Peripheral Arterial Disease

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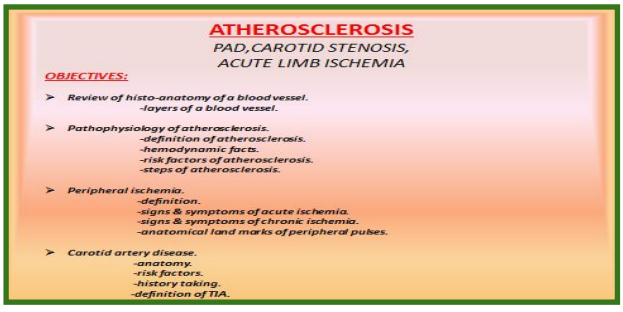
Objectives



Color Index:
-Doctor's Notes -Surgery Recall -Doctor's Slides -Extra explanation -Important

Correction File

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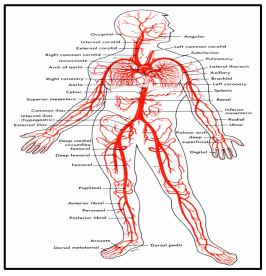
Anatomy of Vascular system

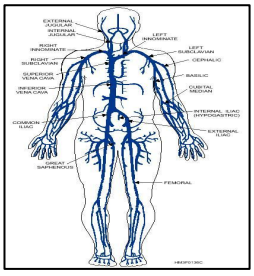
Vascular system is composed of :

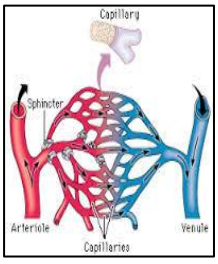
1- Arteries

2- Veins

3- Capillary







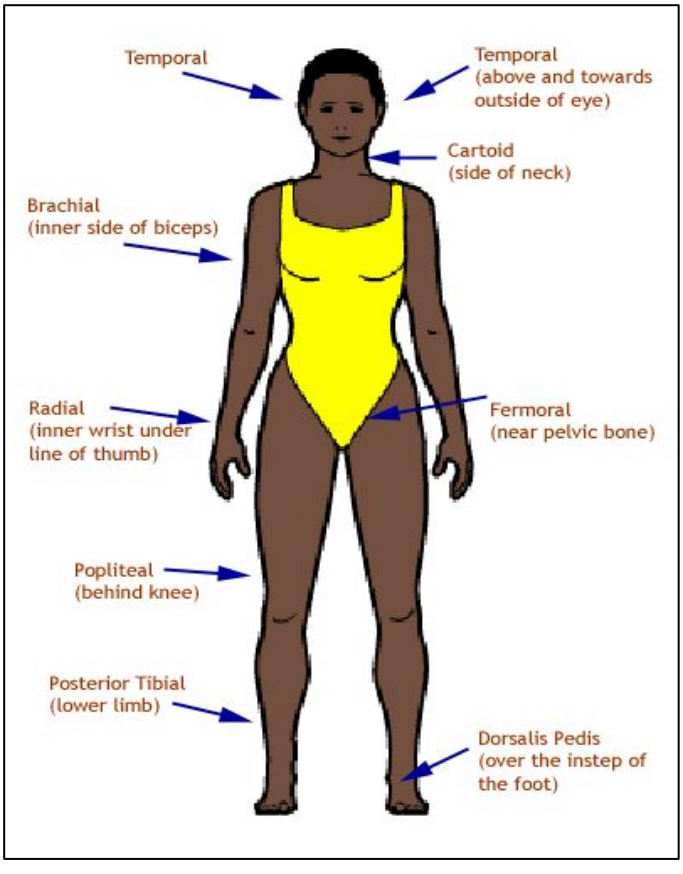
Which arteries supply blood vessel itself ?

Vaso vasorum.

What are peripheral arteries?

All arteries except coronary and carotid.

Sites of pulses arteries in our body



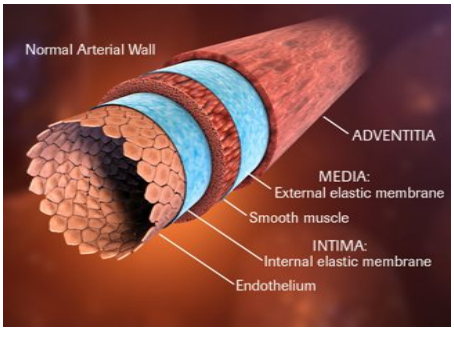
Histology and Hemodynamics of Artery wall

Each artery is composed of 3 layers :

1- intima (endothelial cell + internal elastic membrane)

2- Media (Smooth muscle +external Elastic membrane)

3- Adventitia



Function of endothelial cells (Hemodynamics) :

1-The endothelial cells that line blood vessels provide an active, dynamic interface between the blood stream and the arterial wall.
2-Provide Semipermeable barrier that regulate exchange of fluid, nutrients, gases and wastes.

3-Regulate the vasodilation by releasing Nitric oxide (NO) and prostacyclin (PGI2) and vasoconstriction by releasing Endothelin and Angiotensin II.
4- Provide unique surface that generally allows the cellular elements of blood to flow with adhering to the vessel lining.
5- When injury occurs , they secrete the cytokines that trigger and maintain the inflammatory response

Atherosclerosis

Is the progressive process of thickening and Hardening the wall of artery as result of fat deposit in inner lining (intima). All of us have certain level of atherosclerosis (fatty streaks).

Risk factors of atherosclerosis	
Major risk factors	1-Hypertension. 2-Diabetes mellitus. 3-Hyperlipidemia (High blood levels of LDL and VLDL). 4-Smoking -> Radioactive species. 5-Family history of atherosclerosis
Minor risk factors	Age(elderly and postmenopausal), gender(males),Obesity, homocysteinemia, sedentary lifestyle, physical injury,stress,air pollution,turbulent blood flow at bifurcation area and direct trauma

What does usually cause high blood levels of homocysteine?

Inherited metabolic defect that leads to very high levels of the homocysteine, a metabolite of methionine; high concentrations are toxic to the endothelium.

How can hypertension cause atherosclerosis?

High blood pressure through the wall of artery -> Endothelial injury or dysfunction -> atherosclerosis.

Common sites of atherosclerosis :

1- Branched points such as carotid bifurcation because of turbulence of blood flow.
2-tethered site such superficial femoral artery in Hunter canal in leg.

Atherosclerosis

The first step of atherosclerosis

Pathophysiology :

1-Toxic insult :
such DM . HTN , HL , other injure the endothelial cells

2-Endothelial dysfunction:
1-increase adherence,permeability and hypercoagulability
2-Expression of adhesion molecules,release of chemokines

3- Inflammatory response:
1-adhesion of endothelium and migration to subendothelium
2-Release of cytokines and platelet activation

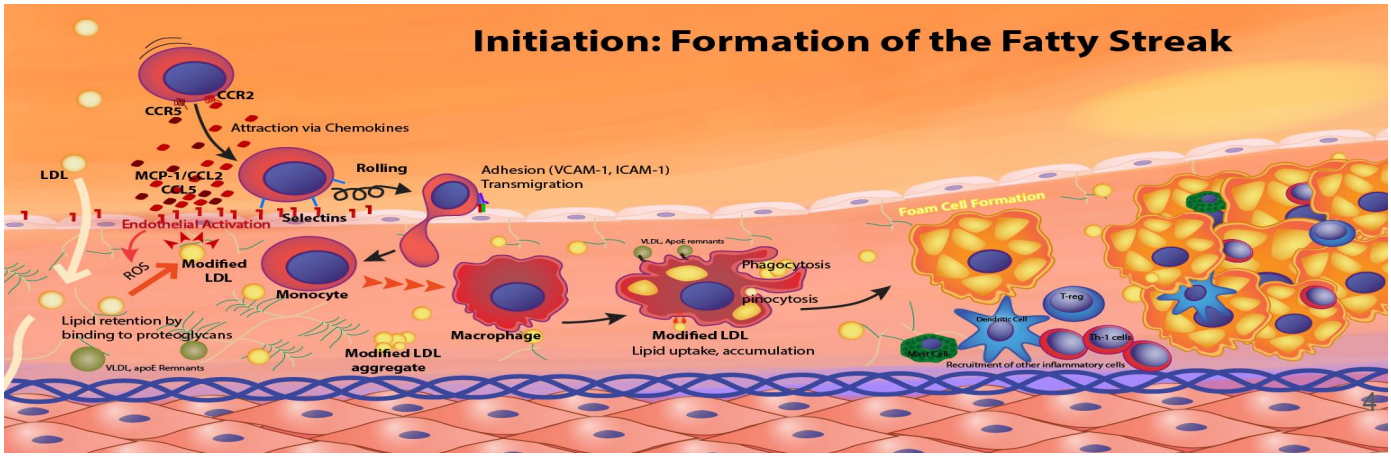
4- FOAM CELL FORMATION :
(engulfing of LDL by macrophages) leading to form FATTY STREAKS (aggregation of foam cells +T lymphocytes)

5-Continues prosis:
Foam cells go in and out of the endothelial lining that triggers more inflammatory response.

6-Intermediate lesion:
layers of macrophages and smooth muscle cells -> atherosclerotic plaque

7- Fibrous plaque:
Progression of intermediate lesion with fibrous cap formation. Mixture with smooth muscle cells, necrotic debris, protein and intracellular and extracellular lipid

8-Thrombus formation:
by rupture of fibrous cap or ulceration of plaque. Ulceration has high risk of microembolization.



PERIPHERAL ARTERIAL DISEASE (PAD)

A-Chronic :Atherosclerotic occlusion of any artery except coronary and carotid.

1-Intermittent claudication

Definition : Muscle or group of muscles pain due lack of blood supply. The pain is resolved by rest or simple analgesia.

Common site : In the lower extremities in the calf muscle, but can occur everywhere.

Classic presentation : pain is caused by walking specific distance and resolved by stopping specific amount of time.

Management By conservative treatment : (PACE)
Pentoxifylline , aspirin .
cessation of smoking and exercise

2-Critical Limb Ischemia :

Definition :rest pain of muscle for 2-3 consecutive weeks that isn't relieved by simple analgesia or Tissue loss(ulcer or gangrene)

The Common site of rest pain: foot over the distal materials (classically at night awakening the patient).

The rest pain can be resolved by standing or hanging the foot on the other side of bed due to gravity that afford more blood flow to ischemic area.

the Common sites of ulcer : Can occur anywhere, but the the most common sites in toes and foot

Treatment : surgery intervention
1-surgical graft bypass
2-angioplasty(balloon dilation
3-Endarterectomy : remove diseased intima and media
4- surgical patch angioplasty : place patch over stenosis)

Signs of chronic PAD : scaly , dry skin ,hair loss , muscle atrophy , absent pulse . thick toenails , buritis ,ulcer and tissue necrosis

Indication of surgery in chronic PAD : (STIR)
severe claudication, tissue necrosis ,Infection and rest pain.

Diagnosis by : 1-Angiogram (gold standard)

B-Acute : Acute occlusion of artery.

Thrombosis	Embolism	Trauma
Thrombosis:The local formation or presence of a blood clot in a blood vessel.	Embolism (The most common cause) : An embolism is an obstruction in a blood vessel due to a blood clot or other foreign matter that gets stuck while traveling through the bloodstream. Originate mainly from : 1-Heart 85% due : Atrial fibrillation (the most common), Died muscle after MI, Endocarditis and Myxoma 2-Aneurysms 3-Atheromatous plaque The most Common site : Common femoral artery	Remember : At levels of artery, Complete cut causes vasoconstriction while partial cut causes vasodilatation, so the complete cut is better.

Signs of acute PAD : 6Ps

Pain , Paralysis . Pulselessness , Paresthesia , Pallor ,Poikilothermia

Diagnosis by : 1-Angiogram 2- ECG (looking for MI and atrial fibrillation) 3-Echocardiogram (looking for clot,MI and valve vegetation)

Immediate management : 1-IV heparin and anticoagulant
2-angiogram

Treatment : Surgical embolectomy

Complication : Gangrene if not treated

What is the Poikilothermia ?

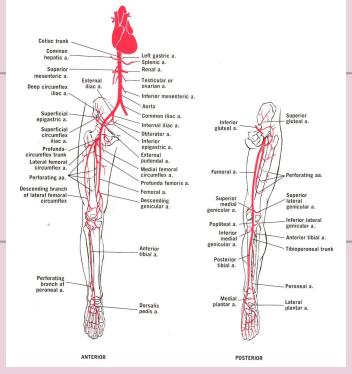
Impaired regulation of body temperature with temperature of limb usually cool, reflecting the ambient temperature.

Mention the types of Atheromatous plaque?

1-Malignant atheromatous plaque (friable or ulcerated): has high risk of microembolization (more severe)
2-Not malignant atheromatous plaque

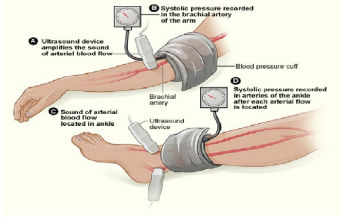
Relationships between pain location and site of occlusion

Site of Pain	Arterial involved
Buttok and hip pain	Aortoiliac occlusion (distal of aorta or iliac) -> lerich syndrome which involves (Claudication, Erectile dysfunction, absence of femoral pulse and muscle atrophy)
Thigh pain	Aortoiliac or common femoral occlusion Remember : After inguinal ligament -> Common femoral artery : Before inguinal ligament -> External iliac
Upper two-thirds of the calf pain	Superficial femoral artery occlusion
Lower one-third of the calf pain	Popliteal artery occlusion
Foot pain	Tibial arteries occlusion



What is ABI test?

Standard for Ankle to Brachial Index which is the ratio of systolic blood pressure at the ankle to systolic blood pressure at the arm(brachial artery).



Normal : more than 1
Claudication : less than 0.6 and more than 0.4
Rest pain : less than 0.4

In patient with chronic PAD, what is the main post operative concern ?

Cardiac statues, because most patients with chronic PAD have coronary artery disease and 20% have abdominal aorta aneurysm +/- carotid artery disease.
MI is considered the most common cause of Postoperative death after surgical intervention of chronic PAD.

Why do bedridden patients come at late stage (tissue lost or rest pain) ?

Because they don't walk, so they won't complain of claudication.

HISTORY Taking

1-Pain.

Location.

Precipitating & aggravating factors.

Frequency & duration.

2- Rule out other causes of pain of lower limb..

3-Patients with co-morbid conditions (Diabetes, Hypertension) and can not walk, present late with rest pain or gangrene.

4-Drug/medical history.

5-Surgical history : those with history of coronary bypass surgery + complication of Laparoscopic cholecystectomy (Lap chole) -> trocar injury to iliac artery.

6-Family history: first degree relative with abdominal aortic aneurysm.

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*There is a relation between Carotid, Coronary and lower limbs. So, You must ask about these questions:

1- transient ischemic attack (TIA):

*How to differentiate between TIA and Formal stroke?

TIA (<24h+with complete recovery of neurological symptoms) and formal stroke(more than 24 hours+ residual dysfunction)

2-Difficulty in speech or swallowing

3-Dizziness / drop attacks

4-Blurred vision

5-Arm fatigue

6-Pain in abdomen after eating:

***What we call pain <u>after</u> eating?**

<u>"Intestinal angina"</u> > In case of mesenteric ischemia.

7-Renal insufficiency (poorly controlled DM+/- HTN)

8-Impotence (due erectile dysfunction)

9-Claudication/rest pain/tissue loss

PHYSICAL EXAMINATION

*** There is no precaution in Vascular examination**

1-Inspection:

- Change in color
- Signs of ischemia
- Burger's test

***Buerger's test** is used in an assessment of arterial sufficiency. The *vascular angle*, which is also called *Buerger's angle*, is the angle to which the leg has to be raised before it becomes pale, whilst in supine decubitus. In a limb with a normal circulation the toes and sole of the foot, stay pink, even when the limb is raised by 90 degrees. In an ischaemic leg, elevation to 15 degrees or 30 degrees for 30 to 60 seconds may cause pallor. (This part of the test checks for *elevation pallor*.) A vascular angle of less than 20 degrees indicates severe ischaemia

- Capillary filling: ***Normally it takes one to two seconds (1-2) s**
- Venous refilling:

The time taken for the veins to refill following elevation of the limb for one minute

Less blood supply -> less venous refilling or return.

- Pregangrenous/gangrenous part examination.

*What are the Signs of chronic ischemia?

"Imagine the ischemia from skin Down to the bones and you'll enumerate the signs of Chronic ischemia":

-Muscle atrophy

-scaly/Dry skin

-Loss of extremity hair\nails

2-Palpation:

*It's important to compare in palpation

- Skin temperature
- Venous refilling.
- Peripheral pulses.
- Joint movements /muscle strength.
- Sensation.

3-Auscultation:

- Bruits.

-What is the difference between Bruits and thrill?

-Bruits: Turbulent blood flow that we can hear it

-Thrill: Turbulent blood flow that we can feel it

***Bruits sites: Carotid+ subclavian+ Femoral and (Iliac in thin people).**

Anatomical landmarks for pulses in lower extremity:- (Extremely imp):

-Femoral artery: Just below the inguinal ligament (at common femoral A.).

-Popliteal artery: at the middle of popliteal fossa (sometimes lateral).

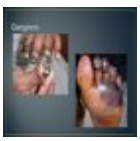
-Posterior tibial artery: The posterior tibial artery pulse can be readily palpated halfway between the posterior border of the medial malleolus and the Achilles tendon

-Dorsalis pedis artery: the pulse felt on the top of the foot, between the first and second metatarsal bones.

Q:How to differentiate between neuropathic ulcer and ischemic ulcer?

1-Neuropathic ulcer occurs in the pressure areas such as sole of the foot, head of toes, and big toes.

2-A huge difference in edges of ulcer.



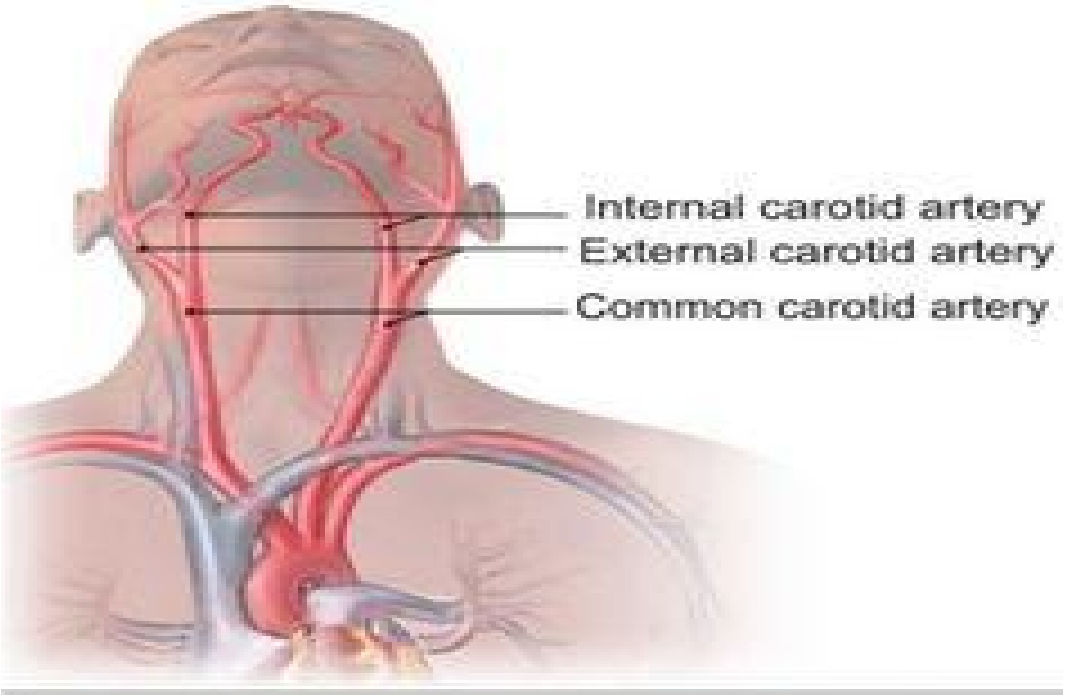
Differentiation of Ischaemic and Neuropathic Ulcer

	Ischaemic ulcer	Neuropathic ulcer
Symptoms	Claudication Rest pain	Usually painless Or painful neuropathy
Inspection	Dependent rubor Trophic changes Gangrenous digits	High arch + clawing of toes No trophic changes Surrounded by callus
Palpation	Cold Pulseless	Warm palpable pulses
Ulceration	Painful At the distal and over bony prominences	Painless Sites of pressures (metatarsal heads, heels)

CAROTID ARTERY DISEASE

Risk Facroes:

- Hypertension.
- Diabetes.
- Hyperlipidemia.
- Smoking.
- Familial tendency.
- Obesity.
- Gender.



The right common carotid originates in the neck from the brachiocephalic trunk; the left from the aortic arch in the thorax

Internal Carotid artery: No Cervical Branches.
External Carotid artery: Give many Cervical Branches.

History:

- transient ischemic attack (TIA)
- Difficulty in speech or swallowing
- Dizziness / drop attacks
- Blurred vision
- Arm fatigue
- Pain in abdomen after eating
- Renal insufficiency (poorly controlled DM+/- HTN)
- Impotence
- Claudication/rest pain/tissue loss

Symptoms & signs:

- *According to the effected area:
- Signs and symptoms may include a bruit, a transient ischemic attack (TIA), or a stroke.