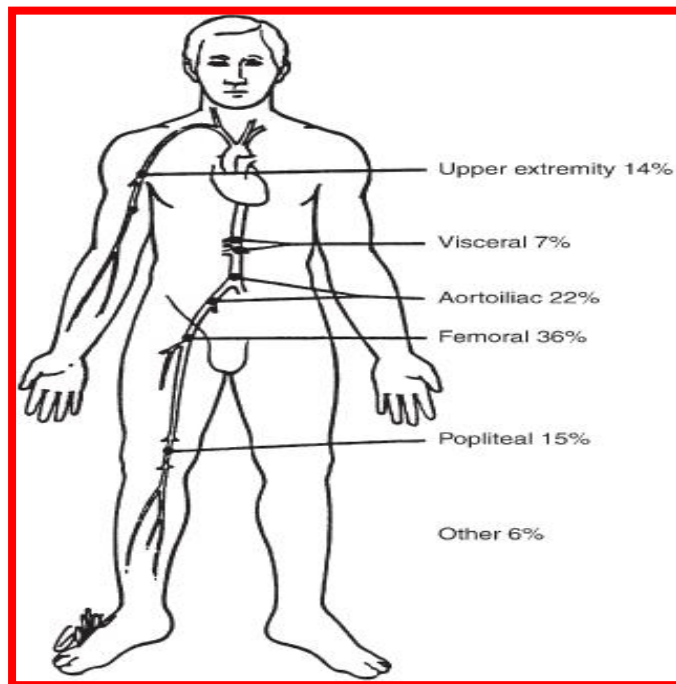
Cardiac source → Arrhythmia, MI, Prosthetic valve, Endocarditis.

Non-cardiac source → Proximal aneurysm, paradoxical emboli.

- Iatrogenic [20%]

Surgical manipulation.

Angiographic manipulation.

What are the common sites for embolus lodgment in the arterial tree?

*Bifurcation of femoral Artery

How do patients with acute limb ischemia present?

Sudden onset of diffuse and poorly localized leg pain, **6 ps**:

- 1- Paresthesias = "pins and needles" or of a limb "falling asleep"
- 2- Pain
- 3- Poikilothermia = coolness
- 4- Pallor
- 5- Pulselessness
- 6- Paralysis

* from the beginning of the first symptoms till the last one = 6 hours and it's called the **golden hours**, need a very quick intervention.

It is a **clinical diagnosis**, no need for investigation.

Treatment? In **golden hours** (6 hours)

- 1- ABC = Airway, Breathing and circulation.
- 2- IV heparin (anticoagulant)
- 3- Thromboembolectomy +/- surgical bypass, Thrombolytic therapy, primary amputation.

What do we worry about after revascularization?

Reperfusion syndrome:

- Local: compartment syndrome = muscle swell → increase pressure → compress arteries, veins and nerves.
- Systemic: Hyperkalemia, Acidosis **"due to lactate accumulation"** and Myoglobinuria.

How we treat Reperfusion syndrome?

- Muscle swell → you open Fascia = Fasciectomy.
- Hyperkalemia → to prevent arrhythmia we give **Calcium** gluconate, insulin and sugar.
- Acidosis → we give bicarbonate
- Myoglobinuria → to prevent renal failure "because myoglobin deposit in renal tubules" give more fluids and diuretics.

Summary:**1- male, above 45 with one risk factor came to primary clinic for regular checkup, no symptoms of PAD, what should you do?**

First use ABI test then if you found ABI result $< \text{ or } = 0.9$. You give pharmacological therapy (1- Anti platelets: Aspirin

2- Statins: Zocor, Crestor, Lipitor. 3- ACE inhibitors) + risk factors modifications, no need for intervention. We use percutaneous transluminal angioplasty or surgical bypass only if he has critical limb ischemia or short claudication distance = less than 100m then he feels the pain.

* if the patient known to have renal artery stenosis we DONOT give ACE inhibitors!! Because it decrease creatinin clearance

2- male, above 45 came to the ER at 2 AM complaining of paresthesias and sudden pain in the right leg with signs of arrhythmia, what should you do? Wait for investigations??!! And lose your 6 golden hours!!

Hell no, it's a diagnosis based on clinical signs. You should examine the leg and compare it to the other leg to confirm diagnosis and give the treatment

(1- ABC = Airway, Breathing and circulation.

2- IV heparin (anticoagulant)

3- Thromboembolectomy +/- surgical bypass, Thrombolytic therapy, primary amputation.)

3- First choice in treating patients diagnosed with CAD?

Carotid Endarterectomy

4- Most common site for Acute limb ischemia?

bifurcation of femoral artery.