

PERIPHERAL ARTERIAL DISEASES(PAD)

INTRODUCTION



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Must To Know Core Clinical Problems

- 1.Acute RLQ pain
- 2.Acute RUQ pain
- 3.Acute epigastric pain
- 4.Acute LLQ pain
- 5.Dysphagia
- 6.Abdominal lumps
- 7.Upper GI hemorrhage
- 8.Lower GI hemorrhage
- 9.Obstructive Jaundice
- 10.Breast lumps, Mastalgia & Nipple discharge
- 11.Neck swellings- Thyroid & Non thyroidal
- 12.Groin swellings
- 13.Scrotal swellings
- 14.Limb ischemia- Acute & Chronic
- 15.Varicose veins
- 16.Renal & ureteric colic
- 17.Hematuria
- 18.Acute retention of urine

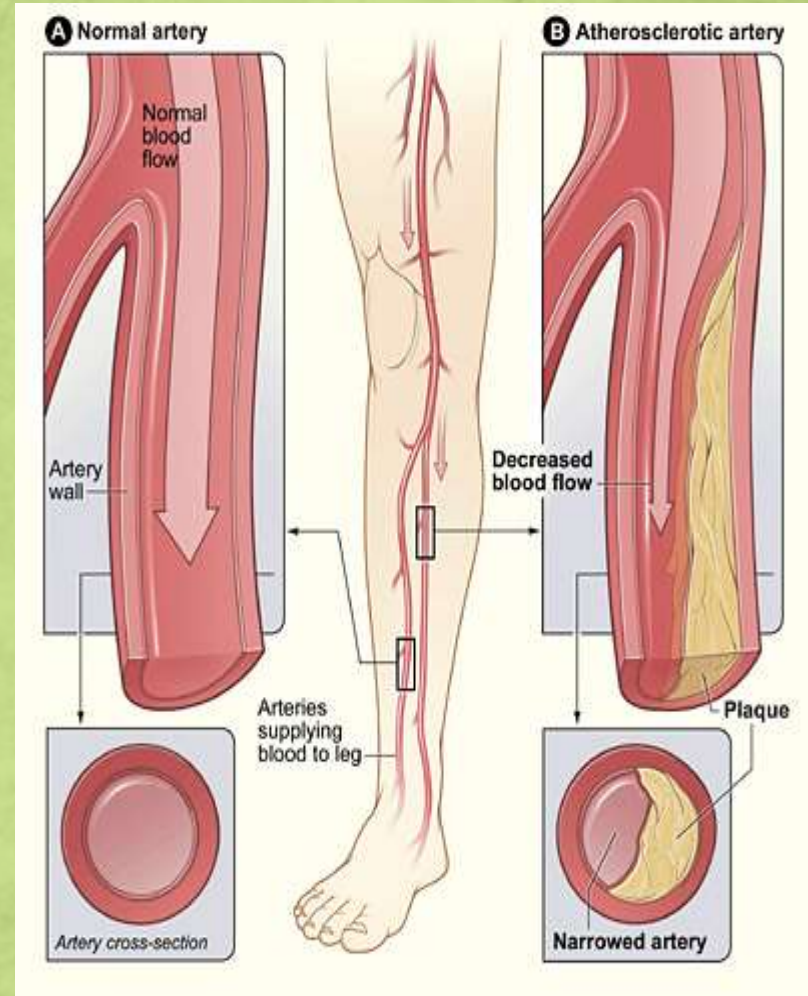
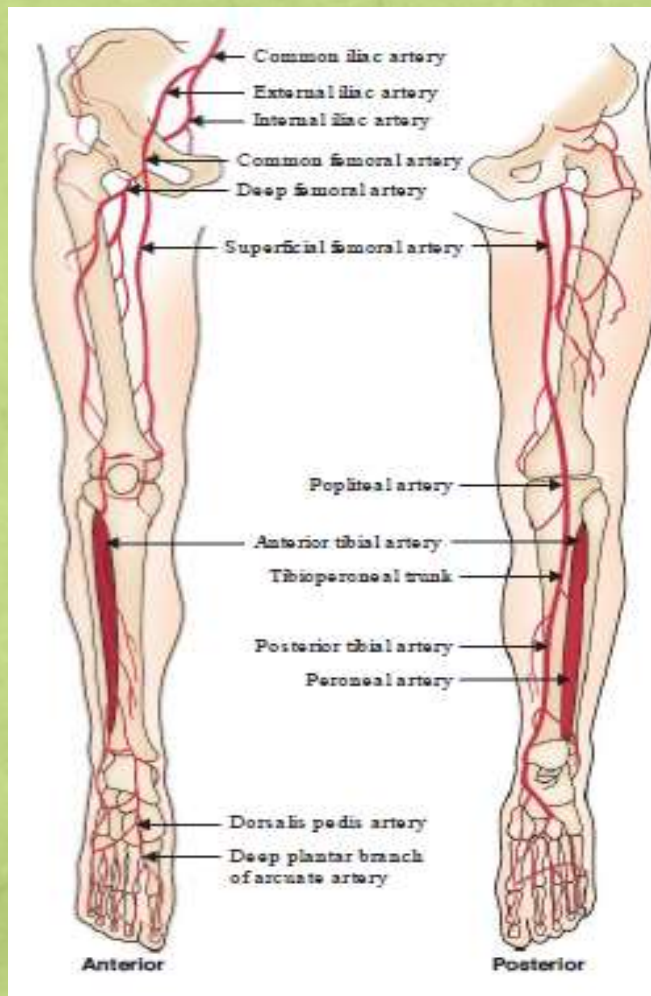
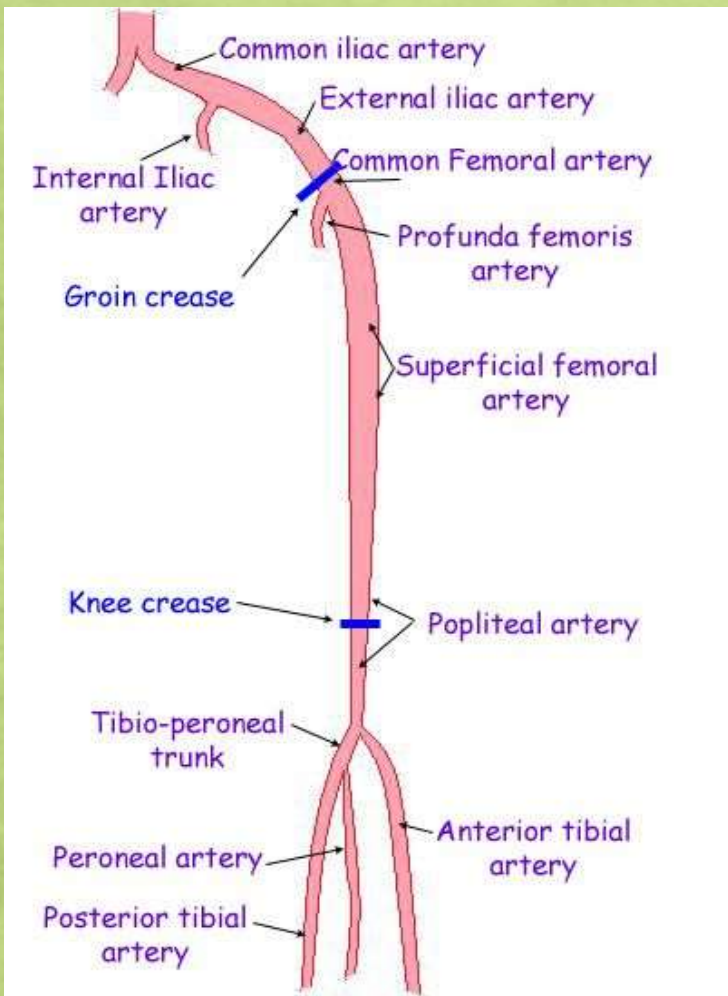
Peripheral Arterial Diseases(PAD)

- ✓ Chronic lower limb ischemia
- ✓ Acute lower limb ischemia
- ✓ Upper limb ischemia

Peripheral Arterial Diseases(PAD)

- ✓ Surgical Anatomy
- ✓ Pathophysiology
- ✓ History/ Symptoms
- ✓ Physical Examinations/ Signs
- ✓ Investigations
- ✓ Diagnostic Algorithm

ANATOMY



Peripheral Arterial Diseases(PAD)

Can present as

Onset and progression:

- ✓ **Acute ischemia:** A sudden onset of severe pain, paraesthesia and paralysis in a previously asymptomatic patient suggests an acute embolic event → symptomatic from few hours to < 15 days
- ✓ **Chronic Ischemia:** A long history of reduced walking distance with claudication pain is suggestive of atherosclerotic disease → symptomatic for >15 days
- ✓ **Acute on Chronic Ischemia:** A sudden worsening of symptoms in a patient who has a long history of claudication may suggest thrombosis of a critically stenosed vessel

Peripheral Arterial Diseases(PAD)

Pathophysiology

Chronic lower limb ischemia:

- ✓ Mainly due to Atherosclerosis and TAO
- ✓ Slow progressive occlusion, so enough time for collateral vessels formation. Symptoms occur from few days to >15 days
- ✓ Disparity between the demand and supply of O₂ → Anaerobic metabolism
- ✓ Progressively develops Intermittent claudication, Rest pain, Ischemic ulcers and gangrene

Acute lower limb ischemia:

- ✓ Mainly due to Embolus or thrombosis from an artery
- ✓ Sudden occlusion, so no time for collaterals
- ✓ Symptoms occur from few hours to <15 days
- ✓ Mottling of skin
- ✓ Sensorymotor loss
- ✓ Sudden gangrene

Peripheral Arterial Diseases(PAD)

History/Symptoms

Chronic lower limb ischemia:

- ✓ Presents with **intermittent claudication** – the development of pain in the muscles of the thigh or calf that is induced by exercise.
- ✓ The pain invariably starts after walking a particular distance and is relieved by rest → **Claudication distance**
- ✓ If the disease progresses, **rest pain** develops. This is often initially relieved by hanging the leg out of bed.

Acute lower limb ischemia:

- ✓ Acute arterial occlusion causes a sudden onset of limb pain, often associated with loss of function and altered sensation.
- ✓ Pain- unrelenting & severe
- ✓ Pallor
- ✓ Paresthesia
- ✓ Paralysis
- ✓ Pulseless
- ✓ Poikilothermia

Peripheral Arterial Diseases(PAD)

Physical Exam/Signs

Chronic lower limb ischemia:

- ✓ Pale and cool limb
- ✓ Loss of hair & brittle nails
- ✓ Weak or absent peripheral pulses.
- ✓ Blistering of skin and ulceration
- ✓ Frank dry gangrene
- ✓ Guttering of veins
- ✓ Burger's angle of Vascular insufficiency:
 - The normal limb can be raised to 90° without loss of colour, but an ischaemic limb will blanch on raising the limb above horizontal.
 - The angle at which this occurs is called Buerger's angle. If it is less than 20° indicates severe ischaemia
- ✓ Dependent rubor

Acute lower limb ischemia:

- ✓ Pain- unrelenting & severe
- ✓ Pallor
- ✓ Paresthesia
- ✓ Paralysis
- ✓ Pulseless
- ✓ Poikilothermia
- ✓ Mottling of skin- dusky purple colour

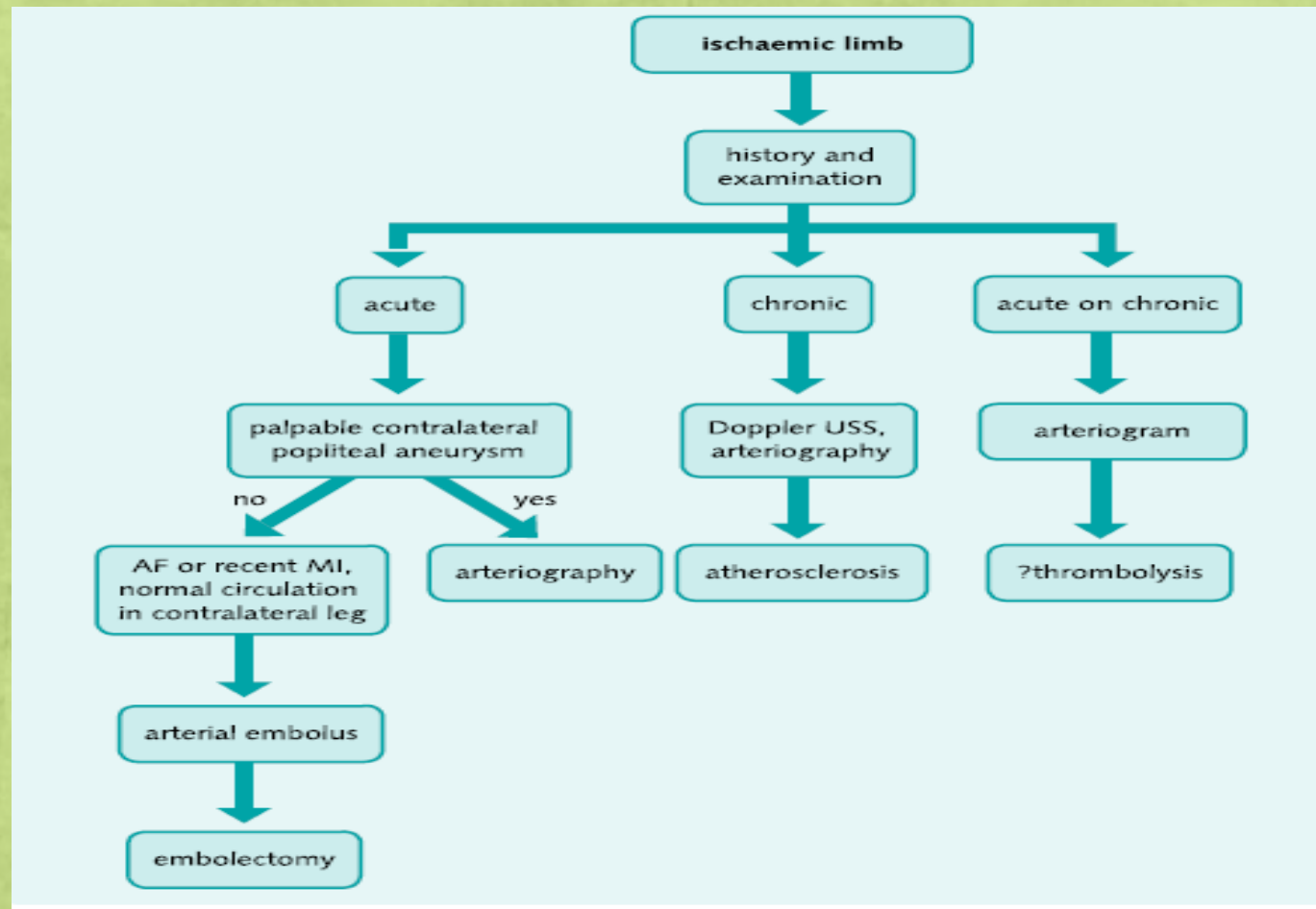
Peripheral Arterial Diseases(PAD)

INVESTIGATIONS

- ✓ Ankle-Brachial pressure index- ABPI
- ✓ Arterial duplex scan
- ✓ Digital Subtraction Angiogram- DSA
- ✓ CT Angiogram/MR Angiogram

Peripheral Arterial Diseases(PAD)

Diagnostic Algorithm



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PERIPHERAL ARTERIAL DISEASES (PAD)

Chronic Limb Ischemia- CLI



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Chronic Limb Ischemia- CLI

- ✓ Epidemiology
- ✓ Etiopathogenesis
- ✓ Symptoms
- ✓ Signs
- ✓ Investigations
- ✓ Differential diagnosis
- ✓ Treatment
- ✓ Mindmap
- ✓ Treatment Algorithm

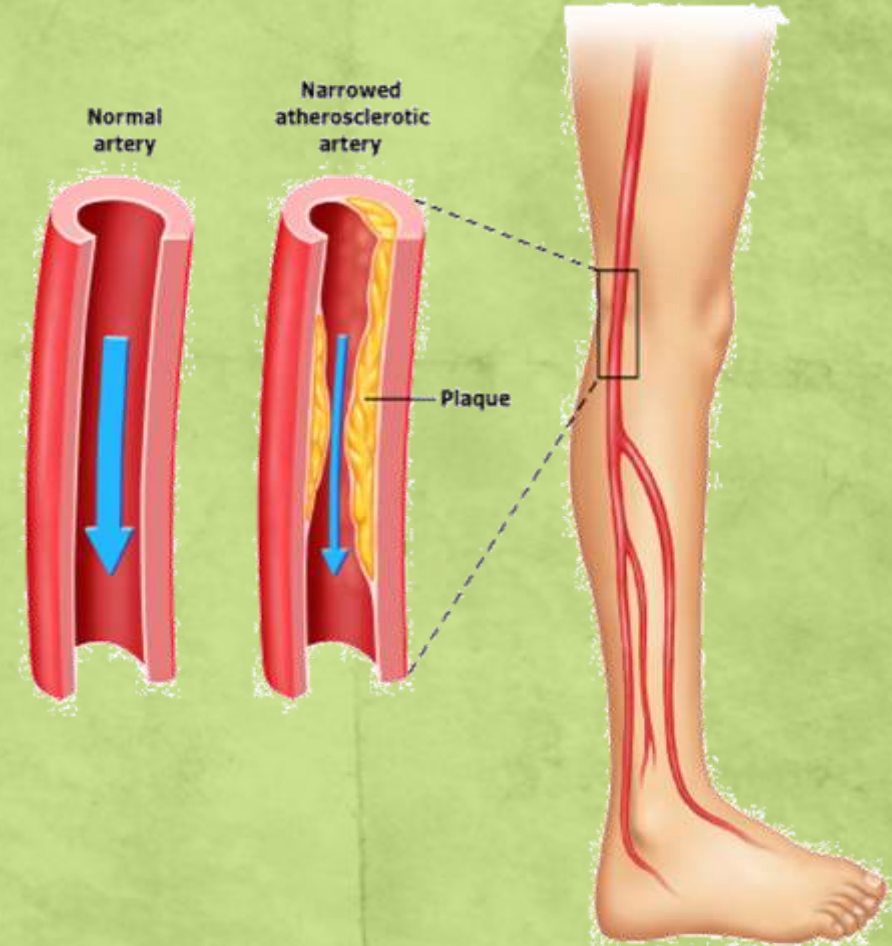
Chronic Limb Ischemia- CLI

EPIDEMIOLOGY

- ✓ About 5% of men over the age of 50 years have intermittent claudication.
- ✓ However, only 5% of patients with intermittent claudication progress to critical limb ischaemia each year.
- ✓ Intermittent claudication is leg pain that is induced by exercise but relieved by rest → Life-Style limiting ischemia
- ✓ Critical limb ischaemia is defined as persistent ischaemic rest pain requiring regular analgesia. It is almost invariably associated with ulceration or gangrene of the foot or toes → Limb threatening ischemia

CLI - ETIOPATHOGENESIS

- ✓ PAD- is occlusive disease of the arteries of the lower extremity.
- ✓ Atherosclerosis and TAO are common causes
- ✓ Arterial narrowing → Decreased blood flow
- ✓ During exercise there is disparity between the demand and supply for O₂ → Anaerobic metabolism → Lactic acid and P substance
- ✓ Site of the pain depends on the level of obstruction
- ✓ Risk factors : diabetes mellitus (DM), tobacco use, hypertension (HTN), and hyperlipidemia



CLI - SYMPTOMS

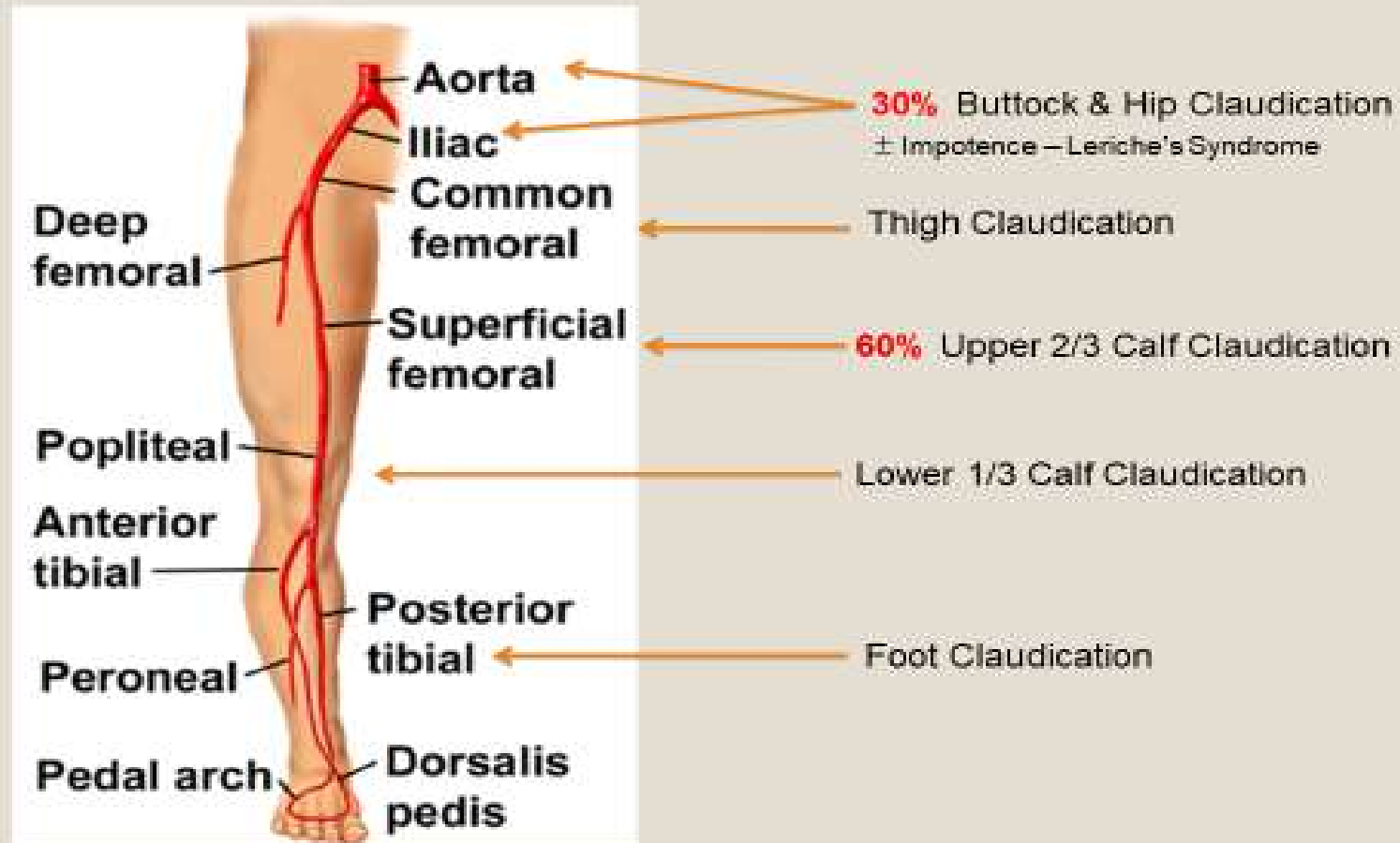
✓ Intermittent Claudication:

- Derived from the Latin word 'to limp'
- “Reproducible pain on exercise which is relieved by rest”
- Claudication distance
- The location of pain depends on the level of obstruction in the vessels
- Buttock and hip pain → Aorto-iliac disease
- Thigh pain → common femoral artery or Aorto-iliac disease
- Calf pain → superficial femoral or popliteal artery disease
- Foot pain → tibial or peroneal artery disease

✓ Critical Limb Ischemia

- The rest pain that characterises critical limb ischaemia occurs or is worsened when the foot is elevated (e.g. in bed) and is improved with the foot dependent → Cry of dying nerve
- It is almost invariably associated with foot ulceration or gangrene

CLI - SYMPTOMS



CLI - SIGNS

- ✓ Physical examination is important in assessing the presence and severity of arterial occlusion.
- ✓ **Arterial palpation** → Decreased amplitude of the pulse denotes proximal obstructions to flow. Peripheral pulses are often present in patients with intermittent claudication but are invariably absent in patients with critical limb ischaemia.
- ✓ **Bruits and thrills** → when a bruit is heard over a peripheral artery, stenosis is present at or proximal to that level
- ✓ **Response to exercise** → exercise will produce decreased pulse strength, decreased distal arterial pressure, and possibly an audible bruit unmasking a significant stenosis.
- ✓ **Integumentary changes** → Loss of hair, brittle nail & muscle atrophy
- ✓ **Skin temperature** → With chronic ischemia, the temperature of the skin of the lower limb decreases

CLI - SIGNS

- ✓ **Burger's angle of vascular insufficiency** → Pallor of the foot on elevation of the extremity to approximately 40 cm with a complete absence of capillary refill indicates advanced ischemia.
- ✓ **Dependent Rubor** → In advanced atherosclerotic disease, the skin of the foot displays a characteristic dark red/cyanotic color on dependency.
- ✓ **Ulceration & Gangrene** → Ischemic ulceration at tip of toes; Dry gangrene
- ✓ **Lerich's Syndrome**: Impotency in male Patients having Aorto-iliac atheroma



PALLOR

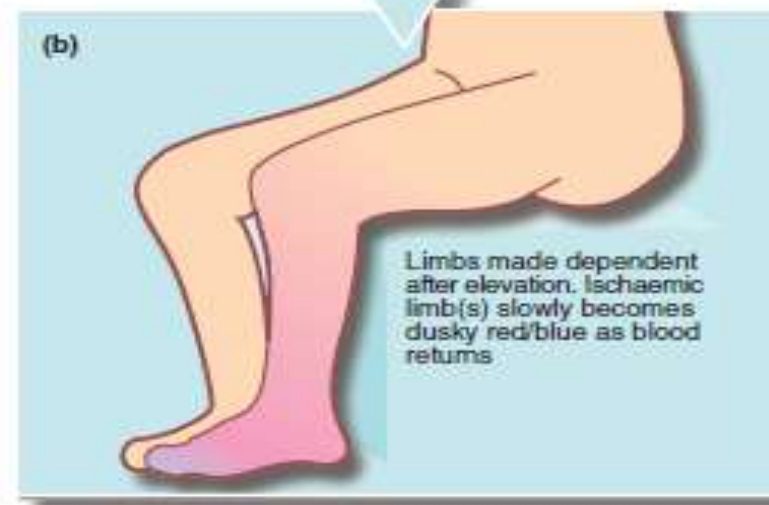
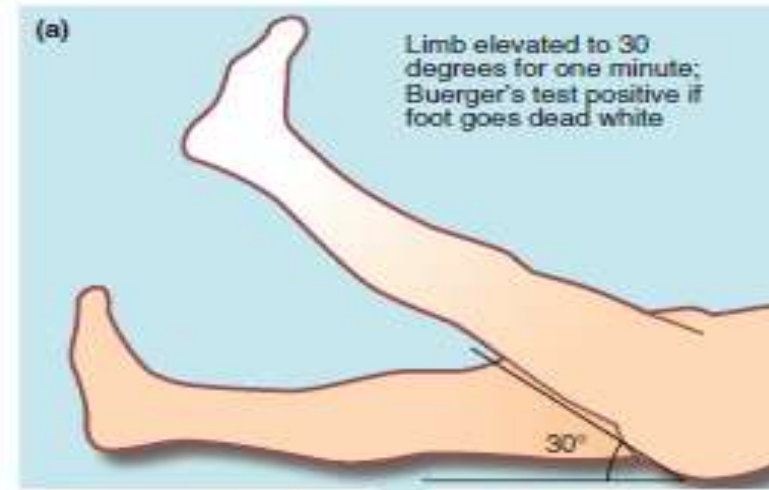


RUBOR

CLI - SIGNS

Burger's angle of vascular insufficiency →

Dependent Rubor →



CLI - SIGNS

Classification of Chronic Limb Ischemia

Rutherford Category	Characteristic
0	Asymptomatic
1	Mild claudication
2	Moderate claudication
3	Severe claudication
4	Pain at rest
5	Minor tissue loss (ischemic ulcer)
6	Major tissue loss (gangrene)

Figure 1: Rutherford classification of chronic limb ischemia

Boyd's classification of claudication

- ❖ Grade I: Patient complains of pain after walking, and distance in which pain develops is called as 'claudication distance'. If patient continues to walk, due to increased blood flow in muscle and opening of collaterals metabolites causing pain are washed away and pain subsides
- ❖ Grade II: Pain still persists on continuing walk; but can walk with effort
- ❖ Grade III: Patient has to take rest to relieve the pain

CLI - SIGNS



CLI - SIGNS

Physical Examination:

Examination:	What do to:
Inspection Expose the skin and look for:	<ul style="list-style-type: none">• Thin Shiny Skin• Hair Loss• Brittle Nails• <u>Colour Changes</u> (pallor)• Ulcers• Muscle Wasting
Palpation	<ul style="list-style-type: none">• Temperature (cool, bilateral/unilateral)• Pulses: ?Regular, ?AAA• Capillary Refill• Sensation/Movement
Auscultation	<ul style="list-style-type: none">• Femoral Bruits
Ankle Brachial Index (ABI)	= <u>Systolic BP in ankle</u> Systolic BP in brachial artery
Buerger's Test	<ul style="list-style-type: none">• Elevate the leg to 45° - and look for pallor• Place the leg in a dependent position 90° & look for a red flushed foot before returning to normal• Pallor at <20° = severe PAD.

CLI - Investigations

- ✓ **Ankle-Brachial Pressure Index(ABPI):**
- ✓ The ankle–brachial pressure index (ABPI) is the ratio of systolic pressure at the ankle to that in the arm.
- ✓ Resting ABPI is normally about 1.0; values below 0.9 indicate some degree of arterial obstruction(claudication)
- ✓ Less than 0.5 suggests rest pain and less than 0.3 indicates imminent necrosis



CLI - Investigations

✓ Ankle-Brachial Pressure Index(ABPI):

Fontaine's classification of Limb Ischemia

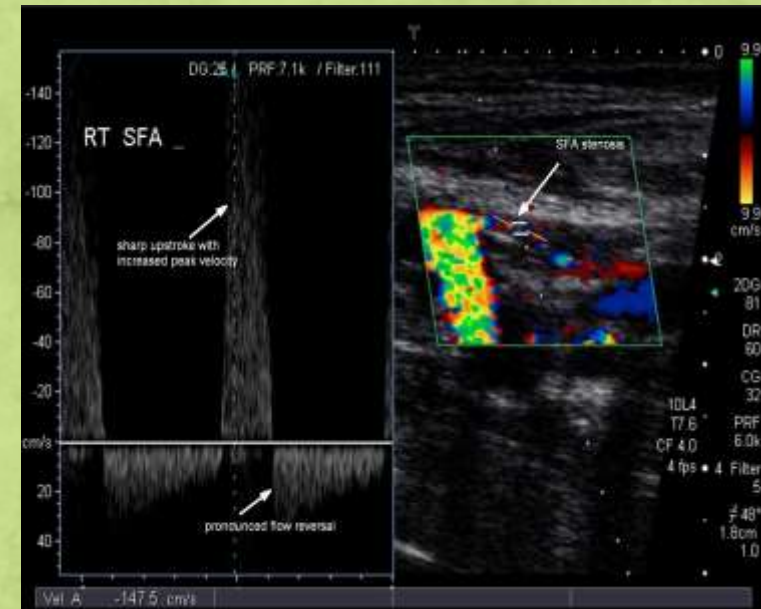
ABI	Clinical Correlation
>0.9	Normal Limb
0.5-0.9	Intermittent Claudication
<0.4	Rest Pain
<0.15	Gangrene

CAUTION:

Patient's with Diabetes + Renal Failure:
They have calcified arterial walls which can falsely elevate their ABI.

CLI - Investigations

- ✓ Duplex Scan:
- ✓ Gold standard investigation
- ✓ Hybrid instrument → Doppler + B mode Ultrasound technology
- ✓ Different colours indicate changes in direction and velocity of flow with areas of high flow usually indicating a stenosis.
- ✓ Can find out the site and extent of obstruction
- ✓ Duplex Ultrasound → normal is triphasic → biphasic → monophasic → Absent



CLI - Investigations

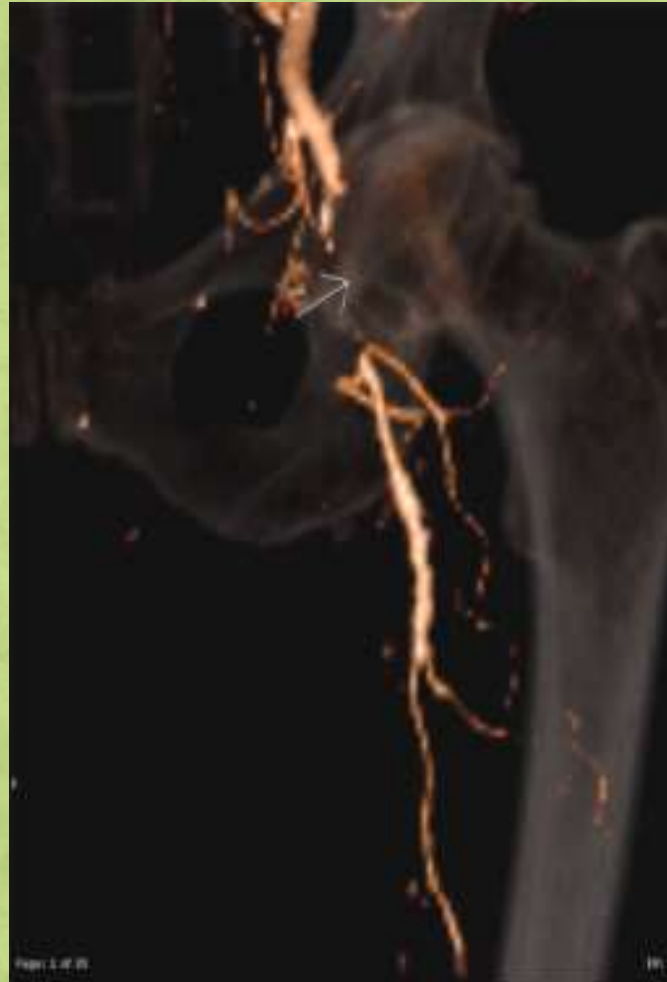
✓ Digital Subtraction Angiogram(DSA):

- ✓ Should be done if planning for surgery → Roadmap for surgery
- ✓ Regular angiogram – with bone and soft tissue subtraction
- ✓ Look for site and extend of obstruction
- ✓ Adequate proximal run-in, collaterals and distal run-off must for surgical intervention



CLI - Investigations

- ✓ **CT & MR Angiogram:**
- ✓ CT angiography and magnetic resonance (MR) angiography are new techniques gaining in popularity
- ✓ They can be useful where duplex scanning is not possible
- ✓ MR has the added advantage of avoiding the need for ionising radiation



CLI – Differential Diagnosis

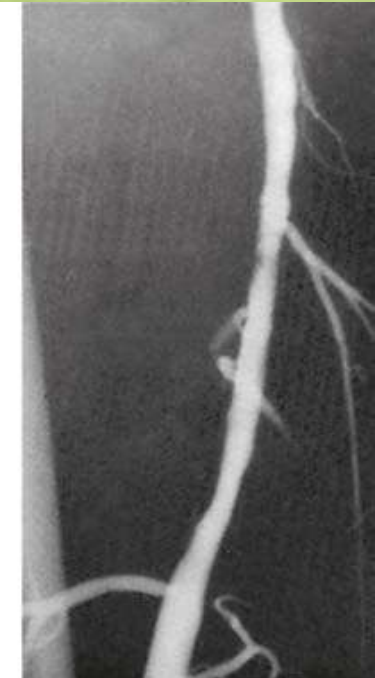
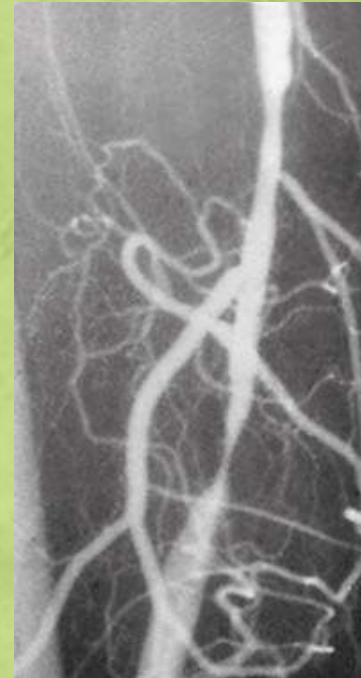
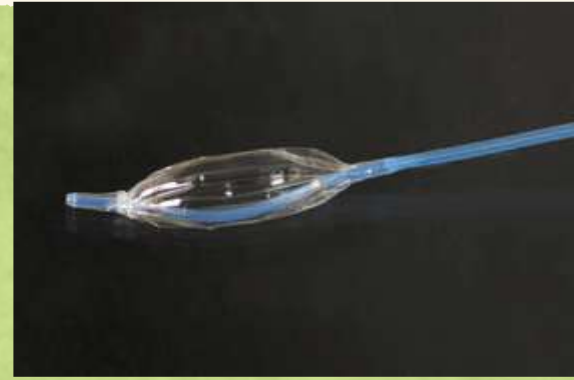
- ✓ **Venous claudication:** Because of DVT. Pain is aggravated by brisk walking which results in reversal of blood flow to the superficial veins. This pain is relieved with rest and limb elevation.
- ✓ **Diabetic Neuropathy:** Because of Peripheral Neuropathy. Pain and paraesthesia over gloves and stockings area and perceived as pins and needles. Unlike arterial claudication not relieved by rest or by lowering the limb
- ✓ **Inter-vertebral disc prolapse:** Pain is because of compression of the nerve roots at vertebral level. Pain radiates in the corresponding nerve root dermatome to the leg. Pain is not aggravated by walking and not relieved by rest
- ✓ **Spinal stenosis:** Pain is because of compression of both spinal cord and its nerve roots. Pain is not aggravated by walking and not relieved by rest.
- ✓ **Osteo-Arthritis:** Pain because of degeneration of cartilage in joints. Presence of pain from the first step onwards and no relationship with walking.

CLI – Treatment

- ✓ Intermittent claudication:
 - Life-style modification: Stop smoking, start supervised exercise, control DM, HTN and Hyperlipidemia
 - Pharmacological Treatment: Pentoxifylline 400 mgm bd or Cilostazol: A phosphodiesterase III inhibitor, both increase claudication distance
- ✓ Critical Limb Ischemia: → Revascularisation Surgery
 - Localised Atheroma: Percutaneous Trans Luminal Angioplasty (PTLA)
 - Extensive Atheroma: By-pass surgeries like Ilio-femoral, Femoro-popliteal or Femoro-tibial By-pass surgeries
- ✓ Frank Gangrene:
 - Different varieties of amputations depending on level of gangrene like Ray amputation for toe gangrene, Trans-metatarsal amputation, Syme's amputation, Below knee amputation Etc

CLI – Treatment- PTLA

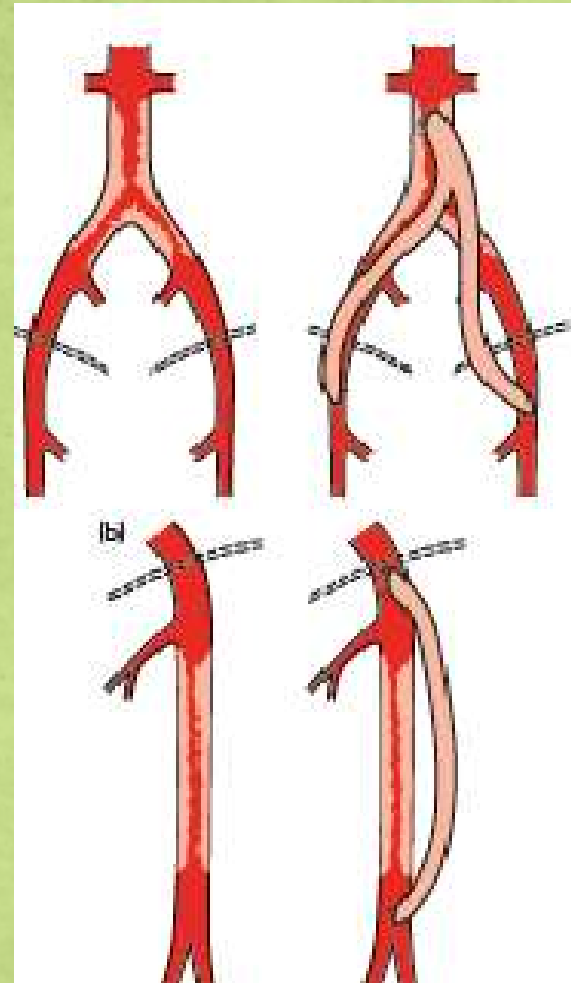
- ✓ Percutaneous Trans Luminal Angioplasty- PTLA:
- ✓ An empty, collapsed balloon on a guidewire is passed into the narrowed segment and inflated to a fixed size using water pressures around 75–500 times normal blood pressure.
- ✓ The balloon crushes the fatty deposits, opening up the blood vessel. The balloon is then deflated and withdrawn.
- ✓ You can also put stent



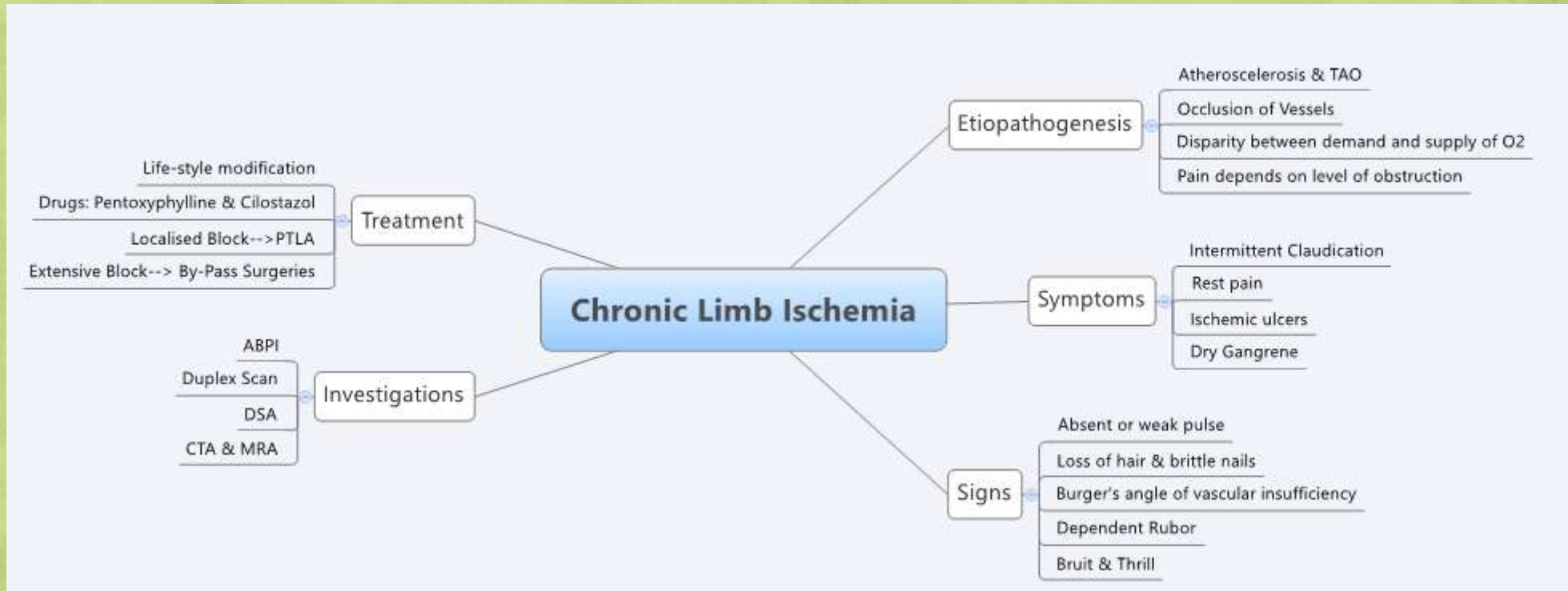
CLI – Treatment- By-Pass

✓ By-Pass Surgeries:

- ✓ Long, multifocal or inaccessible lesions are better treated by surgery
- ✓ In these complex situations, the arterial disease is not amenable to endovascular intervention.
- ✓ For superficial femoral disease, the surgical option is a femoro-popliteal bypass.
- ✓ For above-knee By-pass you can use saphenous vein or PTFE mesh
- ✓ For below-knee By-pass use only saphenous vein graft

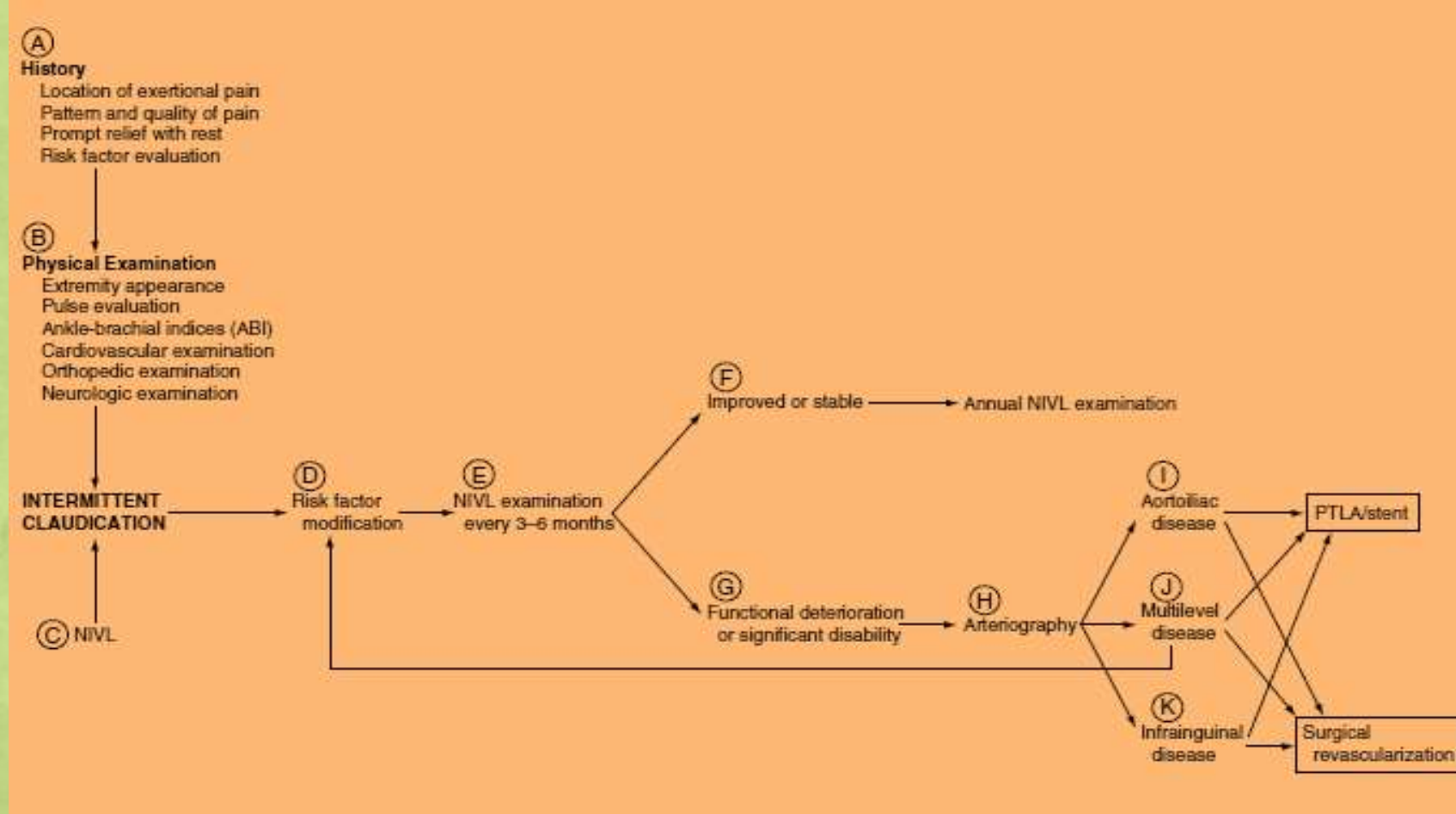


CLI – Mind Map



Chronic Limb Ischemia

Treatment Algorithm



Chronic Limb Ischemia

CASE VIGNETTES

Case No 1: 63-year-old man with exercise-induced right calf pain relieved by rest → Intermittent Claudication → Life-style threatening ischemia

Case No 2: 56-year-old man with impotence and bilateral thigh pain with walking → Lericq's Syndrome

Case No 3: 65-year-old man with nocturnal foot pain relieved by sitting on side of bed → Rest Pain → Limb threatening ischemia

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Acute Limb Ischemia- ALI



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Acute Limb Ischemia- ALI

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- ✓ Clinical Features
- ✓ Investigations
- ✓ Treatment
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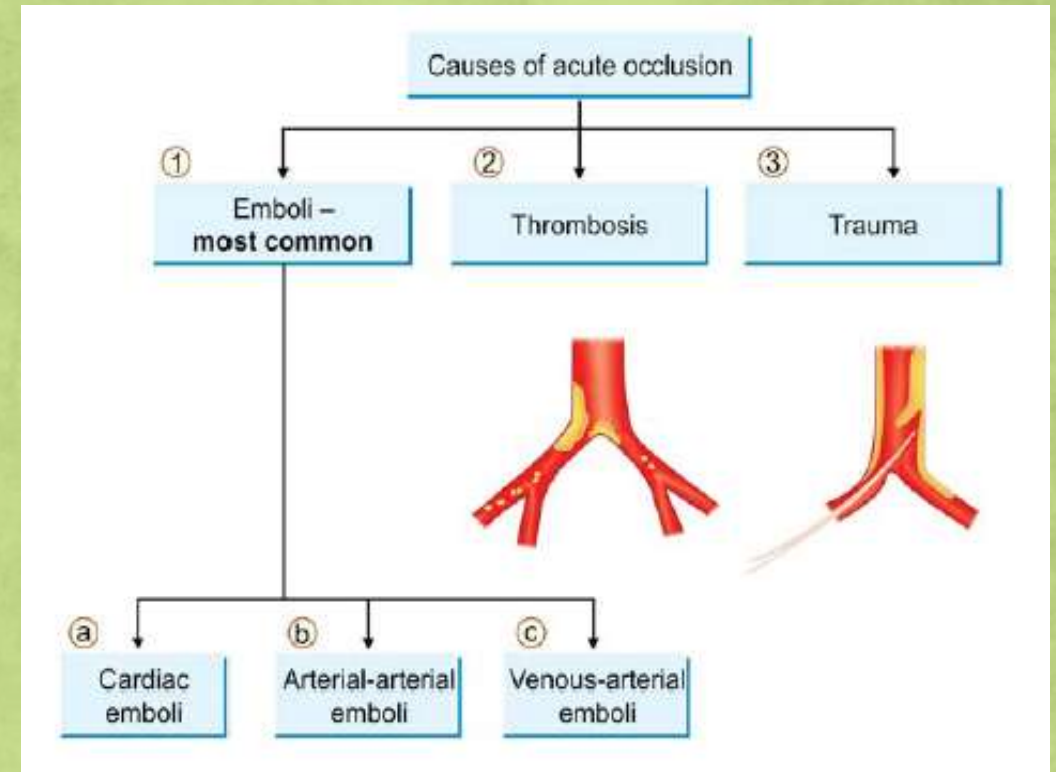
Acute Limb Ischemia- ALI

EPIDEMIOLOGY

- ✓ Acute limb ischaemia is sudden decrease in limb perfusion that causes a potential threat to limb viability.
- ✓ The effects of sudden arterial occlusion depend on the state of the collateral blood supply.
- ✓ The collateral supply in the leg is usually inadequate unless pre-existing occlusive disease has encouraged the collateral circulation to develop.
- ✓ Acute limb ischaemia affects about 1 per 1000 of the population per year and accounts for about 10% of the vascular surgery workload.

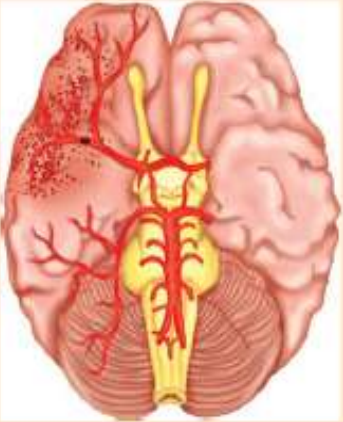
ALI - ETIOLOGY

- ✓ Acute limb ischaemia usually results from embolism.
- ✓ Source of embolus → **Cardiac**: from the left atrium in patients in atrial fibrillation, mural thrombus after a myocardial infarct, prosthetic or diseased heart valves,
Arterial: aneurysmal artery
- ✓ Other causes are thrombosis, trauma and arterial dissection.
- ✓ Rare cause is a paradoxical embolus arising in the venous system that enters the arterial system via an atrial or ventricular septal defect.

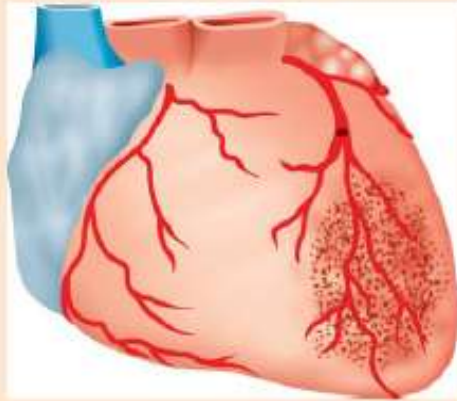


ALI - ETIOLOGY

▲ Infarction develops after 4–8 minutes of ischemia



▲ Infarction develops after 15–20 minutes of ischemia



▲ Infarction develops after 5–6 hours of ischemia



You have more time to salvage the extremities, but not enough time

Make an early diagnosis and do timely intervention to salvage the limb

ALI – Clinical Features

- ✓ '6 Ps':
- ✓ Pain
- ✓ Pulselessness
- ✓ Pallor
- ✓ Paraesthesia
- ✓ Paralysis
- ✓ Perishingly cold → Poikilothermia
- ✓ Purplish Mottling--Fixed staining of the skin and sensory loss are late signs of ischaemia and need urgent surgical intervention.
- ✓ Attempting to differentiate an embolism from a thrombosis is vital to determine the best treatment.

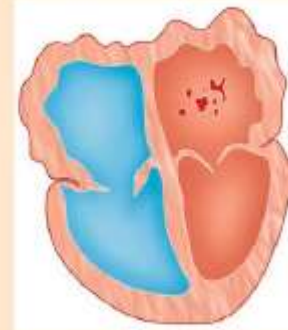


ALI – Clinical Features

<u>CLINICAL FEATURES</u>	<u>EMBOLUS</u>	<u>THROMBOSIS</u>
SEVERITY	Complete (No collaterals)	Incomplete (Collaterals)
ONSET	Seconds-minutes	Hours-days
LIMB AFFECTED (LEG:ARM)	3:1	10:1
PREVIOUS CLAUDICATION	Absent	Present
BRUITS	Absent	Present
DIAGNOSIS	Clinical	Angiography
TREATMENT	Embolectomy, Warfarin	Medical, Bypass

Acute embolic occlusion?

- ▲ Presence of risk factors (e.g. atrial fibrillation, recent AMI, prosthetic heart valve).

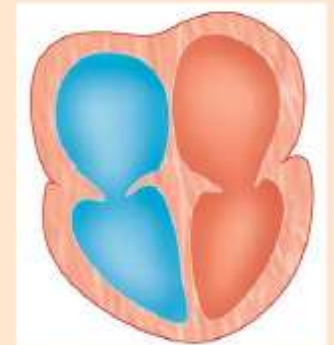


- ▲ Normal contralateral extremity.



Acute thrombotic occlusion?

- ▲ No risk factors for embolism.



- ▲ Contralateral extremity is also diseased.



ALI – STAGING

Stage	Description and Prognosis	Findings		Doppler Signal	
		Sensory Loss	Muscle Weakness	Arterial	Venous
I	Limb viable, not immediately threatened	None	None	Audible	Audible
II	Limb threatened				
IIa	Marginally threatened, salvageable if	Minimal (toes) or none	None	Often inaudible	Audible
IIb	Immediately threatened, salvageable with immediate revascularization	More than toes, associated	Mild or moderate	Usually inaudible	Audible
III	Limb irreversibly damaged, major tissue loss or permanent nerve damage inevitable	Profound, anesthetic	Profound, paralysis (rigor)	Inaudible	Inaudible

ALI - INVESTIGATIONS

- ✓ Acute limb ischaemia is a surgical emergency and the diagnosis is usually clear from the history and examination.
- ✓ The patient should be anticoagulated with heparin & be given opioid analgesia. Heparin bolus 80U/KG IV and then infusion 18U/KG/Hrly, PTT should be 60-80 sec
- ✓ Associated cardiac disease (e.g. arrhythmias) should be investigated and a cardiology opinion obtained as required. Echocardiography
- ✓ Duplex ultrasound scan helps to confirm the presence and level of arterial occlusion
- ✓ Arteriography-DSA- with a view to balloon angioplasty should be considered in patients felt to have acute occlusion in the presence of chronic limb ischaemia.
- ✓ CTA & MRA also can be done

ALI - TREATMENT

In Embolic Occlusion

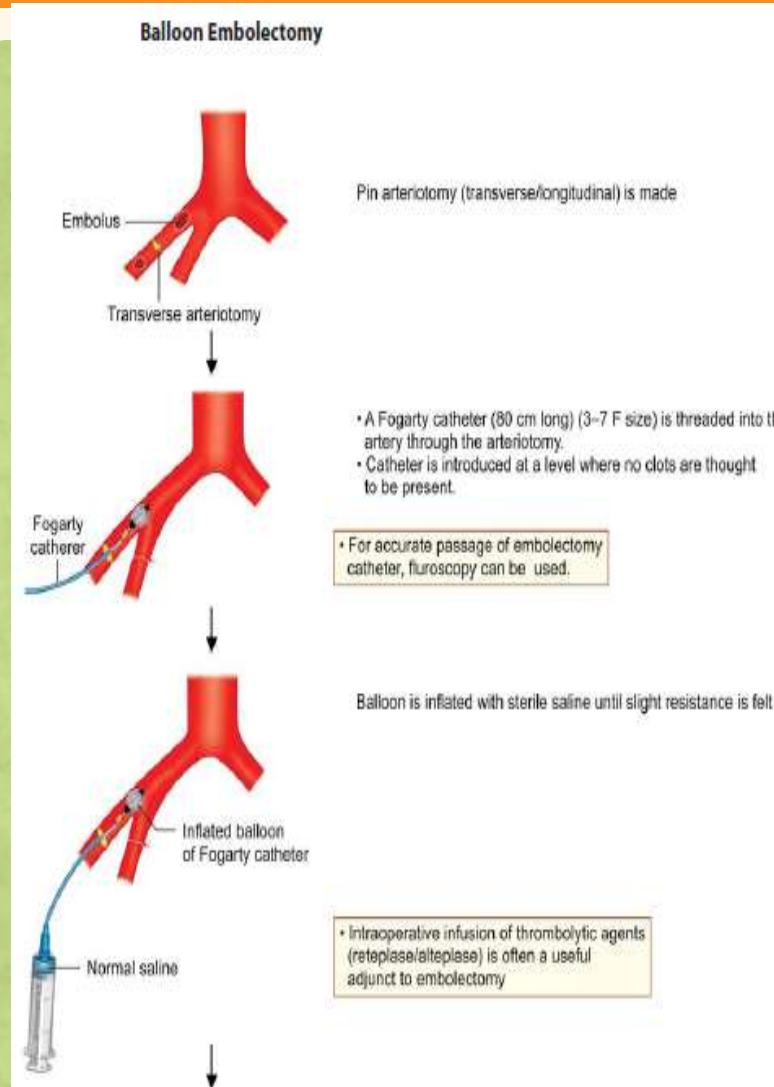
1. Assess the viability and potential salvage of the affected limb:

▲ Viability present

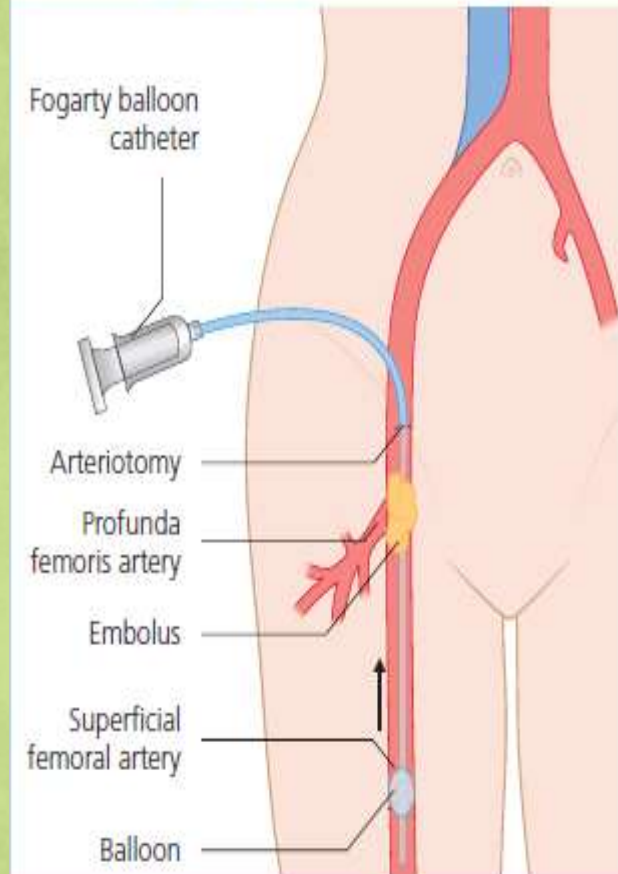
- Time is precious!
- No need of preoperative angiography
- Minimal but expeditious evaluation (chest X-ray, 12 lead ECG, routine blood test)
- Procedure is rather not so complex.

⇓
Urgent intervention

Fogarty Balloon Embolectomy and Intra arterial thrombolysis



Femoral embolectomy using a Fogarty balloon catheter



ALI - TREATMENT

In Acute Thrombotic Occlusion

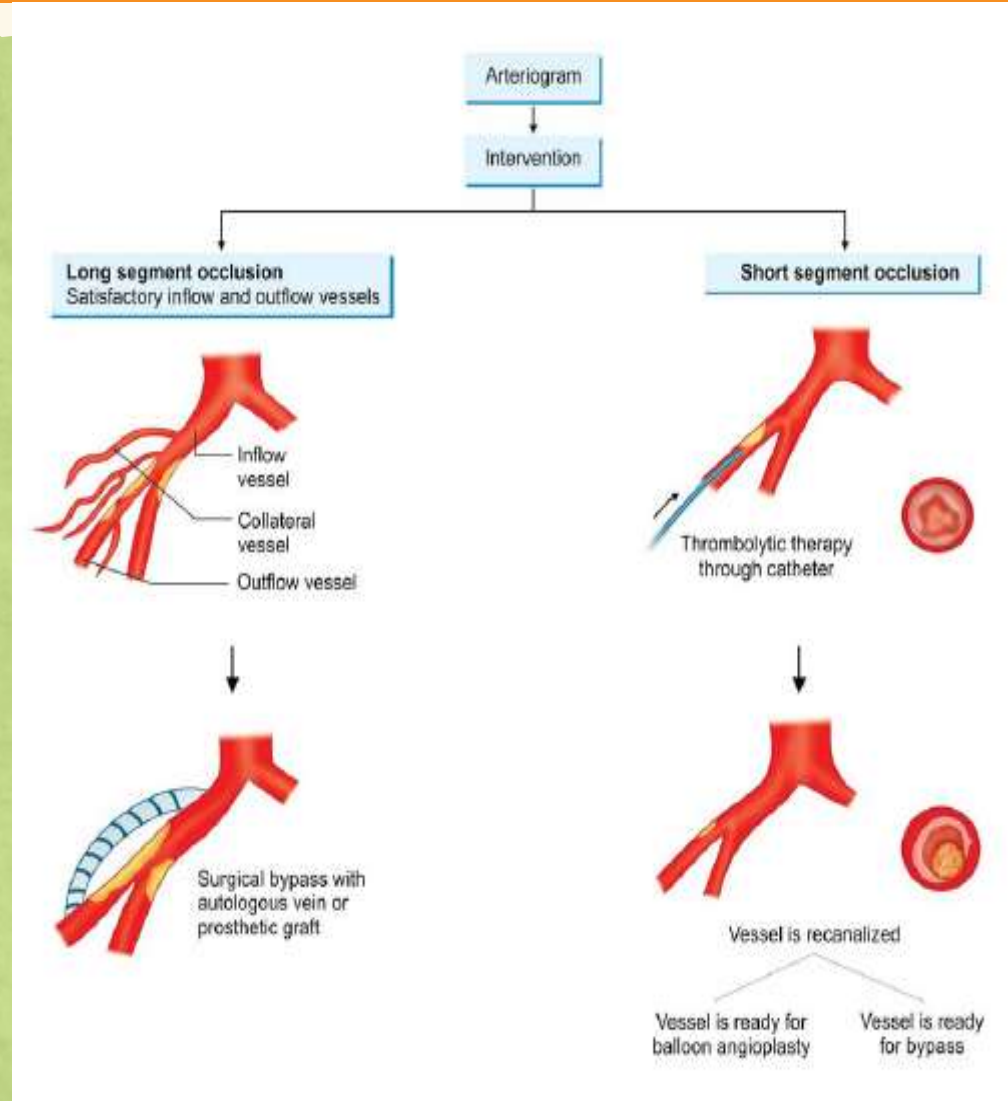
▲ First, do an arteriogram to know—

- Site of thrombotic occlusion
- Degree of occlusion
- Short or long segment involvement
- Status of inflow and outflow vessels.

Management is more complex, because—

- ▲ Diffuse atherosclerosis at multiple levels
- ▲ Various degree of collateral development.

In large segment occlusion: By-Pass surgery
In short segment occlusion: Catheter directed
thrombolysis
& then PTLA- angioplasty



ALI - TREATMENT

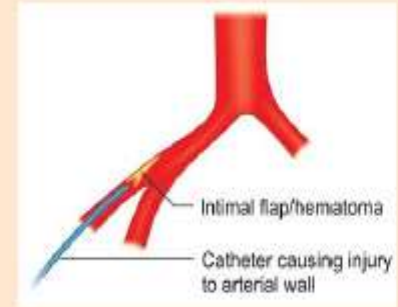
Catheter Directed Thrombolysis

- ▲ Reteplase, alteplase are the thrombolytic agents.
- ▲ Fresher the thrombus, more the chance of successful thrombolysis.
- ▲ During thrombolysis, patient is monitored in ICU. Thrombin time, fibrinogen level, fibrinogen degradation product, PTT and CBC must be evaluated to assess the risk of hemorrhage.
- ▲ Duration of therapy between 4–16 hours.
- ▲ Repeat arteriography is done after 6–18 hours to evaluate the result.
- ▲ **Patient with high risk of major bleeding are not candidates:**
 - Patient with recent surgery
 - Patient with trauma
 - Gallbladder bleeding
 - Intracranial tumors
 - Recent stroke
 - Pregnancy.

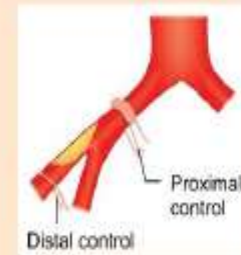
ALI - TREATMENT

In Traumatic Occlusion

- ▲ Operative exploration should be done if limb is ischemic/arteriogram shows intimal flap/hematoma



- ▲ Proximal and distal control of the injured artery must be taken



- ▲ End-to-end anastomosis/graft placement (autologous vein graft)

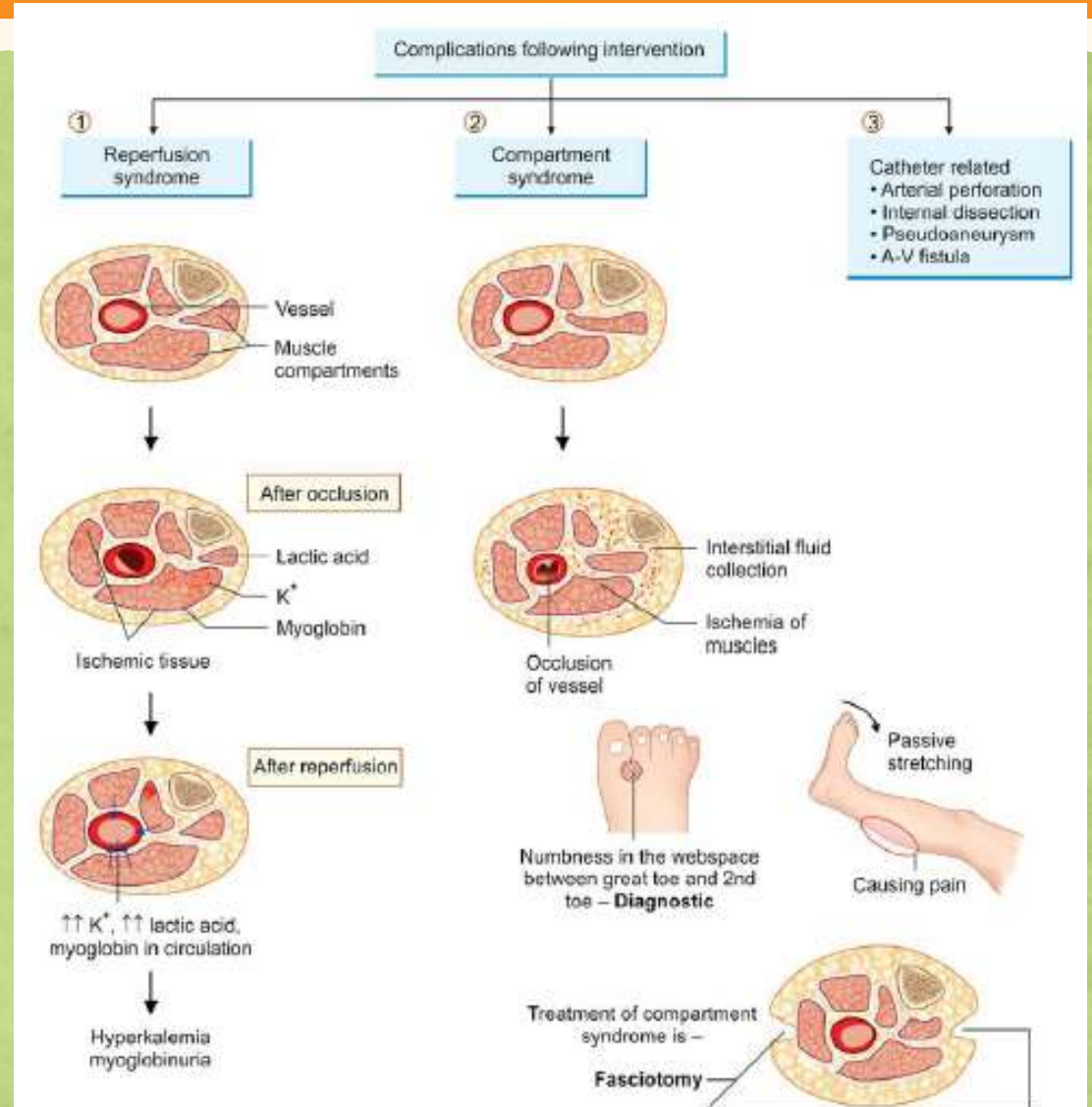


- ▲ Completion angiogram is helpful to document the distal flow.

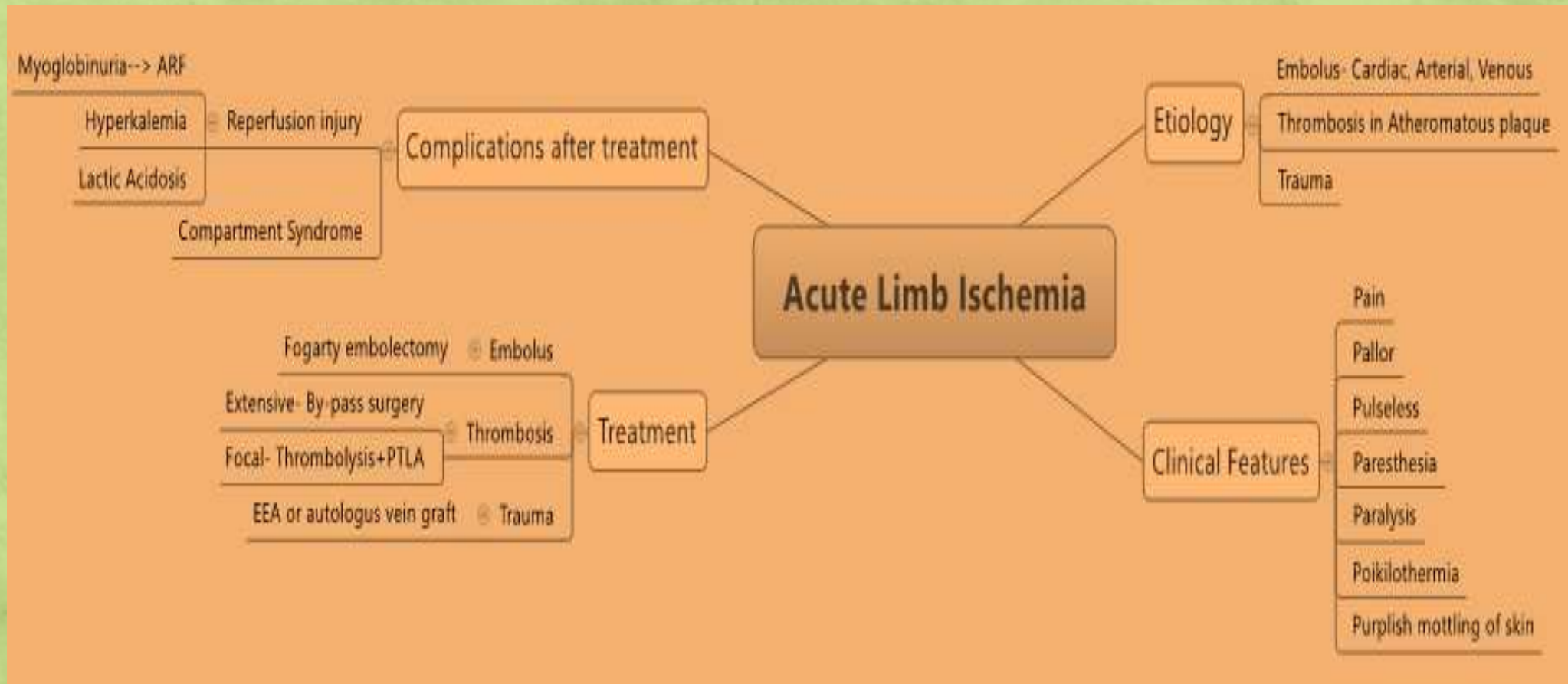
ALI - TREATMENT

COMPLICATIONS

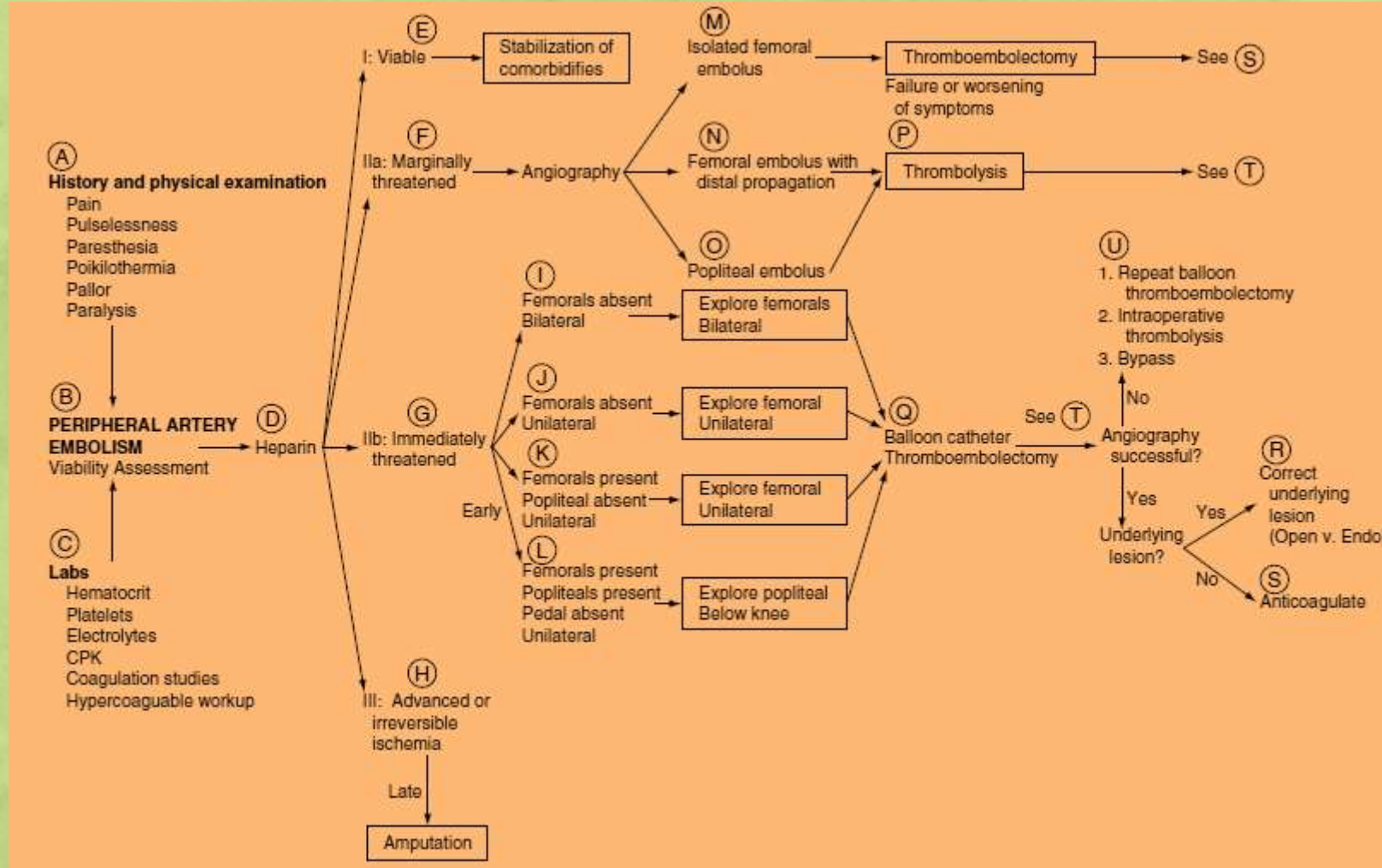
- ✓ Reperfusion Injury
 - Myoglobinuria → ARF
 - Hyperkalemia
 - Lactic Acidosis
- ✓ Compartment Syndrome



ALI – Mind Map



ALI – Treatment Algorithm



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PERIPHERAL ARTERIAL DISEASES (PAD)

Upper Limb Ischemia- ULI



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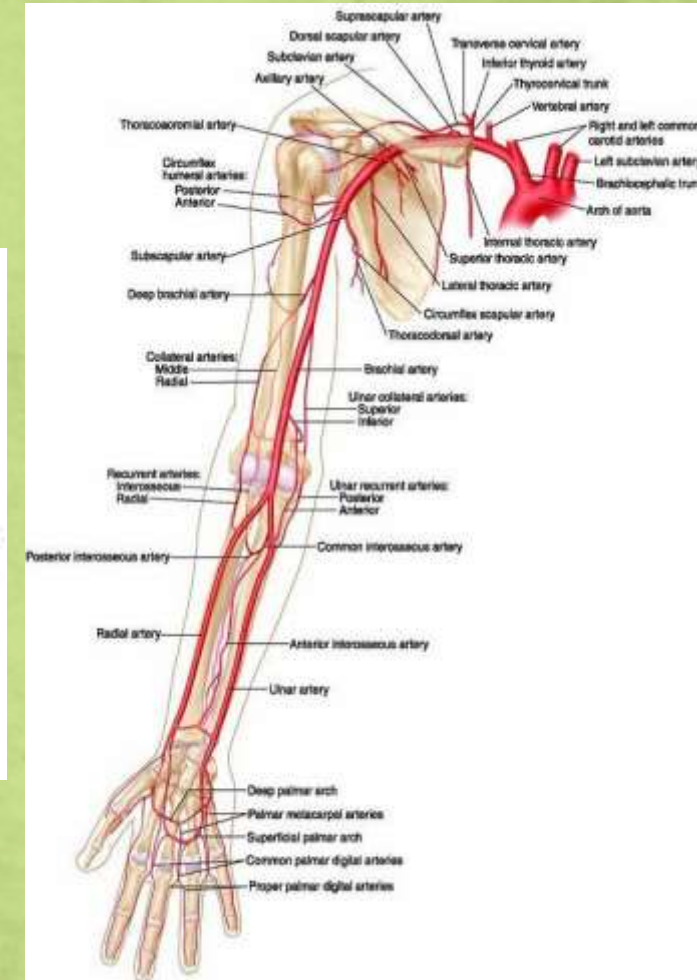
Upper Limb Ischemia- ULI

- ✓ Epidemiology
- ✓ Etiology
- ✓ Clinical Features
- ✓ Investigations
- ✓ Raynaud's phenomenon
- ✓ Thoracic Outlet Syndrome
- ✓ Thrombo Angitis Obliterans

Upper Limb Ischemia- ULI

EPIDEMIOLOGY

- ✓ Less common than lower limb ischemia 1:9
 - Because of rich collaterals
 - Less workload
- ✓ Small vessel occlusive diseases affecting palmar and digital arteries 90%
- ✓ Large vessel occlusive disease 10%
- ✓ Affects young persons
- ✓ More diverse pathology



ULI - ETIOLOGY

COMMON

- Raynaud's Phenomenon → Raynaud's disease and Raynaud's syndrome
- Thoracic outlet syndrome
- Drug induced vasospasm
- Thrombo Angitis Obliterans- TAO
- Thromboembolism
 - 20% of all emboli
 - 30% arterio-arterial

UNCOMMON

- Autoimmune diseases like SLE and Scleroderma
- Arteriosclerosis
- Vasculitis like Fibromuscular dysplasia & Takayasu and Giant cell arteritis
- Traumatic and environmental factors

ULI – Clinical Features

- ✓ Acute or Chronic
- ✓ Predisposing factors like exposure to cold and smoking
- ✓ Palpable pulses
- ✓ Hand and fingers discoloration
- ✓ Neurological status
 - Decreased sensation and muscle weakness
 - Ischemic, compressive or intrinsic neuropathy
- ✓ Signs related to prior procedures like AV access or catheterisation
- ✓ Unilateral or bilateral

ULI - INVESTIGATIONS

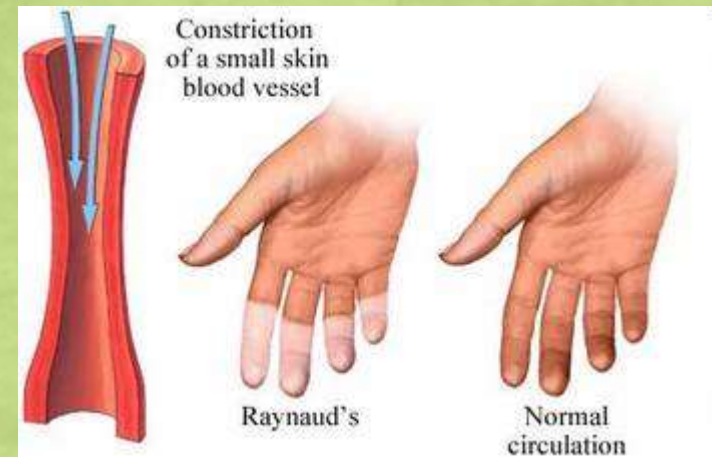
- ✓ Arm pressures on both sides
- ✓ Segmental pressures- bilateral
- ✓ Digital Pulse Volume Recordings
- ✓ Duplex scan for Axillary and Brachial arteries
- ✓ CTA and MRA
- ✓ Selective Arteriogram

RAYNAUD'S PHENOMENON

- ✓ Episodic attacks of small arteries and arterioles of the distal part of the extremities in response to cold exposure or emotional stimuli.
- ✓ These are **two types**
- ✓ **1. Raynaud's syndrome:** These attacks are in response to the underlying collagen disorders like scleroderma and rheumatoid arthritis. Can also occur in those who are using vibrating tools.
- ✓ **2. Raynaud's disease:** similar condition occurring in the absence of any underlying disease

RAYNAUD'S PHENOMENON

- ✓ The affected digits may go through a classic **sequence of colour changes** including.
- ✓ **Pallor** due to severe vasospasm in the dermal vessels.
- ✓ **Cyanosis** — As the hand is warmed and the capillaries are slowly filled up with deoxygenated blood and the part becomes cyanosed.
- ✓ **Rubor or redness**—As the arteriolar spasm completely passes off, blood enters more quickly and the part becomes red and swollen.



RAYNAUD'S PHENOMENON

- Clinical Features

- ✓ Typically the patient is a female in her adolescence and in 50 percent of cases there is a family history.
- ✓ The patient suffers from the classic attack of vasospasm in the upper limbs on exposure to cold.
- ✓ Relief is brought on by warmth. The affection may be bilateral and in 10 percent cases, the lower limbs are primarily involved.
- ✓ Tissue necrosis is very rare



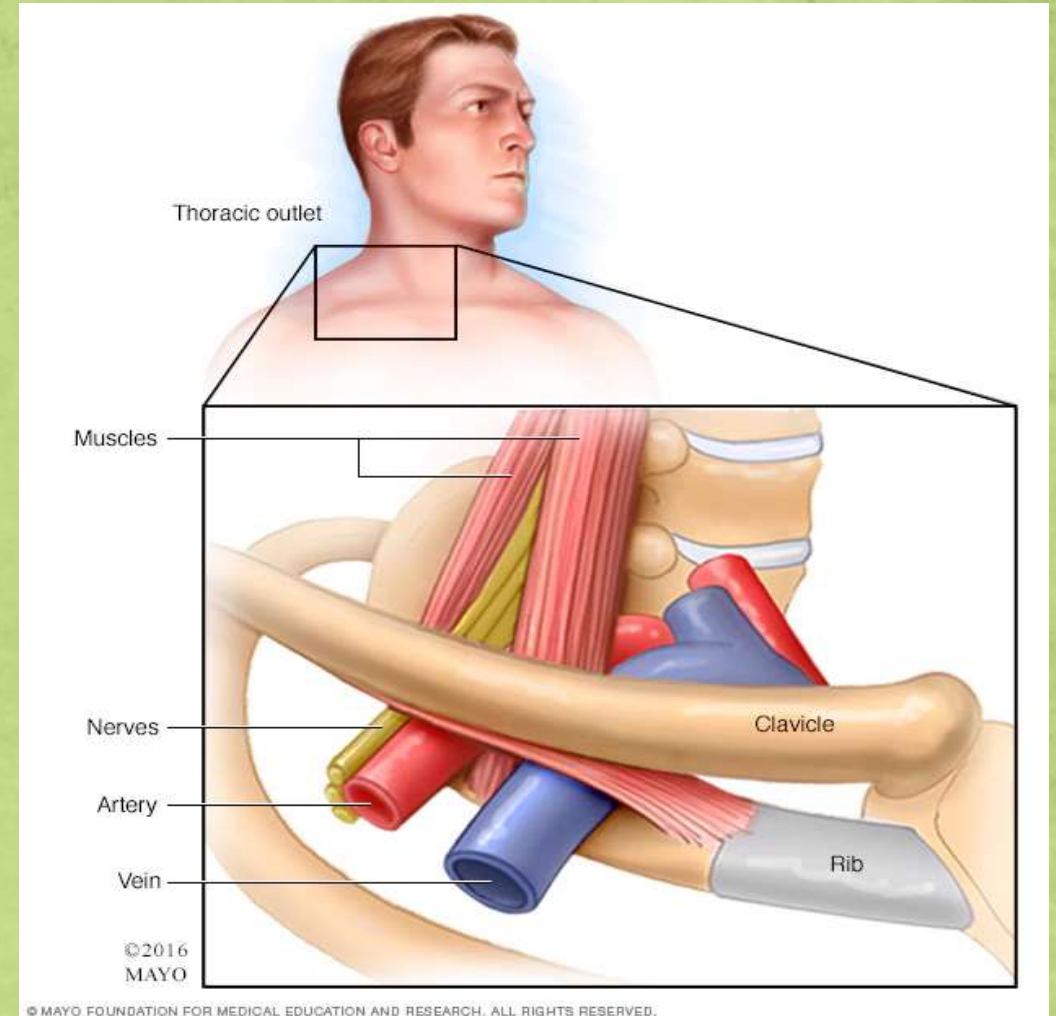
RAYNAUD'S PHENOMENON

- Treatment

- ✓ To avoid cold exposure, hands should be protected by gloves or hand warmers in extremely cold weather.
- ✓ Cessation of smoking.
- ✓ The above two measures are enough for most of the patients and only about 10 percent of patients with Raynaud's syndrome require further treatment.
- ✓ The drug of choice is the calcium channel blockers like nifedipine 10mg three times a day.
- ✓ Cervical sympathectomy is not considered to be of much benefit.

Thoracic Outlet Syndrome

- ✓ Constellation of neurological, arterial and venous disorders resulting from compression of the neurovascular bundle as it leaves the chest to enter the upper limb via the scalene triangle.
- ✓ This triangle is bounded by scalenus anticus anteriorly, scalenus medius posteriorly and the first rib inferiorly.



Thoracic Outlet Syndrome

- Etiology

- ✓ **Cervical rib**—It is the anterior tubercle of the transverse process of the 7th cervical vertebra which attains excessive development and results in cervical rib. It produces symptoms in only 10 percent of cases.
- ✓ A **wide scalenus anticus muscle** may narrow the space in the interscalene triangle and cause symptoms
- ✓ **Congenital abnormality of the first rib**— A wider first rib may give rise to symptoms.
- ✓ **Fracture of the clavicle or the first rib** may produce bony callus which may lead to small subclavian aneurysm, peripheral emboli and ischemia of hand.

Thoracic Outlet Syndrome

- Clinical Features

- ✓ Symptoms of thoracic outlet syndrome vary depending on whether nerves or blood vessels or both are compressed.
- ✓ Majority of patients are middle-aged females.
- ✓ The **neurological symptoms** include pain and paresthesia in the neck, shoulder, arm and hand
- ✓ **Symptoms of arterial compression** are pallor or intermittent cyanosis of the hand and fingers. Embolic episodes give rise to pain, pallor, cyanosis or even gangrene of the fingers. Adson's test → positive
- ✓ **Venous compression** will produce cyanosis of the skin of the hand and arm. Impaired venous and lymphatic return gives rise to edema.

Thoracic Outlet Syndrome - Differential Diagnosis

- ✓ Cervical spondylosis.
- ✓ Cervical cord compression.
- ✓ Cervical disk protrusion.
- ✓ Raynaud's syndrome.
- ✓ Carpal tunnel syndrome.
- ✓ Pancoast's tumor pressing over the nerves

Thoracic Outlet Syndrome - Investigations

- ✓ X-ray of the neck and cervical spine.
- ✓ Duplex scan → Doppler ultrasound.
- ✓ Subclavian angiogram

Thoracic Outlet Syndrome

- Treatment

A. Conservative

In mild cases, treatment is conservative.

- ✓ Exercise program to strengthen the muscles of the shoulder girdle, particularly the elevators
- ✓ To avoid weight lifting.
- ✓ Drugs like analgesics, muscle relaxants and antidepressants for relief of neurological symptoms.

B. Surgery

Patients with refractory symptoms require surgery. Operative treatment includes:

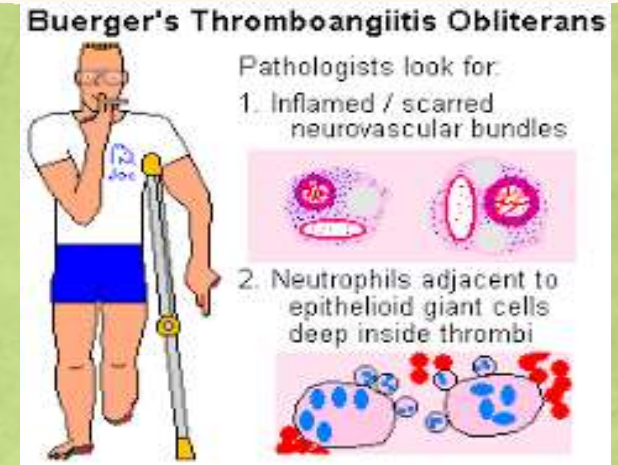
- ✓ Excision of the cervical rib.
- ✓ Division of the scalenus anticus muscle and
- ✓ Often resection of the first rib to increase the thoraco-axillary channel and to reduce the neurovascular compression.

Thrombo Angitis Obliterans (Burger's Disease)

- ✓ This disease was first described by Leo Buerger in 1908 and is characterized by the following:
- ✓ Low grade inflammation of the small and medium size arteries, mostly of the lower limb.
- ✓ Thrombophlebitis of the superficial or the deep veins
- ✓ Raynaud's phenomenon.
- ✓ Almost all patients are young males below 30 years of age and smokers

Thrombo Angitis Obliterans - Pathology

- ✓ The mechanism by which smoking causes Burger's disease is not known
- ✓ Possibly due to direct endothelial injury by a tobacco product, vasoconstriction, increased sensitivity to tobacco products and a hypercoagulable state leading to thrombosis.
- ✓ There is dense infiltrate of polymorphonuclear leukocytes in the thrombus.
- ✓ Perivasculitis is present but the elastic lamina is intact and there is no necrosis of the vessel wall
- ✓ Fibrosis may occur in chronic lesions and will lead to fibrous encasement which may also involve the accompanying vein and the adjacent nerves.



Thrombo Angitis Obliterans

- Clinical Features

- ✓ The patient is usually a younger man who smokes or chews tobacco and complains of intermittent claudication.
- ✓ There may be a history of recurrent migratory superficial thrombophlebitis.
- ✓ Progression of the disease is related to the smoking habit and may culminate in rest pain, ulceration and gangrene
- ✓ Remission of the disease is linked to abstinence from smoking. The gangrene is usually of dry type and slowly progressing. A minor trauma may precipitate gangrene.
- ✓ O/E absence of posterior tibial and dorsalis pedis pulses in the feet.
- ✓ Absence of the posterior tibial pulse especially when bilateral is highly suggestive of the disease.

Thrombo Angitis Obliterans - Investigations

- ✓ **Arteriography** is the most important investigating procedure. It shows segmental obliteration of the middle and small size arteries.
- ✓ Digital arteries are characteristically involved. The collaterals which develop due to the occlusion give a characteristic corkscrew appearance



Thrombo Angitis Obliterans - Treatment

A. Conservative

Conservative treatment has a great role to play in this disease.

- ✓ Quitting smoking is very important.
- ✓ Various drugs have been tried with questionable value. This includes vasodilator drugs, anticoagulants, dextran and steroids. Prostaglandin E2 infusion may help the patient during an exacerbation

B. Surgical treatment

- ✓ Direct arterial surgery is not usually possible due to the distal nature of the disease. It can sometimes be done for proximal segmental occlusions.
- ✓ Amputations should be as conservative as possible.
- ✓ Lumbar sympathectomy not done nowadays

ULI - Summary

- ✓ Diagnosis based mainly on H&P
 - Confirm with non-invasive imaging → Duplex scan/CTA/MRA
 - Invasive imaging to decide optimal surgical intervention
- ✓ Revascularisation for large vessel occlusive disease is usually durable
- ✓ For vasospastic small vessel disease do only supportive treatment

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