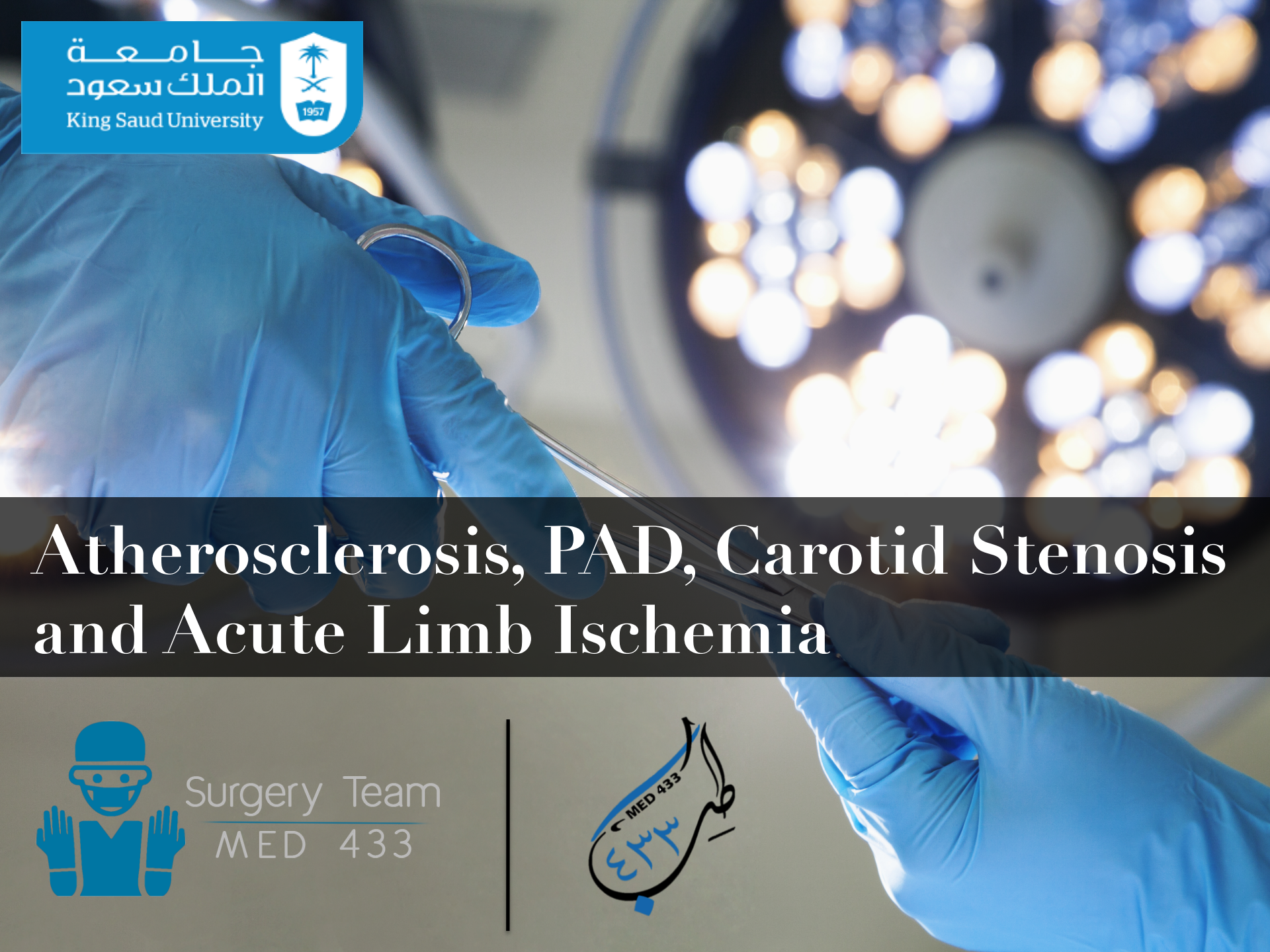


جامعة الملك سعود
King Saud University
1957

Atherosclerosis, PAD, Carotid Stenosis and Acute Limb Ischemia

Surgery Team
MED 433

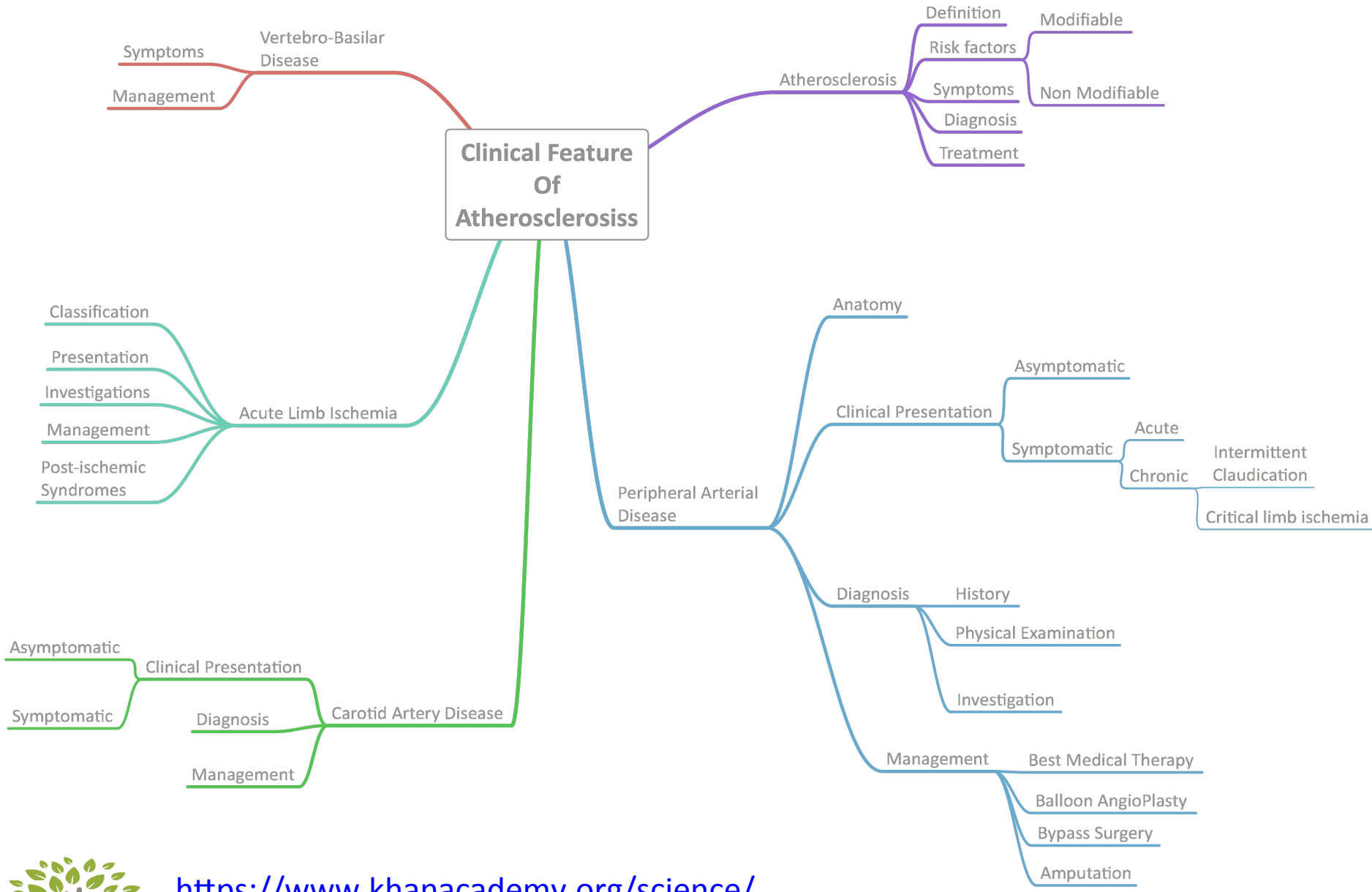
MED 433

Objectives :

- **Pathophysiology Of Arterial Disease :** Pathology, Clinical features
- **Chronic Lower Limb Arterial Disease:** Anatomy، Clinical features, Intermittent claudication , Critical limb ischemia and Management of lower limb ischemia
- **Amputation :** Indication, Level of amputation, Surgical principles, Rehabilitation and limb fitting, Phantom pain
- **Arterial Disease Of The Upper Limb :** Overview and Management
- **Cerebrovascular Disease:** Definitions, Carotid artery disease, Vertebrobasilar disease
- **Renal Artery Disease :** Atherosclerosis, Fibromuscular hyperplasia, Management
- **Mesenteric Artery Disease.**
- **Acute Limb Ischemia:** Etiology, Classification, Clinical features, Management, Post-ischemic syndromes
- **Aneurysmal Disease :** Classification, Abdominal aortic aneurysm, Peripheral aneurysms
- **Buerger's Disease (Thromboangiitis Obliterans).**
- **Raynaud's Phenomenon:** primary, secondary Raynaud's phenomenon

Sources : Slides, Raslan's Notebook, Principles & Practice of Surgery by: O. James Garden

Color Index : Slides & Raslan's | Textbook | Doctor's Notes | Extra Explanation



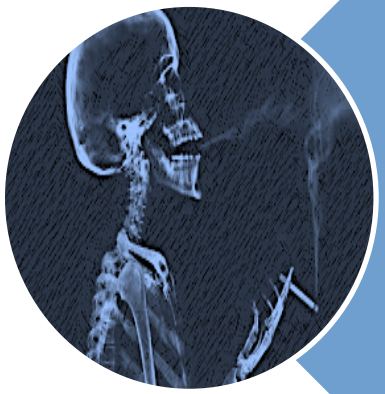
https://www.khanacademy.org/science/health-and-medicine/circulatory-system-diseases

1st :Atherosclerosis

1- Definition:

It is an inflammatory process of progressive thickening and hardening of the walls of medium sized and large arteries as a result of fat deposits on the inner (intimal layer) lining of the arteries.

2- Risk Factors:



Modifiable

- Smoking (Cause Circulation of reactive oxygen species "free radicals")
- Hypertension (Physical wall injury)
- DM
- Hyperlipidemia (Minor)
- Homocystenemia
- Obesity
- Hypercoagulable state
- Lack of physical inactivity

Note:
Elevated **homocysteine** promotes atherosclerosis through increased oxidant stress, impaired endothelial function, and induction of thrombosis

Non Modifiable

- Male (as the protective female hormones are very low)
- Advanced age
- Family history

3- Normal Physiology:

Hemodynamic Facts

- 1- The endothelial cells that line blood vessels provide an active, dynamic interface between the blood stream and the arterial wall.
- 2- provide a semi-permeable barrier that regulates the exchange of fluid, nutrients, gases, and waste products between the blood and the tissues
- 3- provide unique surface that generally allows the cellular elements of blood to flow with adhering to the vessel lining .
- 4- Endothelial cells also regulate constriction and relaxation of vessels by releasing vasodilatory molecules (e.g., nitric oxide (NO) and prostacyclin (PGI2) and vasoconstrictive molecules (endothelin and angiotensin-II).

4- Pathophysiology of Atherosclerosis :

Endothelial Injury

Atherosclerosis is triggered by physical or chemical injury to the endothelial cell layer of arteries.

Chemical Injury

- **Smoking**
- **Hyperlipidemia and Homocystenemia**
- **DM**

Physical Injury

Hypertension (blood flow exerts high level of stress on arterial wall)

especially in the bifurcation (branching) areas of an artery

Cont.. Pathophysiology of Atherosclerosis

The key word in atherosclerosis is **inflammation**

Fat deposits accumulate and will cause endothelial injury that will secrete cytokines that trigger and maintain an inflammatory response.

Macrophages infiltrate the endothelium to ingest lipids and become foam cells (fatty streak)

Cytokines attract further leucocytes and smooth muscle cells

Smooth muscle cells migrate from the media into sup-endothelial space and begin to proliferate

At this stage plaque is raised and encroaches upon the lumen of artery

If the fibrous cap covering the plaque is thin it may rupture and cause the sudden formation of a blood clot (thrombosis).

that block the area or flow to distal arteries, and also may cause thromboembolism

5- Clinical Feature Of Atherosclerosis:

all the lecture is subdivided from this chart, so when ever you feel lost in the lecture, take a look at it

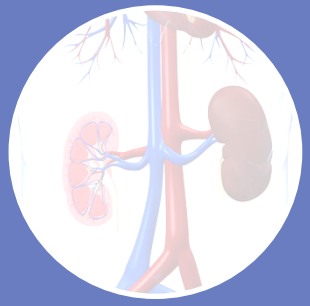
The patient's symptoms and sign will depend upon the region supplied by the affected artery

1- Coronary Arteries:

- Angina
- MI

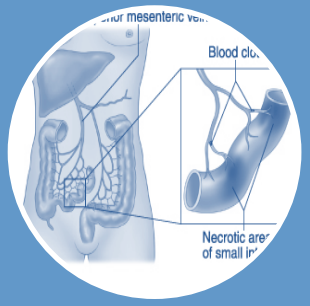
2-cerebral Circulation :

- Stroke [1]
- Transient Ischemic Attack(TIA) [2]
- Amaurosis Fugax [3]
- Vertebrobasilar Insufficiency (VBI)



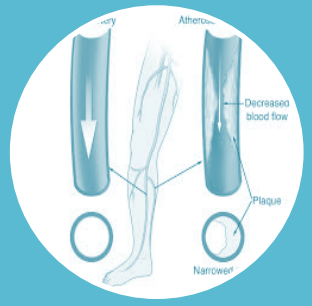
3-Renal Arteries:

- hypertension
- renal failure



4- Mesenteric Arteries:

- mesenteric angina
- acute intestinal ischemia



5- Limbs (PAD):

- Intermittent Claudication (IC)
- Chronic Critical Limb Ischemia (CLI)
- Acute Limb Ischemia

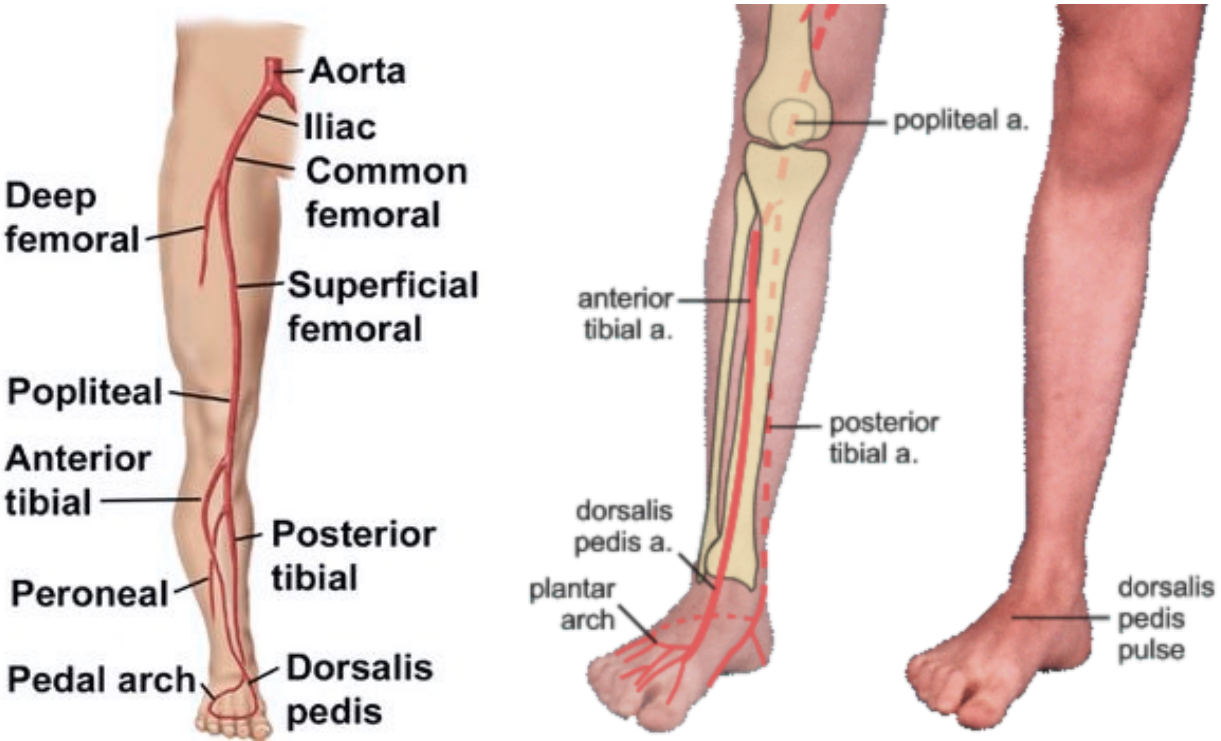
1 **Stroke:** may be defined as an episode of focal neurological dysfunction lasting more than 24 hours, of presumed vascular etiology.
2 TIA: is like a stroke, producing similar symptoms, but usually lasting only a few minutes and causing no permanent damage.
3 Amaurosis Fugax: is a painless transient loss of vision in one eye owing to partial occlusion of a branch of the retinal artery causing lack of blood flow, by a cholesterol emboli.

★ Peripheral Artery Disease (PAD) :

- Sequence of atherosclerosis of peripheral vessels excluding the carotids and coronaries
- PAD is a marker of systemic atherosclerosis
- Patients either symptomatic or asymptomatic, they generally have widespread arterial disease
- **They usually may have co-existing diseases such as :**
  - Coronary artery disease (CAD) {35%-92%}
  - Cerebrovascular disease (CVD) {25%-50%}
- About **40%-60%** of patients **die** from CAD while **10%-20%** die from CVD

1- Anatomy:

Arteries Of Lower Limb



2- Clinical Presentation:

PAD can be either Acute or Chronic:

1- chronic

- **A) Intermittent claudication**
- **B) Critical Limb Ischemia**

Both are due to an atherosclerotic plaque

2- Acute

- **Acute Limb Ischemia** due to (Thrombus , Embolus, Trauma)

2nd : Chronic Lower Limb Arterial Disease

Chronic PAD	Intermittent Claudication (muscle pain)	Critical limb ischemia
pain	Comes after walking a specific the distance (with exertion) , called claudication distance	Rest pain worse at night and awakens the patient from sleep
Relieving Factor	Quickly relieved by resting	Hanging the limb out of bed (as the gravity help in distal blood flow)
	Single level disease affecting one arterial segment	Multilevel disease affecting different arterial segments

A) Intermittent Claudication (IC)

- **Claudication Pain:** is a muscular pain which is present with **exertion** (after walking particular distance) and quickly relieved by resting
- The site of claudication gives clue to the likely site of arterial disease.

Unilateral thigh and/or buttock	Bilateral thigh and/or buttock	Calf	Foot
• Iliac Artery	• Aortioiliac Artery	• Femoropopliteal Artery	• Infrapopliteal/tibial Artery

- Arterial disease most frequently affects superficial femoral artery (SFA)

What is happening during this stage ?

SFA becomes narrowed

- Over next few months collateral vessels arising from deep femoral artery
- So they are going to carry high proportion of blood to lower leg

→ As a result majority of patients symptoms gradually improve or even disappear and this moderate phase may remain stable for several years

→ But without best medical therapy atherosclerosis will progress and become sever and involve other segments such as iliac , tibial vessels which lead to :

→ Development of : **critical limb ischemia**

B) Critical Limb Ischemia (CLI)

- CLI is caused by **multiple lesion** affecting different arterial segments down the leg
- Patients usually have :
  - ✓Rest pain that **worse at night** and so sever that can awake him from sleep
  - ✓Pain is relieved by hanging the limb out of bed
  - ✓Patient is highly prone to tissue loss (ulcer) or gangrene

3- Diagnosis: (in symptomatic patients)

A) History (you have to ask about) :

Pain
(site – precipitating and aggravating factor- frequency-duration- evolution

Rule out other causes of pain in the lower limbs

Drugs and Medical history

Surgical history

family history: first degree relative with abdominal aortic aneurysm

Vascular review of symptoms
TIA, Difficulty in speech or in swallowing
Dizziness , drop attacks
Blurry vision , Arm fatigue
Pain in abdomen after eating
Renal insufficiency(poorly control hypertension ,Impotence,
Claudication ,rest pain , tissue loss , gangrene

B) Physical Examination :

Inspection

1-change in color 2-signs of ischemia 3- Buerger's test
4- capillary filling test 5-venous refilling
6- pregangrenous /gangrenous examination

palpation

Skin temperature, venous refilling
peripheral pulses ,Disappearing pulses
Joints movements and muscle strength
sensation

Auscultation

Listen for femoral and abdominal aortic bruits, which is a sharp harsh systolic sound indicate a narrowing lumen.

If you are not sure whether pulse is palpable, count out pulses with second person palpating an easier artery such as the radial artery. If pulsations are simultaneous, you are likely palpating pulse accurately.

NOTE:

- **Absence of Pulse:** it signifies arterial obstruction proximal to the area palpated
- In general physical examination (atrophy of calf muscle ,loss of extremity hair and thickened toenails are clue to underlying (PAOD)

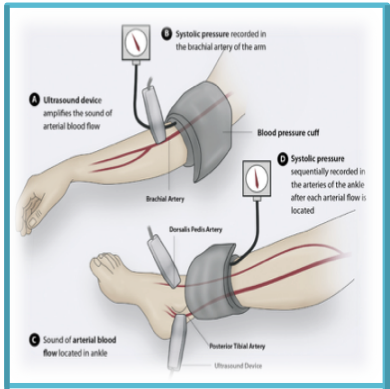
★ **Buerger's test :** is used in an assessment of arterial sufficiency. The vascular angle, which is also called Buerger's angle, is the angle to which the leg has to be raised before it becomes pale. In a limb with a normal circulation the toes and sole of the foot, stay pink, even when the limb is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

Examination finding of chronically ischemic limb characterized by:
1-skin that is thin and dry 2- pallor on elevation ,upon dependency the foot becomes bright red (sunset)
3-venous guttering 4- brittle and crumbly nails 5- muscle wasting 6-reduced temperature 7- pulses that are weak or absent
8- thrills on palpation and bruit on auscultation (sometimes)

C) Investigation

Vascular investigations will be detailed in a separated lecture in the 2nd semester)

They are primarily used for conforming the diagnosis after history and examination and exclude other diseases ,and assess severity

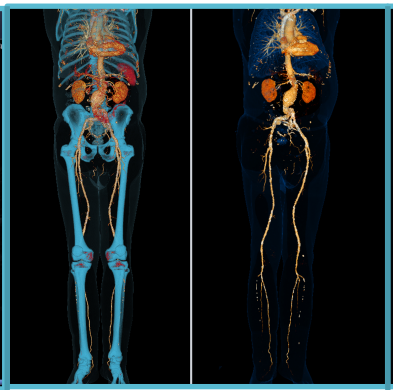


1- ABI (Ankle Brachial Index)

Is the index (difference) between the **systolic pressure** of the ankle and the brachial systolic pressure. It's also used for screening in asymptomatic patients

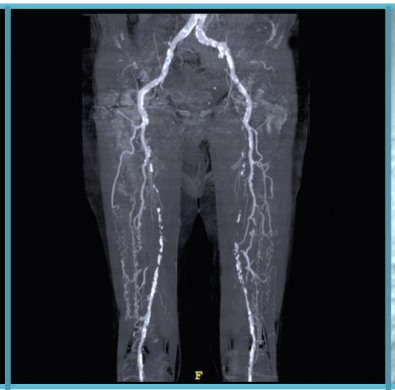
Arterial Duplex (Doppler +US)

Doppler is better in assessing dynamic view than the conventional angiogram



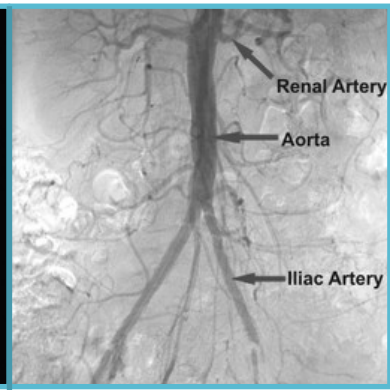
CT Angiography

is a **computed tomography** technique used to visualize arterial and venous vessels throughout the body)



MR Angiography

Is a group of techniques based on magnetic resonance imaging (MRI) to image blood vessels (2D or 3D)



The Conventional Angiogram:

(dye and X-rays)

- **Gold Standard**
- Conventional angiogram is very accurate in **mapping** out the arteries

2- Non- Invasive Tests

3-Invasive Test

ABI= Highest ankle systolic pressure (PT or DP) / Highest brachial systolic pressure

- **Result : Normal** >0.9 | **Abnormal** < 0.9 (mild 0.8-0.9) , (moderate 0.5-0.8), (sever <.5), (very sever <0.25)
- Patients With Intermittent Claudication usually have ABPI of 0.5-0.9 While in CLI is less than 0.5
- In patient with **DM and Chronic Renal Failure** , ABI is **not reliable** as the arteries are calcified and difficult to compress this result in false high values

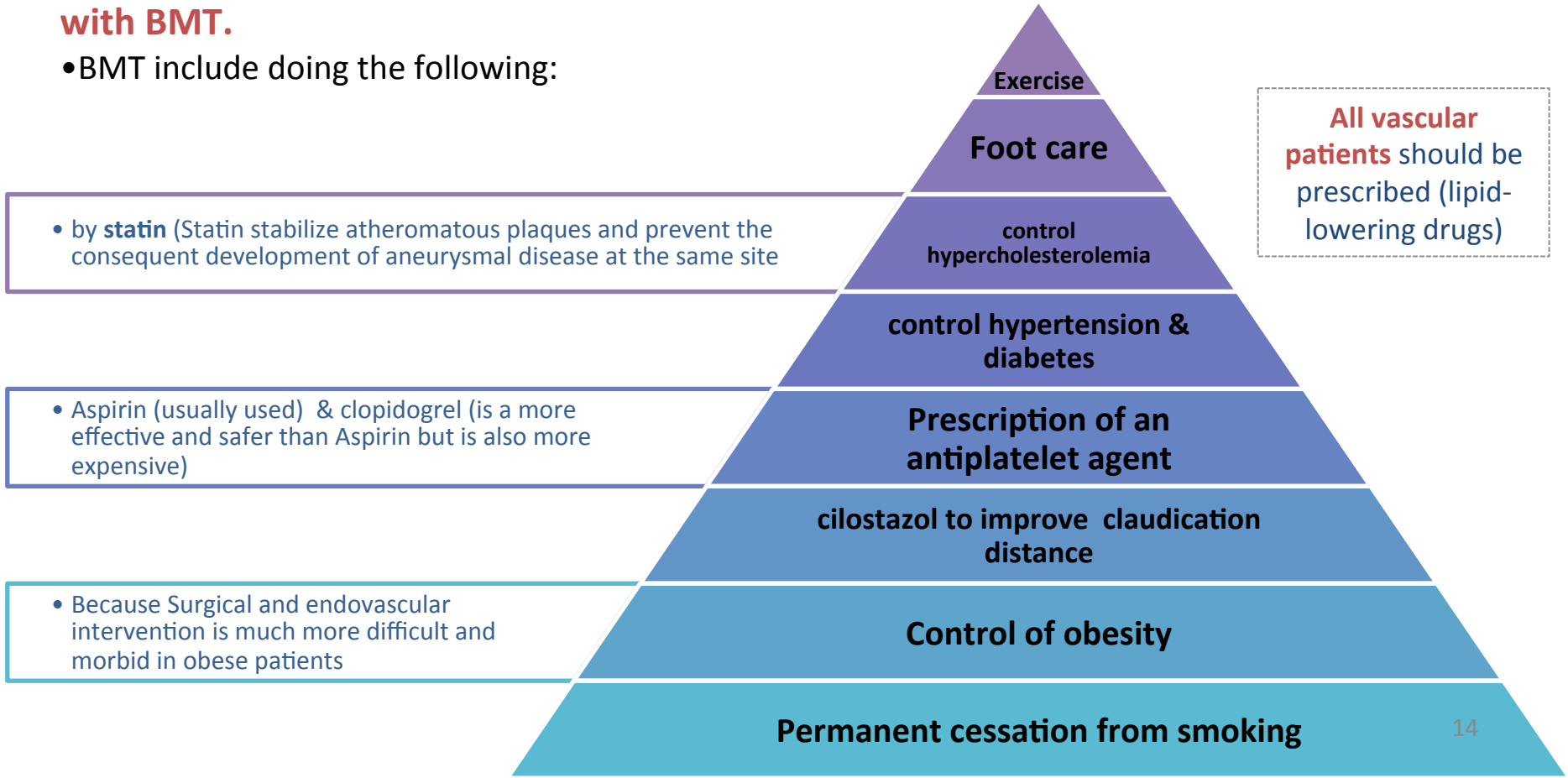
4- Management:

★ **Goals of Treatment :**

1- Relief of symptoms	2- Improve the quality of life	3- Limb salvage	4- Prolonging survival

1) Best Medical Therapy (BMT)

- **Used in :** patients who present with IC (especially in IC caused by femoropopliteal disease) **you have to start with BMT.**
- BMT include doing the following:



if the patient complaint with BMT or he have a disabling Claudication pain or he presents with CLI :

2) Balloon Angioplasty (BAP) with or without stenting

- This is the **treatment of choice** for disease segment that are **less than 10 cm** long.
- This procedure enlarges the lumen by disrupting the atheromatous plaque.

Intermittent Claudication

- **BAP is not preferred in femoropopliteal and infra-popliteal segments.**
- **Uses**: **IC due to aortoiliac disease.**

Critical Limb Ischaemia

- BAP is safer and less expensive than BSX in the short term
- **Uses:** in patients with no suitable vein for BSX

3) Bypass Surgery (BSX)

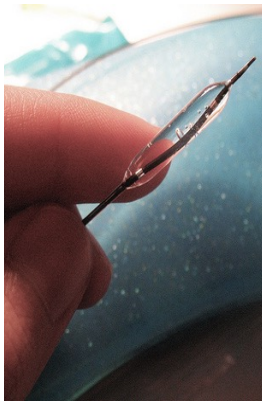
- This involves replacing or bypassing the diseased arterial segment with either a **vein from the same patient** (most commonly used) or a synthetic graft (used in case a vein graft is not possible)
- **Complications of BSX :** infection and graft occlusion

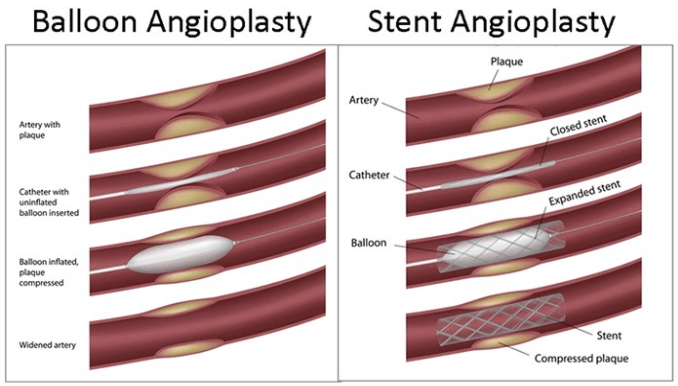
Intermittent Claudication

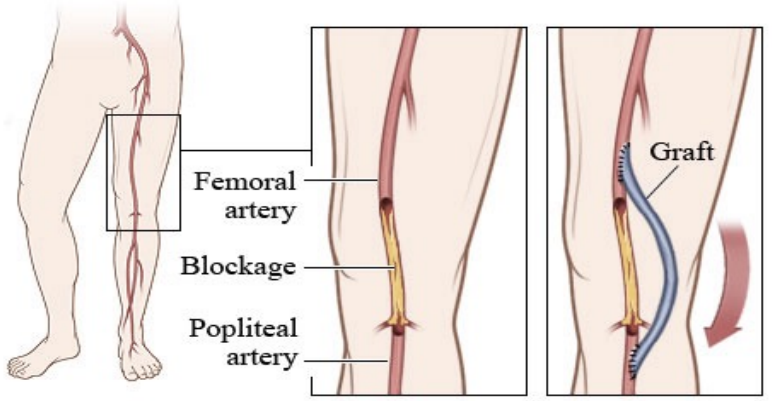
- A lot of vascular surgeons don't prefer BSX as a management to IC for many reasons
- but it may be used in femoropopliteal and infra-popliteal segments

Critical Limb Ischaemia

- BSX (with vein) offers a more durable and complete revascularization in the longer term than BAP
- **BSX is the treatment of choice in All CLI patient**







4) Amputation

if these treatments do not work, or if the tissue damage is too far advanced initially, amputation will remove a source of major infection and may be necessary to save their life

✸ Level of Amputation

This is determined by: local blood supply, the status of the joints, the patient's general health and his or her age. (See the picture)

✸ Rehabilitation And Limb Fitting :

At 1 week: the patient should begin to bear weight on the other limb between parallel bars.

At 10 days: begin to walk with a pneumatic walking aid.

At 3 weeks : If healing is progressing well, a temporary prosthesis can be fitted.

✸ Phantom pain :

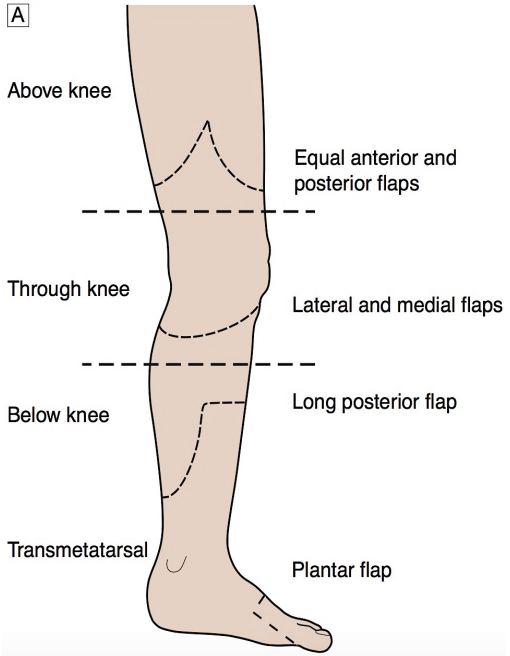
Phantom limb pain, is pain occur after an amputation of a limb ,can be a serious problem, especially if pain has not been well controlled before and after the amputation. With appropriate drug therapy, reassurance and time, it usually settles but can take a long time to do so .

Major Amputation

- It affects function because it involves the whole leg.
- **1- Primary :** we start with it
- **2- Secondary :** when patient doesn't respond to other treatment

Minor Amputation

- Doesn't affect function
- 1- below knee amputation
  2- above knee amputation



3rd : Acute Limb Ischemia

Sudden decrease or worsening in the limb perfusion causing a potential threat to the limb viability resulting from a sudden obstruction of the arterial system, most commonly by a thromboembolism.

✸ **Classification:** According to :

RTA*: Road Traffic Accidents

A) Cause :

1- Embolus (Most common cause)

2- Thrombosis

3- Iatrogenic

4- Trauma **(Such as : limb fractures and dislocations, blunt injuries occurring in RTA*, stab wounds and gun shot wounds)**

5- Arterial dissection

B) Severity :

1- Incomplete Ischemia (Limb not threatened)

2- Complete Ischemia (Limb threatened)

3- Irreversible Ischemia (Limb non-viable = Amputation is required)

✸ **Possible Sources For An Embolus:**

1- Spontaneous 80% :

✓ **Cardiac Source: (most common cause)**

- **Arrhythmias**
- **MI**
- **Prosthetic valve**
- **Endocarditis**

✓ **Non-Cardiac:**

- **Proximal Plaque**
- **Aneurysm** (an excessive localized swelling of the arterial wall)
- **Paradoxical Emboli** (blood clot of venous origin through a lateral opening in the heart, such as a patent foramen ovale or ASD)

2- Iatrogenic 20% : (caused by medical procedures)

- ✓ Angiographic manipulation
- ✓ Surgical manipulation

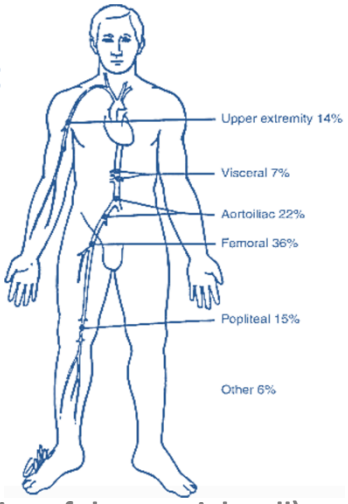


Table 21.2 Embolus vs. thrombosis in situ

Clinical features	Embolus	Thrombosis
Severity	Complete ischaemia (no collaterals)	Incomplete ischaemia (collaterals)
Onset	Seconds or minutes	Hours or days
Limb	Leg 3:1 arm	Leg 10:1 arm
Multiple sites	Up to 15%	Rare
Embolic source	Present (usually AF)	Absent
Previous claudication	Absent	Present
Palpation of artery	Soft; tender	Hard/calcified
Bruits	Absent	Present
Contralateral leg pulses	Present	Absent
Diagnosis	Clinical	Angiography
Management	Embolectomy, warfarin	Medical, bypass, thrombolysis
Prognosis	Loss of life > loss of limb	Loss of limb > loss of life

❖ **Common sites** of embolus lodgment in the Arterial tree:**(Look at the picture)**

Femoral (the most common):**is usually associated with profound ischemia to the level of the upper thigh.**

Presentation Of Acute Limb Ischemia

6 Ps

Pain
Sudden onset of diffuse and poorly localized leg pain

Pulselessnes

Paresthesias
loss of light touch over the dorsum of the foot/hand

Poikilothermia
inability to maintain a constant core temperature independent of surrounding temperature

Pallor

Paralysis
inability to wiggle toes/fingers

6ps are commonly misattributed to **compartment syndrome**.

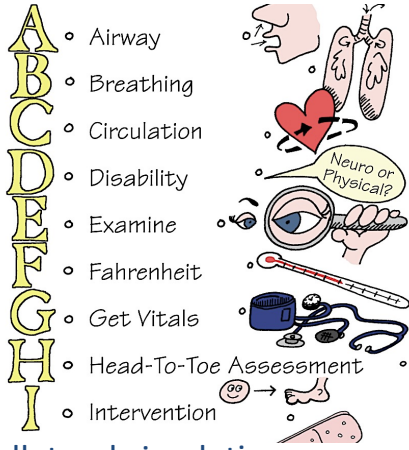
- One more symptom would be the development of **gangrene.**
- Immediate medical attention should be sought with **any** of the symptoms.

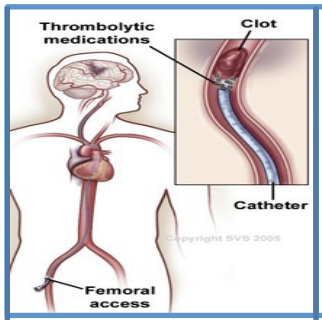
Investigations

- Acute limb ischemia is a **clinical diagnosis** (A **diagnosis** made on the basis of medical signs and symptoms only)
- If time allows, **pre-operative angiography** is often wise (especially if **atherosclerotic thrombus** is suggested)

Management Of Acute Limb Ischemia

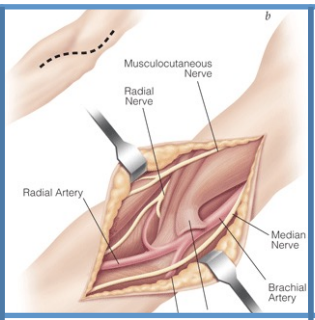
- **Goal Of Management: Rapid restoration of adequate arterial perfusion** without the development of morbid local or systemic complications.
- In Case of **emergency (Which is almost always in this case)**:
  - **Golden time** is **6 hours** after the appearance of symptoms.
  1. **ABC** : most important step (Take a look at the picture)
  2. Give **Heparin** IV (Heparin is given **to** limit propagation of thrombus & protect the collateral circulation. Heparin is **contraindicated** in: **trauma** {especially head injury} & suspected **aortic dissection**)
  3. Rapid surgical thrombo-embol-ectomy:





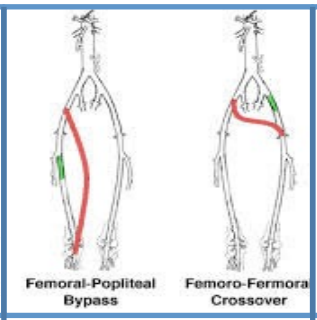
Thrombolytic Therapy

- For **thrombosis in situ**
- Thrombolytic therapy for acute thrombotic occlusion is not done if severe ischemia is present, as it takes time to dissolve clot.



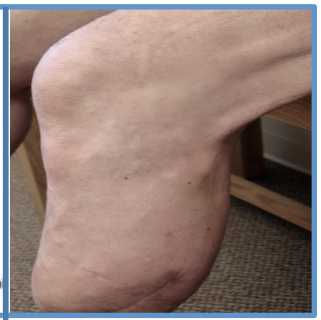
Embolectomy

- In complete Ischemia
- Young patients with Acute embolus of brachial artery



Surgical Bypass

- For thrombosis in situ
- **For Popliteal aneurysm,** as it can undergo thrombosis or act as a source of emboli.



Primary Amputation

Thoracic Outlet Syndrome

- Pressure on the **subclavian artery** from a cervical rib or abnormal soft tissue band may lead to a poststenotic dilatation lined with thrombosis, predisposing to **occlusion or embolization** of the distal circulation
- **Investigations :** duplex scan, MRA.
- **Treatment** : thrombolysis, thrombectomy/embolectomy, excision of the cervical rib and repair (replacement) of the aneurysmal segment.

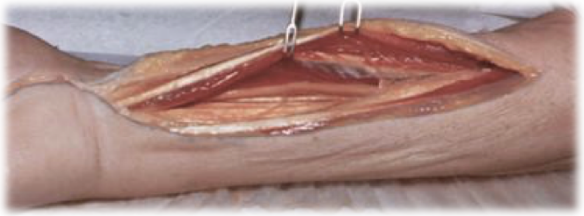
✸Post-ischemic Syndromes

Reperfusion Injury

It is a worrisome complication of revascularization, Effects can be:

★ Local Effect : **Compartment Syndrome:**

- It is a condition where the pressure inside the reperfused artery rises due to edema after the ischemic injury.
- The raise in pressure will stop the blood flow to the area and cause **more severe ischemia**
- Needs emergency **fasciotomy** to relief the pressure (Look at the picture)



★ Systemic Effects :

1- Hyperkalemia: (Endotoxaemia)

- Due to muscle ischemia and breakdown
- **Can lead to: cardiac arrest**
- **Treated and prevented with: Calcium Gluconate**

2- Acidosis: Bicarbonates should be given

3- Myoglobinuria :

- Leads to : **Acute Tubular Necrosis**
- Patient should be given plenty of of fluids

4- Acute Respiratory Distress Syndrome (ARDS).

5- Myocardial Stunning. (Decreased myocardial contractility)

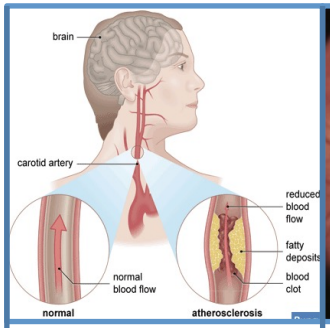
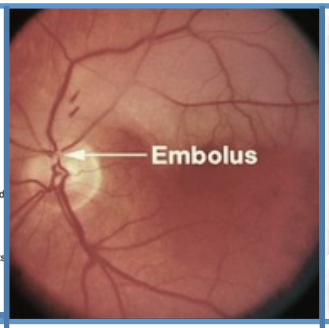
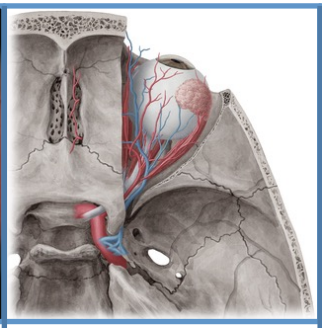
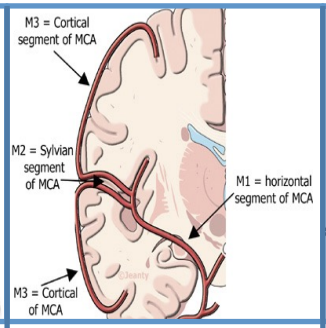
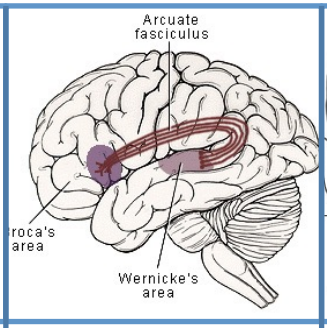
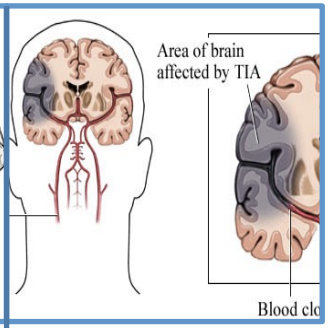
Typical scenario: You are asked to localize a lesion on a patient. You can palpate a femoral pulse but no popliteal or pedal pulses on the right side. Left-sided pulses are present. Think: Localize lesion to the vessel above site where pulse is first lost. The lesion is likely to be in the superficial femoral artery (SFA). Tissue ischemia will extend one joint level distal to segment of artery occluded.

4th : Carotid Artery Disease

- Stroke is the third leading cause of death and a principal cause of long term disability
- Prevention of stroke is **More Important** than its treatment
- The origin of the internal carotid artery is particularly prone to atheroma.
- The higher the degree of stenosis, the more likelihood to cause symptoms.

✸ Clinical Presentation:

- **Asymptomatic.**
- **Symptomatic:** The patient may present with :

					
Ischaemic Stroke	**Amurosis Fugax** • Transient visual loss for less than 24 hours	**Permanent Blindness** • Monocular (one eye) and on the same side (ipsilateral).	**Hemiparesis & Hemisensory Loss** • on the opposite side (contralateral)	**Dysphasia** • Inability to talk • If the dominant hemisphere is affected	**Transient Ischemic Attacks (TIA)** • Loss of motor or sensory function for less than 24 hours

- **Amaurosis fugax** is never synchronously bilateral, as it is almost infinitely improbable that an embolus would enter both retinal arteries at exactly the same time.
- Bilateral, Non-synchronous **Amaurosis Fugax** is possible in patients with bilateral carotid disease.

✸ Diagnosis :

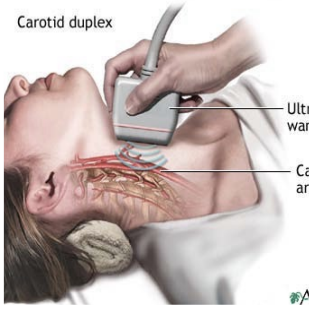
Symptomatic:

1. History
2. Examination
3. **Investigations**

Asymptomatic

1- Carotid Bruit: It is detected by hearing a carotid bruit. That's why It is very important that you screen for a carotid bruit in all patients with risk factors or over 50.

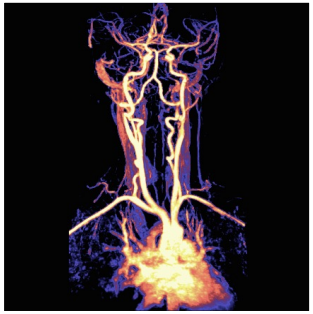
2- Arterial Duplex.



1- Color Flow Doppler (Duplex) Ultrasound (CDU):

- is the **initial investigation of choice** for imaging the carotid arteries
- The stenosis is measured by velocity and not anatomical diameter

2- Magnetic Resonance Angiography (MRA)



✸ Management :

- **Goals Of Treatment:**

1- Prevention of strokes 2- Prolong survival

- **Indications To Intervene:**

✧ **Symptomatic Patients :**

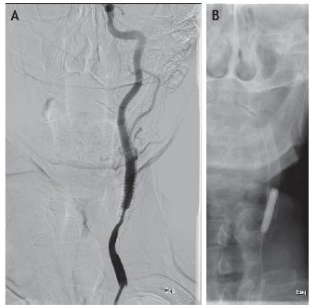
1. **>70% Stenosis:** intervention will decrease stroke in 2 years from 9% to 26%
2. **50-69% Stenosis:** Marginal benefit but greater for male
3. **Recovered ischemic stroke patients**

✧ **Asymptomatic Patients : >60% Stenosis:** decrease stroke at 4 years from 5% to 11%

3- Computed Tomographic Angiography (CTA)

4- Intra-Arterial Digital Subtraction Angiography (IA-DSA)

- is associated with a small risk of TIA/stroke and nowadays is used rarely for diagnostic purposes.

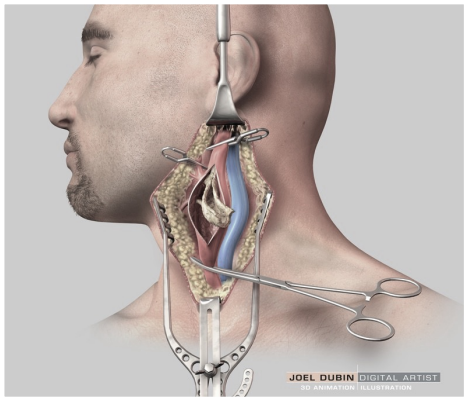


✸ Cont.. Management:

Medical Therapy

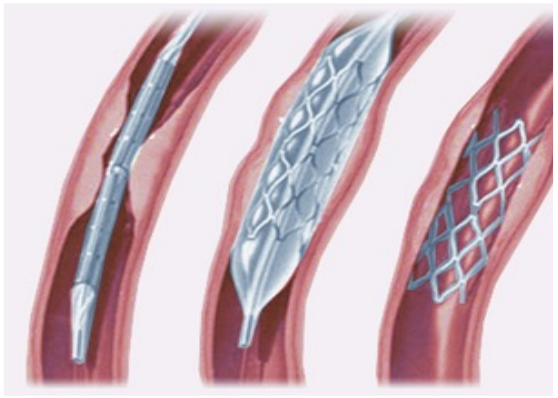
All patients should receive Best Medical Treatment (BMT) (BMT was detailed earlier)

Carotid Endarterectomy (CEA)



- **Best Method** and standard of care.
- **Contraindications:**
- 1- Patients with completed major stroke and little in the way of recovery
- 2- Patients with an occluded internal carotid artery

Carotid Stenting



- Stenting still needs more evidence but it is reserved for certain groups of patients
- The risks of brain injury are greater than with CEA
- **Used : when CEA is not possible** because of : 1-anatomic Factors 2-clinical factors (for example, recurrent stenosis after previous surgery or radiation arteritis)

CEA + BMT= significant reduction in recurrent stroke, compared with BMT alone

5th : Vertebro-Basilar Disease: Vertebro-Basilar Insufficiency (VBI):

✸ **Symptoms**: 1- Cortical blindness (bilateral) (due to occipital ischemia) 2- Vertigo & loss of balance.

✸ **Management :** 1- Response to vascular or endovascular intervention (Because the disease is focal & discrete)

2- Best Medical Therapy (BMT) only (the great majority of patients)

The topic in the upcoming slides were NOT mentioned in the lecture, yet they are required according to Dr. Adnan's objectives

6th : Arterial Disease of The Upper Limb

- Occlusive arterial disease is about 10 times commoner in the leg than in the arm.

✸ Etiology:

The left subclavian artery just proximal to the origin of the vertebral artery is the **most common site** of disease. **This may lead to:**

1- Arm Claudication: This is relatively unusual, because of collateral supply mainly from the vertebral artery.

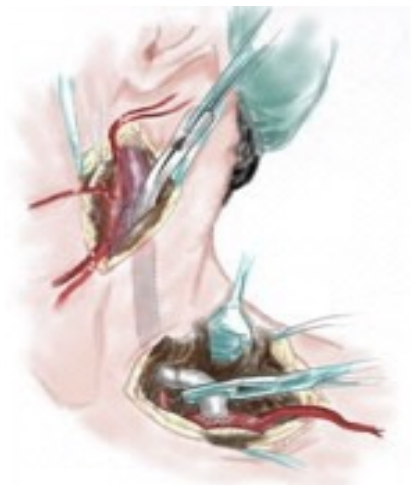
2- Atheroembolism To The Hand : lead to symptoms that are often mistaken for Raynaud's phenomenon, except that in this case the symptoms are unilateral.

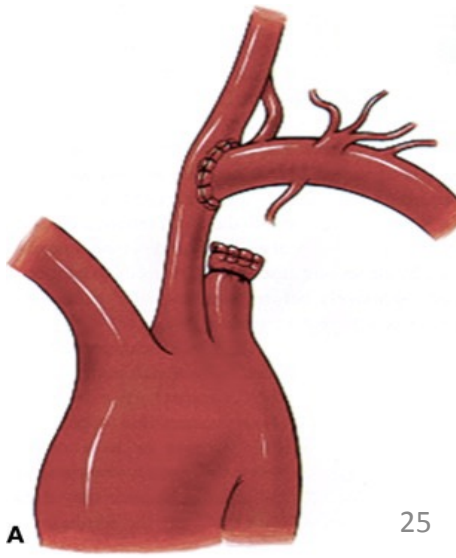
3- Subclavian Steal:

- In this circumstance, when the arm is used, blood is 'stolen' from the brain, with retrograde flow via the vertebral artery.
- This leads to **vertebrobasilar ischemia (VBI)**, characterized by:
  - dizziness
  - cortical blindness
  - collapse when the arm is used

✸ Management:

- **Balloon Angioplasty and Stenting:** (Most cases)
- Carotid–Subclavian Bypass. (See the pictures)





7th : Renal Artery Disease

Renal Artery Stenosis Caused By :	1- Atherosclerosis (the most common)	2- Fibromuscular Hyperplasia (Less common)
Pathophysiology	✧ Under perfusion of the juxtaglomerular apparatus ➔ increase in renin and angiotensin ➔ **hypertension**. ✧ The disease may also lead to ischemic necrosis of the renal parenchyma ➔ progressive renal failure.	• It may cause hypertension, but rarely renal failure. • mostly affects **young and middle-aged women**
Treatment	• **Medically** (In most cases) • **Surgically :Primary Stenting** (Although the evidence for benefit is weak) in selected patients to: ✓ control hypertension that is refractory to medical therapy ✓ preserve renal function.	**BAP** (Balloon Angioplasty)
Complications	acute arterial occlusion, embolization and rupture	

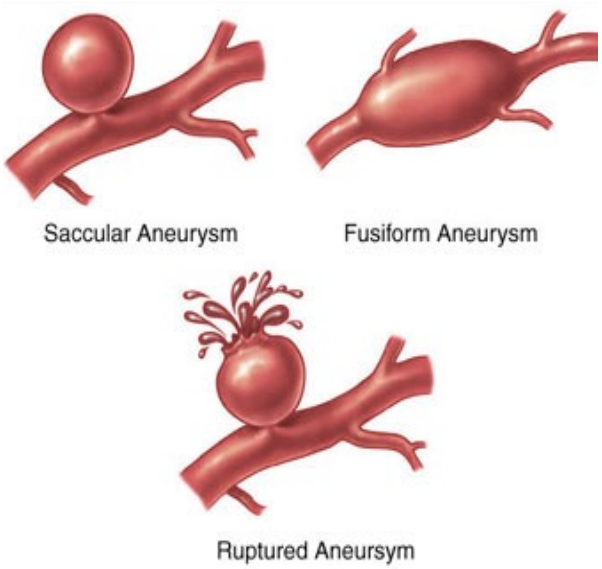
8th : Mesenteric Artery Disease

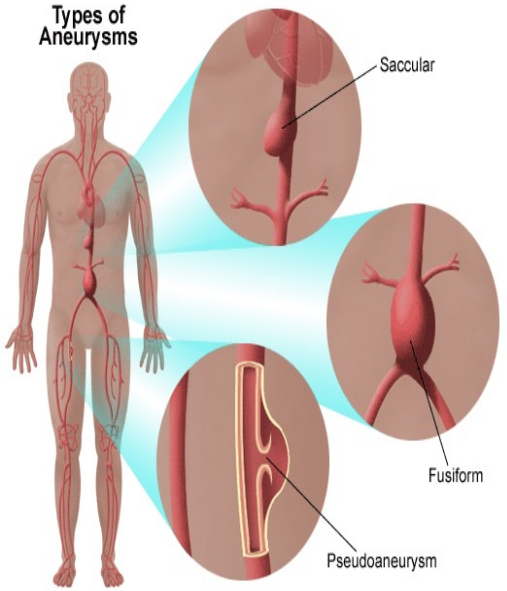
		✧ Acute Mesenteric Ischemia
Cause	critical stenosis of 2 of the 3 visceral vessels (coeliac axis, superior and inferior mesenteric arteries)	occlusion of the **Superior Mesenteric Artery** (SMA) by embolus or acute thrombosis.
Symptoms	**1- Mesenteric Angina** : severe central abdominal pain **2- Diarrhea** (15–30 minutes after eating). **3- Significant Weight Loss** (Caused by Food avoidance and intolerance)	**1- Excruciating abdominal pain** (sudden onset) 2- collapse **3- peritonitis** 4- bloody diarrhea
Treatment	**1- Surgery** (Risky, but excellent result) **2- BAP & Stenting:** increasingly used, particularly in patients with: high operative risk and in those who have limited life expectancy.	**1- SMA Embolectomy** (embolus) **2- SMA Bypass** (thrombosis) **3- Laparotomy:resection of non-viable bowel.**

9th : Aneurysmal Disease

Aneurysm is abnormal focal dilation of endothelial lined vascular structure
(the arterial aneurysms are the most common one)

- **Site :** the most common site which requires treatment is the **infrarenal abdominal aorta**
- **Etiology:**
  - **1- Atherosclerotic:** share same risk factors of atherosclerosis and may coexist in the same time
  - **2- Mycotic (fungal):** Treponema pallidum **syphilis** ,salmonella
- **True and False Aneurysms:**
  - **1- True** : all three layers of the arterial wall enclose a true aneurysm which may be fusiform or saccular
  - **2- False (Pseudo Aneurysm)** : when the wall of the artery is damaged the resulting surrounding hematoma can remain in continuity with lumen leading to pulsatile swelling whose wall comprises compacted thrombus and surrounding connective tissue





1- Abdominal Aortic Aneurysm (AAA)

General information

- Present in up to 5% of men aged over 70 years
- 2-3 times **commoner in men** than women of the same age
- 70% of cases only the **infrarenal** segment s involved

Investigation

1- Ultrasound: is the best way to estimate the **size**

2-CT Angiography: will provide much more accurate information about the size and extent of aneurysm, surrounding structures. **It is the standard pre-intervention investigation**

Classification

1- Asymptomatic AAA (60%):

May be detected **incidentally** and once it's small (0.5 and <5cm) in size.

2-Symptomatic AAA (10%):

- **Should be considered for repair** (because pain often predates rupture)
- **Distal embolization is definitive indication for repair** even if it's small, as limb loss is common if it's left untreated.

3- Ruptured AAA (30%):

The most common emergency presentation and if the patient survives, it's due to the following reasons:

- The rupture usually **retroperitoneum** which restrict the extent of the leak
- **Intense vasoconstriction** of non essential circulation beds
- **Drops BP** which limit the blood loss
- Patient develops intensely **pro-thrombotic state**

Management

- Best way is to follow up the patient is by repeated ultrasound .
- When it reaches **5.5cm** the patient is fit to surgery

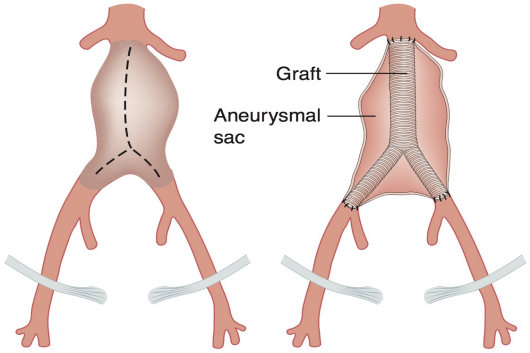
Surgery :

1- Open Repair (See picture #1)

2- Endovascular Aneurysmal Repair (EVAR) (See picture #2)

The **only way** of saving the patient is to either **clamp and graft the aorta** or **insert a stent graft (EVAR)** (if necessary having controlled the bleeding **through BAP** of the thoracic aorta).

1



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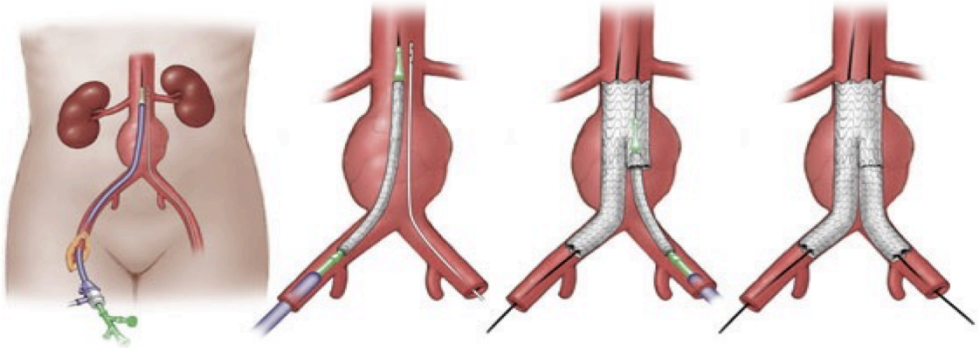
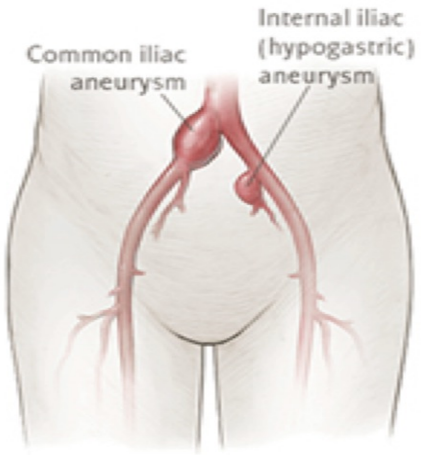
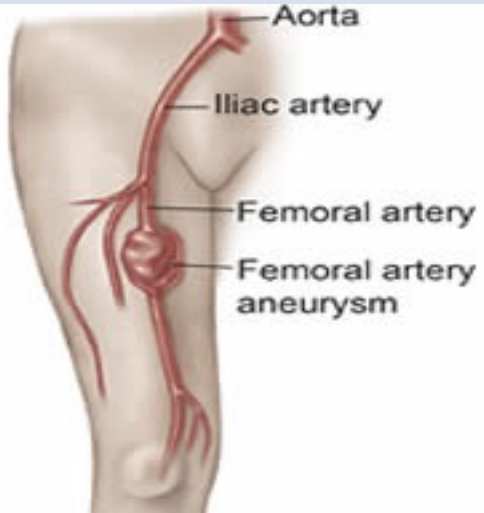
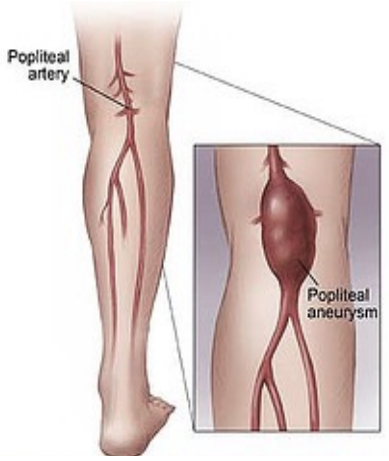


2- Peripheral Aneurysms

	A) Iliac Aneurysms	B) Femoral Aneurysms	C) Popliteal Aneurysms
Classification	20% of patients, AAA extend into common iliac or internal iliac and pulsatile mass felt below the level of umbilicus	10% of patients with AAA **1-Three main types:** • Iatrogenic fales aneurysm • Nonspecific aneurysm • Anastomotic aneurysm (**in patient who undergone bypass grafting**) **2- Rupture:** is less common	★ If patient presents with this type ,there is 50%t that he has AAA •**The main complications are:** distal embolization and acute thrombosis •Rupture is rare put it can compress the popliteal vein and present as DVT
Treatment	Most often treated in the course of AAA repair	**Surgical Repair :** If : **1- It's large >3cm** **2- the patient is symptomatic**	• **Exclusion of aneurysm and bypass** (best treatment) ★ **-/+ thrombolysis** (if patient present with acute ischemia due to thrombosis)
Pictures			

10th: Buerger's Disease "Thromboangitis Obliterans"

Definition

Buerger's Disease: It is a non-atherosclerotic, idiopathic, recurrent, segmental, inflammatory, vasculopathy of **medium and small sized** arteries and veins of the upper and lower extremities **(peripheral arteries)** that is quite distinct from atherosclerosis.

✧The condition is known as "**Thromboangitis obliterans"** if there is involvement of the neighboring vein and nerve.

Clinical Features & Investigations

- **Common in people from:** Asia, India, North Africa and **the Middle East**.
- **Usually present in :**
  - ✓ **Young (20 - 40 Years old)**
  - ✓ **Male**
  - ✓ **Smokers** (most important one)
- **Patients Present with :**
  1. **Claudication In The Feet** (Such pain is often **misdiagnosed** as musculoskeletal in nature)
  2. **Rest Pain in the Fingers or Toes** (which is often misdiagnosed as **primary Raynaud's phenomenon**)
  3. **Superficial Thrombophlebitis** (Because the condition also affects the veins)

⚛ **On Examination :** Wrist and ankle pulses are usually absent, but brachial and popliteal pulses are palpable

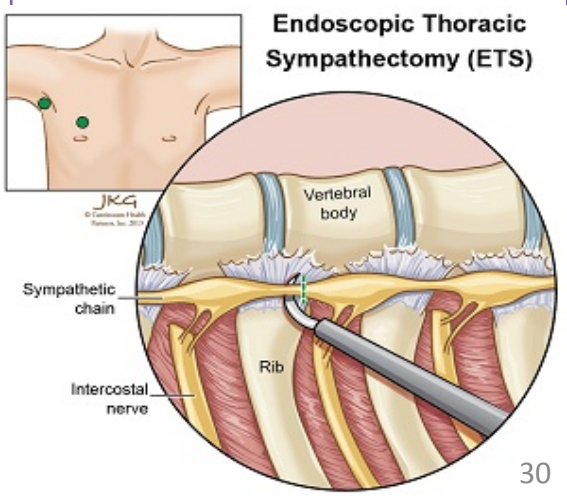
✸ **Investigations: Arteriography:** shows narrowing or occlusion of arteries below the diseased segment, but relatively healthy vessels above that level.

Management

★ **The condition often remits if the patient stops smoking.**

- **The condition could be managed by :**

1. **Sympathectomy.**
2. **Prostaglandin Infusions.**
3. **Amputation:** if required, it can often be limited to the digits at first. But, if the patient **continues to smoke**, then **bilateral below-knee amputation** is done.



11th: Raynaud's Phenomenon

Raynaud's phenomenon describes digital pallor due to vasospasm of the digital arteries, followed by cyanosis owing to the presence of deoxygenated blood, then rubor due to reactive hyperemia upon restoration of flow, in response to cold and emotional stimuli.

Primary Raynaud's Phenomenon

- **Most common in:**
  - ✓ women in temperate climates.
  - ✓ Usually, with a family history.
  - ✓ Appear between the age of 15 and 30.
- It is due to reversible spasm of digital arteries
- The underlying cause is unclear
- **It does not progress to ulceration or infarction.**
- No investigation is necessary.

★ **Management :**

1. **avoid exposure to cold**.
2. Treated in the first instance with **Nifedipine** (a calcium channel blocker).

Secondary Raynaud's Phenomenon

- Tends to occur in **older** people in association with:

1- Connective Tissue Disease: most commonly **systemic sclerosis**

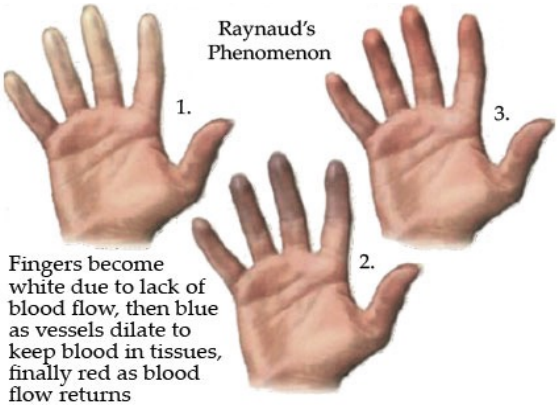
2- Vibration-induced Injury: from the use of power tools

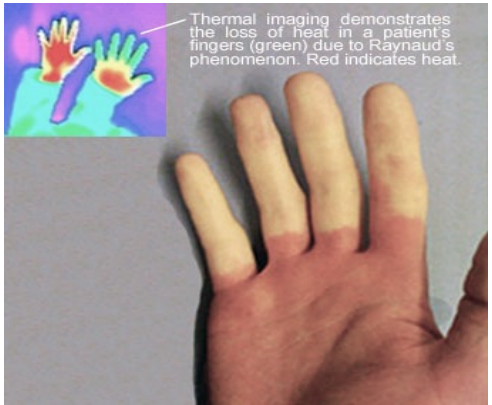
3- Atherosclerosis, most commonly secondary to **thoracic outlet obstruction** from the cervical rib.

- Sometimes, It is fixed obstruction of the digital arteries.
- **Fingertip ulceration and necrosis are often present.**

★ **Management :**

1-protected fingers from cold and trauma.
2-If infection present, give antibiotics.
3- surgery is avoided if possible.
4- Cervico-Thoracic Sympathectomy: helps for a year or two.
5- Prostacyclin infusions: are sometimes beneficial





※ Summery :

- **Atherosclerosis** is an inflammatory process of progressive thickening and hardening due to intimal fat deposit following a *physical* or *chemical* injury.
- Clinical Feature Of atherosclerosis depends on its site
- If the plaque occurs in the peripheral circulation **(PAD)** it leads to a reduced blood follow to the part distal to it, and represented by *two clinical features*.
  A-Intermittent claudication (Pain following **walking a particular distance**)
  B-Critical limb ischemia (**Rest pain**, relieved by hanging the limb out of bed)
- **PAD** is diagnosed by history, Physical examination and ABI, Arterial Duplex and other radiological tools.
- Management is very important in relieving symptoms and **increasing the survival rate** and to **prevent consequent gangrene**, otherwise *amputation* is mandatory.
- Another condition is **Acute limb ischemia**; is an emergency when the artery of the limb is occluded by an embolus (usually cardiac in origin), leading to the 6Ps:
  Pain – Paralysis – Paresthesia – Pulslessness – Poikilothermic – Pallor
- Rapid restoration of adequate arterial perfusion should be performed by **IV Heparin** or surgical removal of the embolus *if heparin is contraindicated*.
- When a plaque is formed in the internal carotid artery, it can progress end up with **Carotid artery disease**, mostly **asymptomatic**. However it can affect any brain center causing related symptoms (e.g. **Amurosis Fugax**).
- When the diagnosis was made, patient should be managed by either **medical therapy, carotid endarterectomy or carotid stenting.**

Thank You..

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