



# PERIPHERAL OCCLUSIVE VASCULAR DISEASE

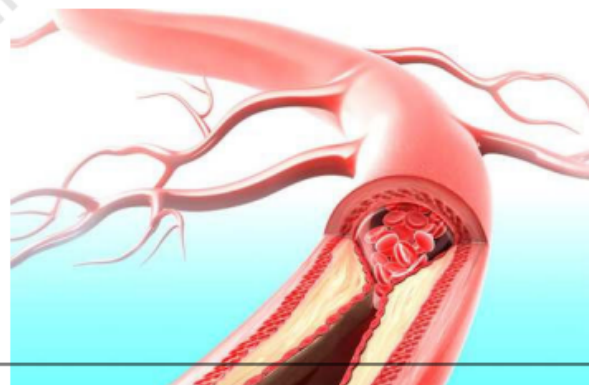
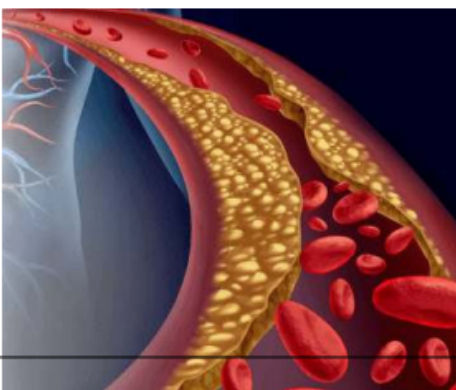
# S1 UNIT

- Byabang Limli
- Chaithra Jayaprakash
- Chinky M
- Cristoss Gregory
- Darsana Raj
- Deepak Peter
- Deepak Roy
- Deepthi Roy S
- Deepu Krishnan M



# WHAT IS POVD?

*A Clinical disorder characterised by stenosis or occlusion of the arteries of periphery especially those supplying limbs.*

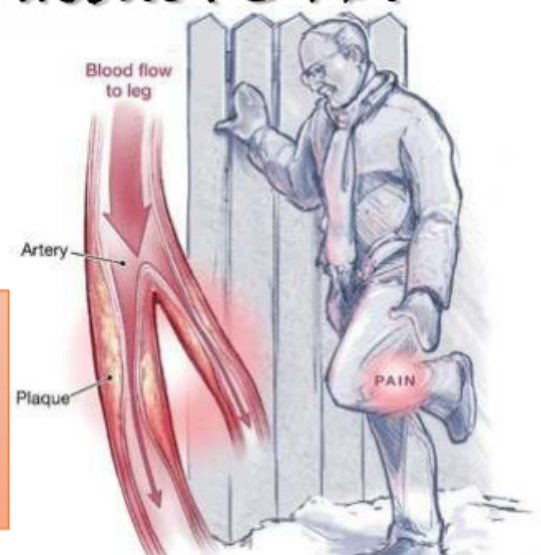


## Why are we so much concerned about POVD?

Peripheral artery disease has been estimated to affect about 20% individuals aged 55 to 75 years

Only 25% present with symptoms, most common of which is **Intermittent Claudication**.

1-2% of pts with IC progress to point where amputation or revascularisation is required.



- Mortality rate of people with IC is 2-3 times higher than general population.
- Death-- due to MI or stroke- means- IC nearly always occur in association with widespread atherosclerosis.





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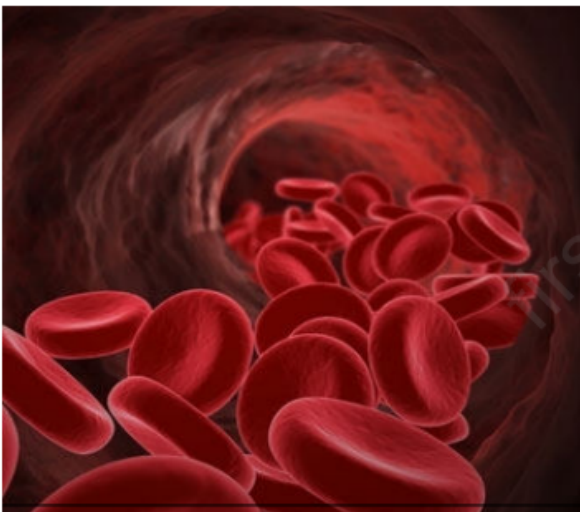
- ANATOMY OF ARTERIAL SYSTEM
- ETIOPATHOGENESIS
- CLINICAL FEATURES
- CLINICAL EXAMINATION
- INVESTIGATIONS
- MEDICAL THERAPY
- SURGICAL MANAGEMENT
- ACUTE LIMB ISCHEMIA

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# ANATOMY OF ARTERIAL SYSTEM

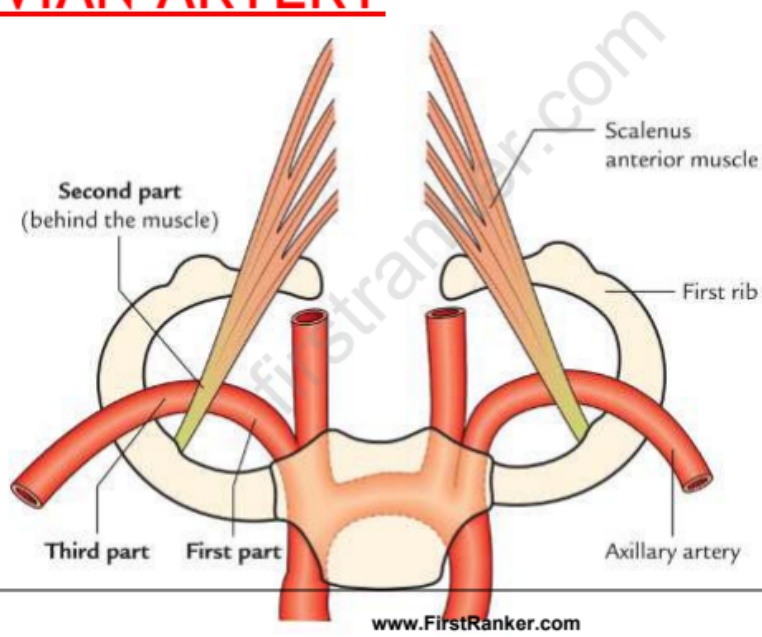
**BYABANG LIMLI**

**Roll No.42**

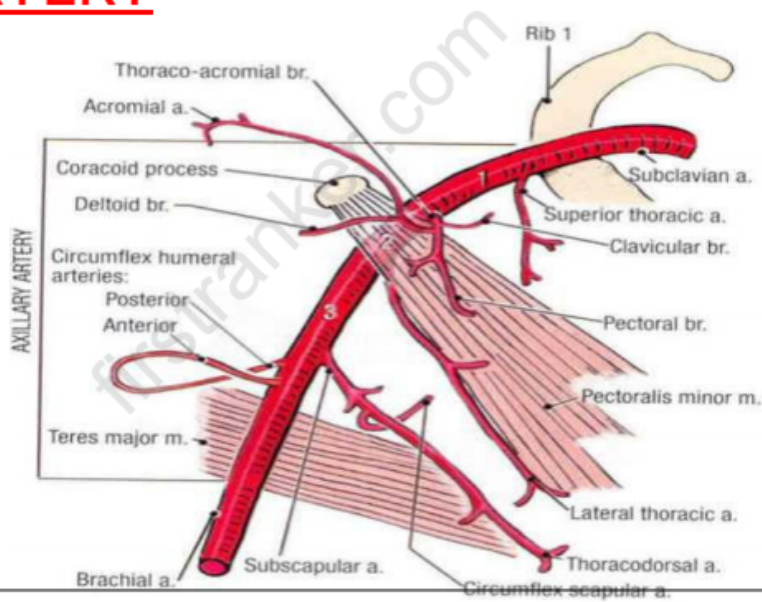


***ARTERIES OF UPPER LIMB***  
***ARTERIES OF UPPER LIMB***

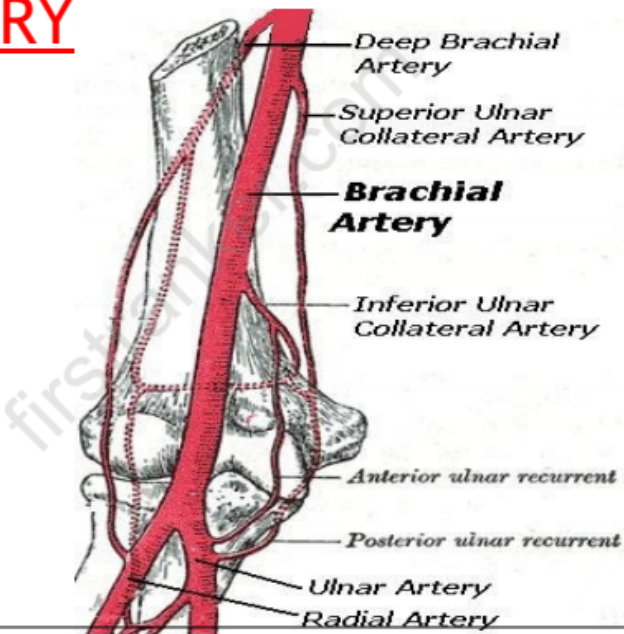
# SUBCLAVIAN ARTERY



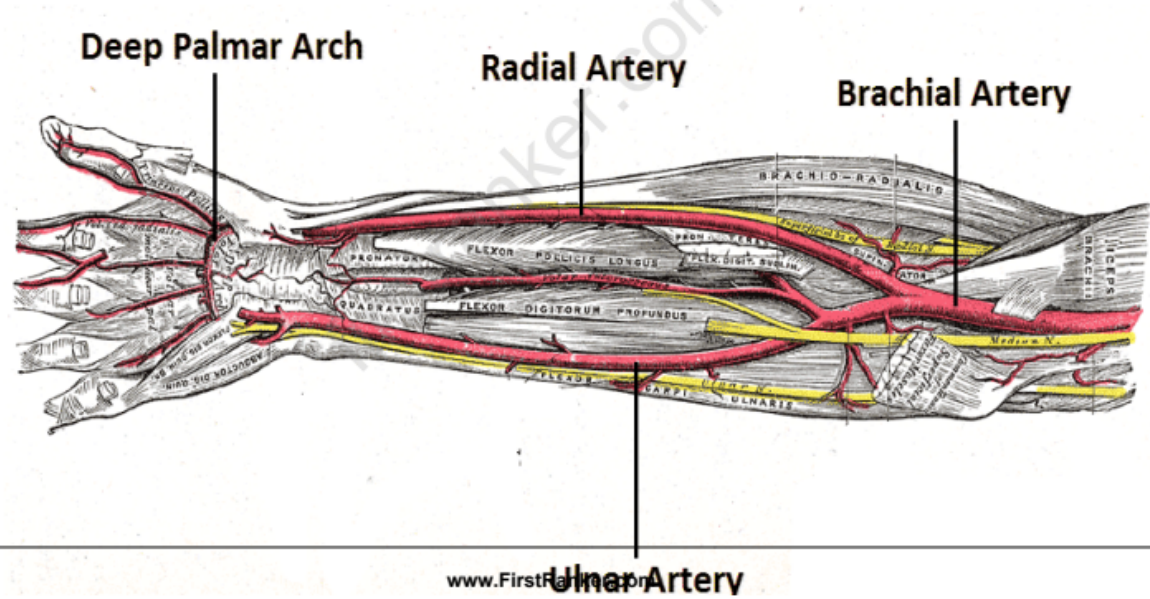
# AXILLARY ARTERY



# BRACHIAL ARTERY

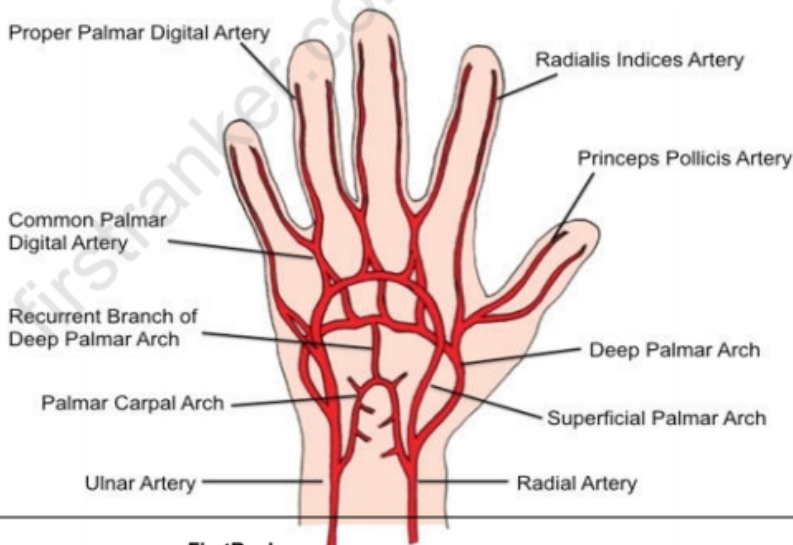


ARTERIES OF FOREARM

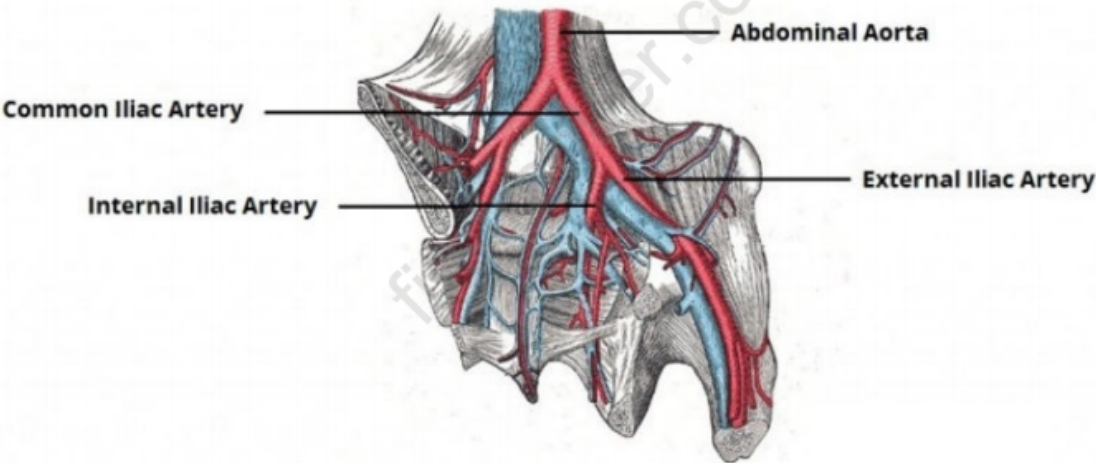


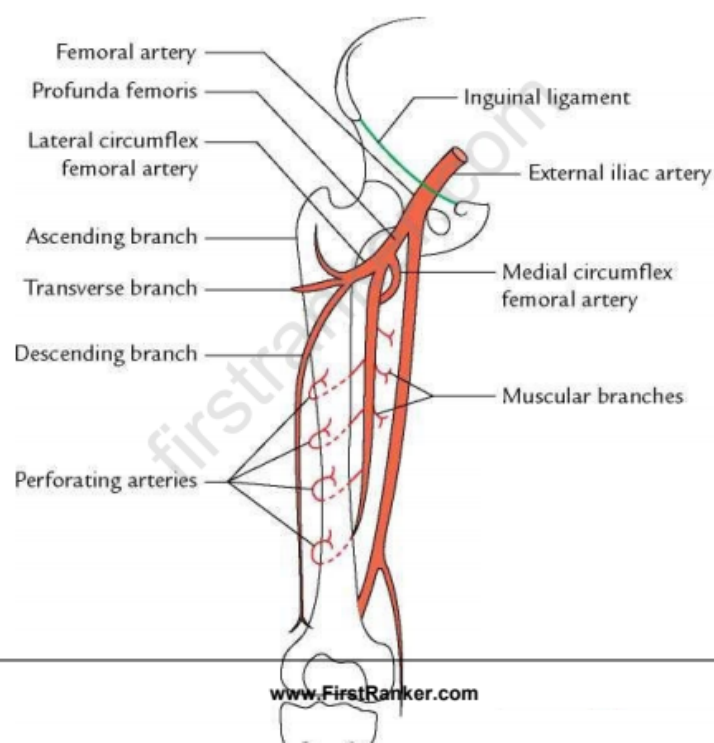


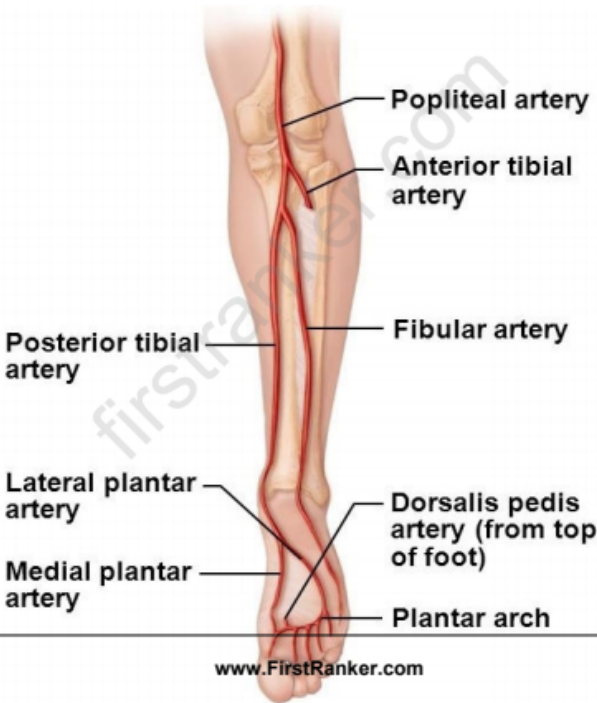
PALMAR ARCHES

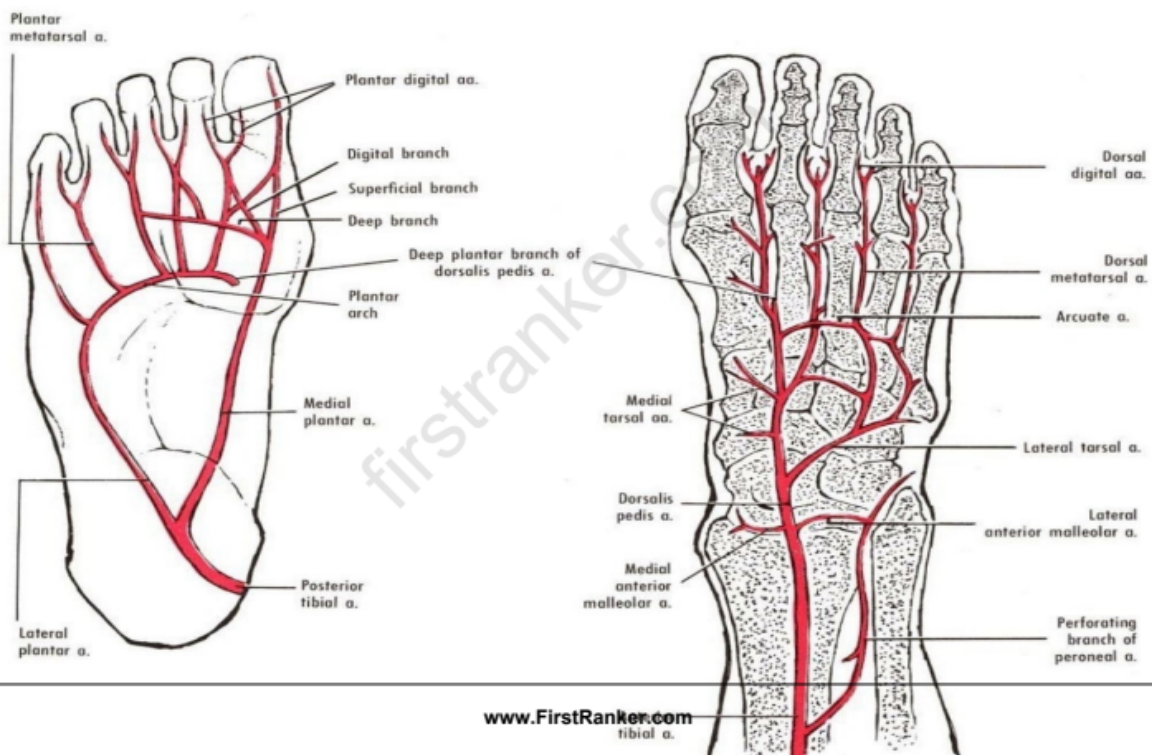


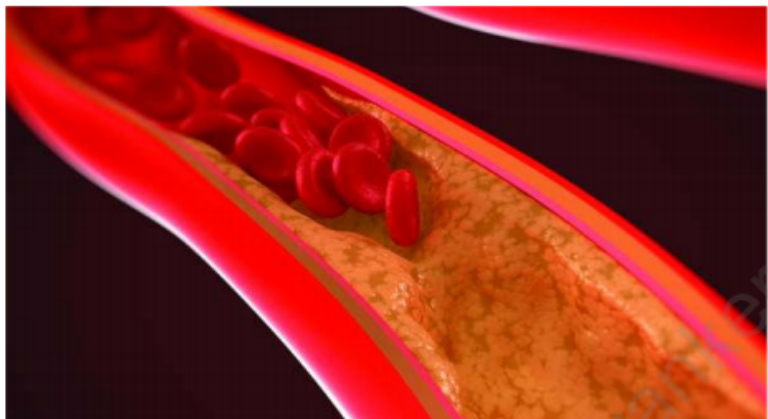
# ***ARTERIES OF LOWER LIMB***











# ETIOPATHOGENESIS

CHAITHRA JAYAPRAKASH

Roll No.43

## CAUSES OF POVD

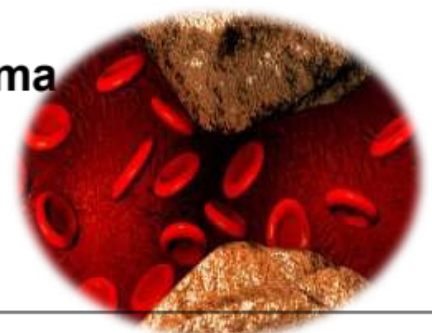
- **ATHEROSCLEROSIS**
- **NON ATHEROSCLEROTIC CAUSES**

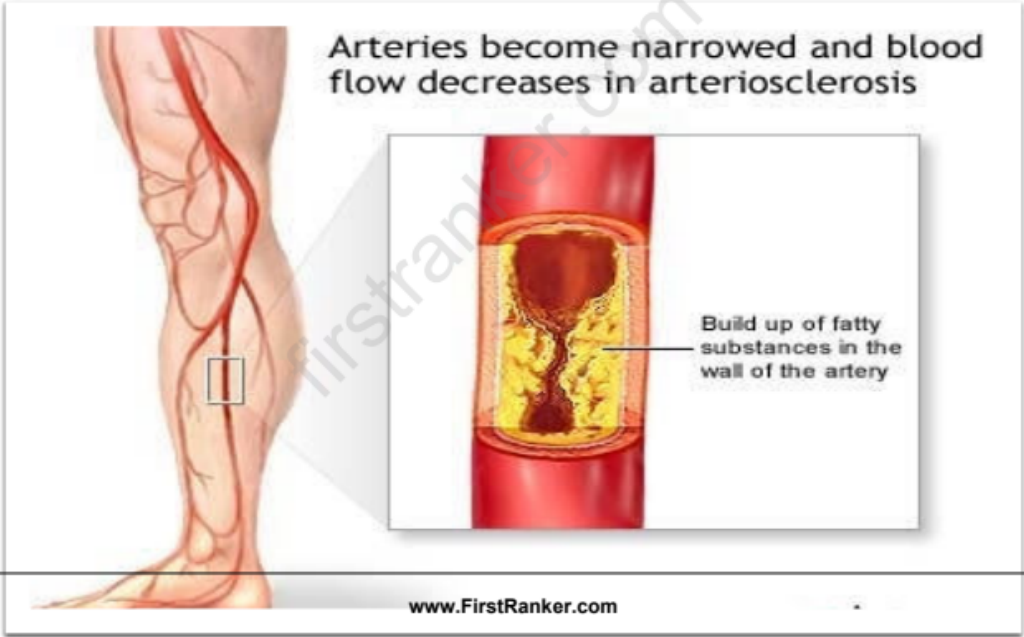




## ATHEROSCLEROSIS

- Leading cause of occlusive arterial disease
- Usually localized in **large** and **medium-sized** vessels.
- Characterized by intimal lesions called **atheroma**
- Lesions occurs preferentially at
  - ✓ Arterial branch points
  - ✓ Sites of increased turbulence
  - ✓ Sites of intimal injury





# RISK FACTORS

## FIRMLY ESTABLISHED:

- Dyslipidemia
- Cigarette smoking
- Hypertension
- Diabetes mellitus



## RELATIVE FACTORS:

- Age
- Gender
- Family history
- Hypothyroidism
- Sedentary lifestyle
- Homocysteinemia

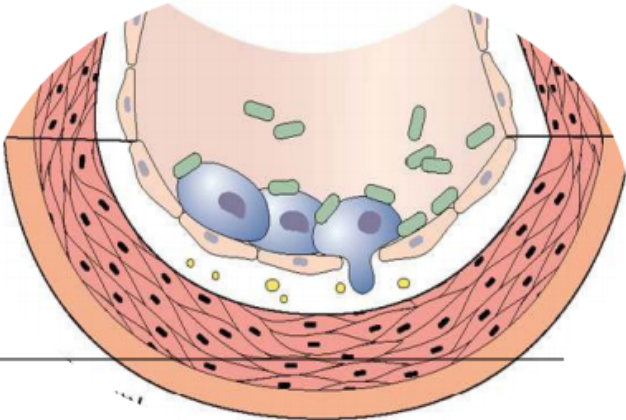
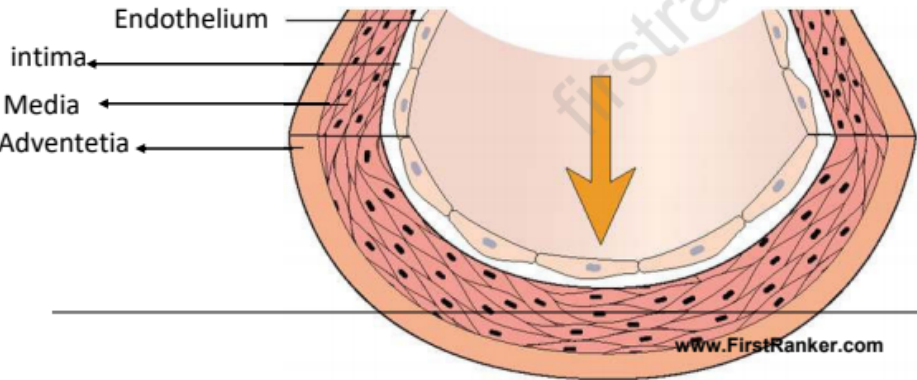


# PATHOGENESIS OF ATHEROSCLEROSIS

RESPONSE TO INJURY

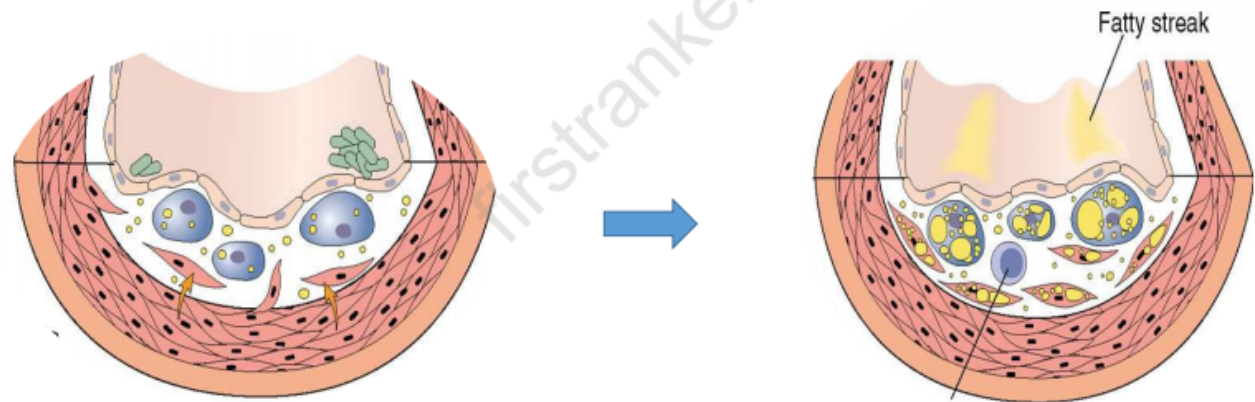


ENDOTHELIAL DYSFUNCTION

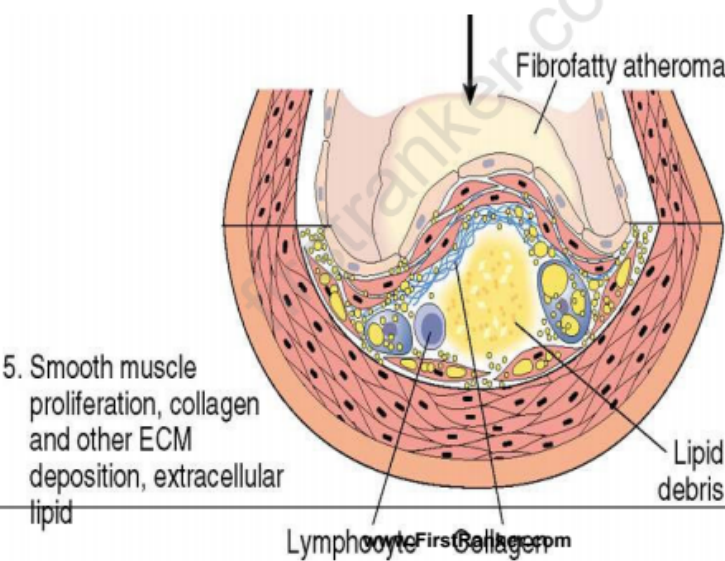


INITIATION OF FATTY STREAK

FATTY STREAK



# FIBRO-FATTY ATHEROMA



## COMPLICATIONS

- Narrowing of lumen → ISCHEMIA
- Weakening of wall → ANEURYSMS
- Thrombosis → ATHEROEMBOLISM
- Loss of elasticity → ELEVATION OF DIASTOLIC BP

## LATE CHANGES

- Calcification
- Rupture, Ulceration
- Thrombus formation
- Haemorrhage

# NON ATHEROSCLEROTIC CONDITIONS CAUSING LIMB ISCHEMIA

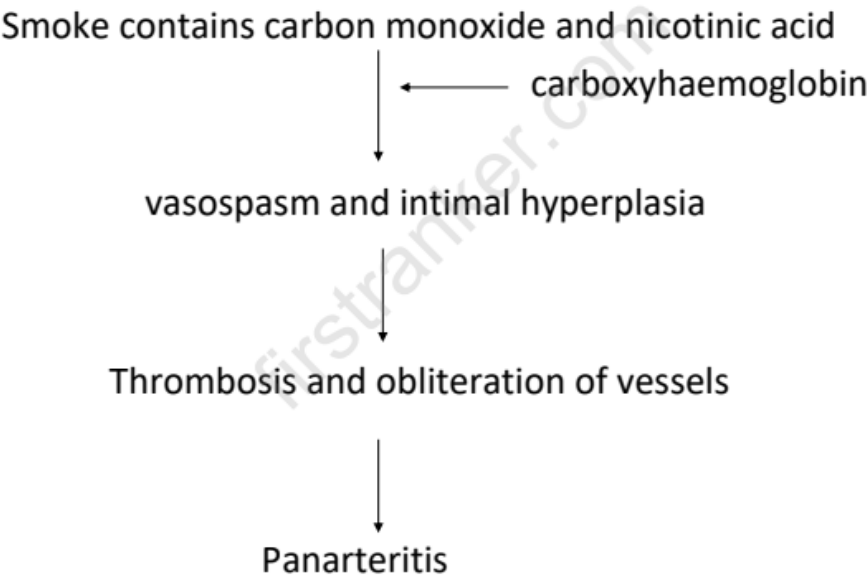
- |                                                      |                   |
|------------------------------------------------------|-------------------|
| ❖ <b>THROMBOANGITIS OBLITERANS (BUERGER DISEASE)</b> | PRESSURE NECROSIS |
| ❖ <b>RAYNAUDS SYNDROME</b>                           | EMBOLISM          |
| ❖ TAKAYASU'S DISEASE                                 | SCLERODERMA       |
| ❖ CYSTIC MYXOMATOUS DEGENERATION                     | TRAUMA            |
| ❖ POPLITEAL ARTERY ENTRAPMENT SYNDROME               | RADIATION         |
| ❖ FIBROMUSCULAR DYSPLASIA                            | DIABETES MELLITUS |

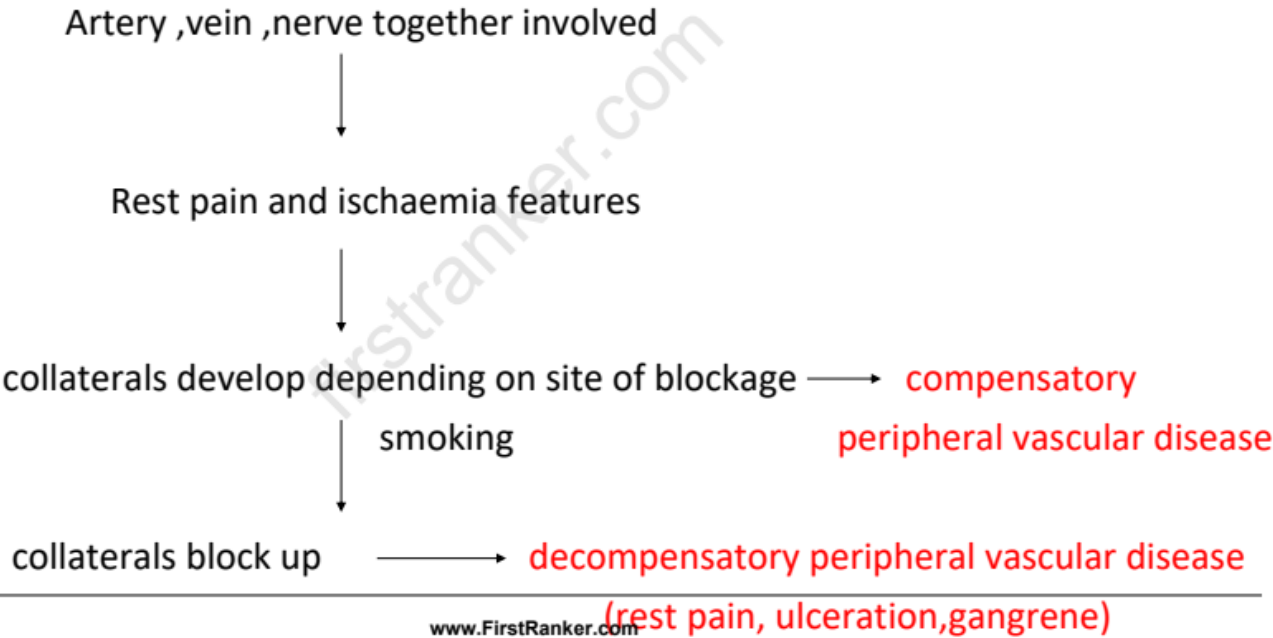


## THROMBOANGITIS OBLITERANS (BUERGER' S DISEASE)

- ❖ It is a segmental inflammatory disease that most often affects small and medium-sized arteries, veins, and nerves of the upper and lower extremities.
- ❖ Caused by idiosyncratic endothelial cell toxicity due to some components of tobacco
- ❖ Seen in men of age group 20-40 years who smokes

# PATHOGENESIS:





## SHIANOYA'S CRITERIA FOR BUERGER'S DISEASE:

- Tobacco use : only in males
- Starts before 45 years
- Distal extremity first involved without embolic or atherosclerotic features
- Absence of diabetes mellitus or hyperlipidemia
- With or without thrombophlebitis

## RAYNAUD'S DISEASE

- Idiopathic condition
- Characterized by recurrent, episodic **vasospasm** of small arteries and arterioles of digits due to **cold exposure or emotional stress, tobacco.**
- Young women < 30 yrs.
- Due to abnormal sensitivity of arterioles to cold.



# Triphasic colour response

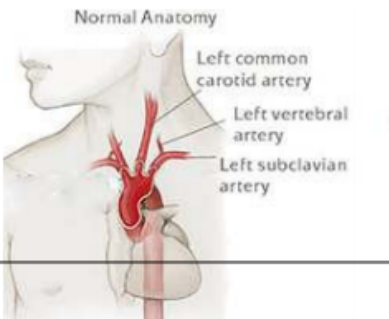
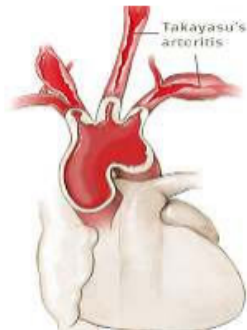


Fingers become white due to lack of blood flow, then blue as vessels dilate to keep blood in tissues, finally red as blood flow returns

- **White:** arteriolar vasospasm & reduced blood flow
- **Blue:** accumulation of deoxyhemoglobin
- **Red:** return of blood flow after release of Vasospasm

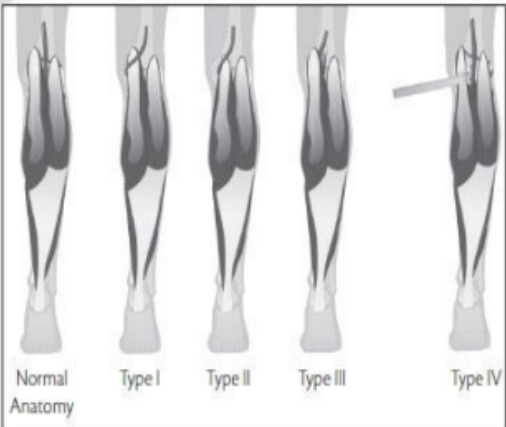
# TAKAYASU'S DISEASE

- ✓ **"Aortic arch syndrome" or the "pulseless disease".**
- ✓ A form of idiopathic large vessel granulomatous vasculitis with massive intimal fibrosis and vascular narrowing.
- ✓ Usually affecting aorta & it's branches



# POPLITEAL ARTERY ENTRAPMENT SYNDROME

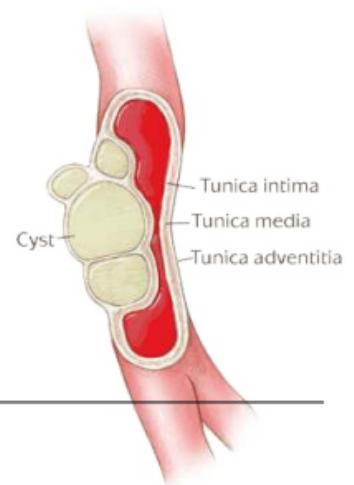
Symptomatic Compression / occlusion of popliteal artery due to developmentally abnormal relationship with medial head of gastrocnemius / popliteus muscle





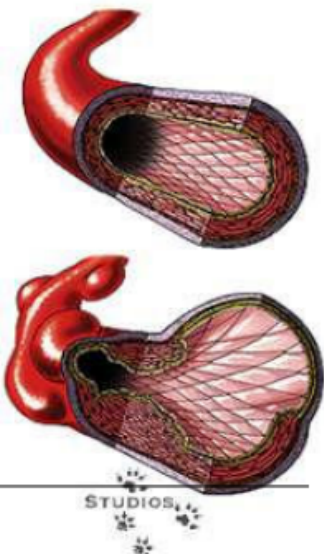
## CYSTIC MYXOMATOUS DEGENERATION

- Idiopathic accumulation of clear jelly like substances in the outer layers of main artery (like a synovial ganglion)
- More common in popliteal artery.



# FIBROMUSCULAR DYSPLASIA

- Developmental anomaly characterized by irregular thickening in medium and large arteries
- Due to Medial and intimal hyperplasia & fibrosis



# CLINICAL FEATURES

**CHINKY M**

**Roll No. 44**

## A CLINICAL SCENARIO

- A 60 year old man comes to OPD with history of **cramp like pain** in the left leg during walking for the past 5yrs, which used to relieve on taking rest, now presented with **continuous severe aching type** of pain even **at rest** on the same limb. There is also **blackish discolouration** of left big toe.

# Patient may present with...

- Claudication pain
- Rest pain
- Ischemic ulcer
- Pre gangrene
- gangrene



## INTERMITTENT CLAUDICATION

**CRAMP LIKE PAIN FELT IN THE MUSCLE THAT IS ;**

- brought on by walking
- not present on taking the first step
- relieved by standing still
- reproducible



### CLAUDICATION DISTANCE

The distance at which patient complains of pain after walking

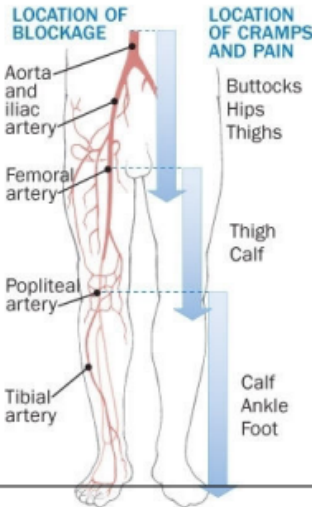
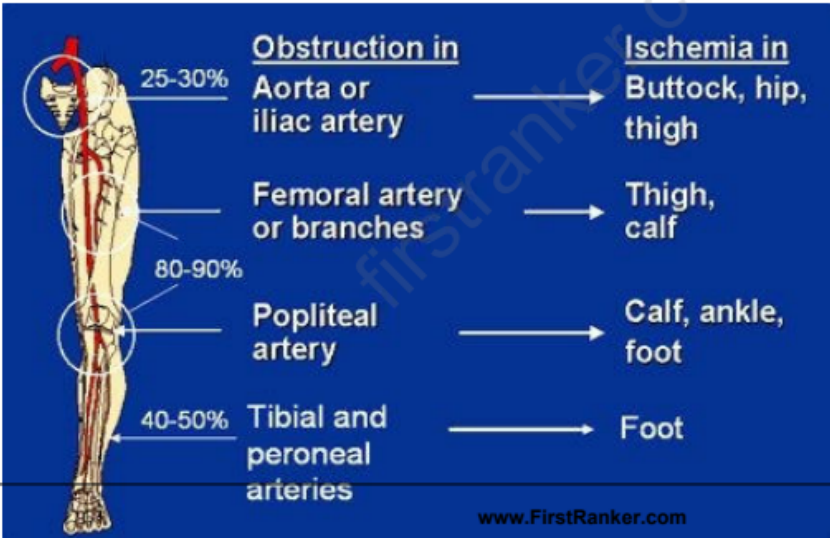
### MAXIMUM WALKING DISTANCE

Distance the patient can walk maximally with pain

# BOYD’S CLASSIFICATION OF CLAUDICATION PAIN

|         |                                                                                                        |
|---------|--------------------------------------------------------------------------------------------------------|
| GRADE 1 | Patient experiences pain after walking some distance. The person continues to walk and pain disappears |
| GRADE 2 | Pain persists and still continues to walk with effort.                                                 |
| GRADE 3 | Pain compels the patient to take rest.                                                                 |

# CLAUDICATION SITE ACCORDING TO THE LEVEL OF OBSTRUCTION





# REST PAIN

- Continuous aching type of pain in foot at rest  
*cry of dying nerves*
- Aggravated by elevation of leg above level of heart, lying down
- Reduced on hanging down
- worse at night



## ISCHEMIC ULCER

- Inadequate blood supply
- Tender; punched out edge;
- Deep-Base rests on bone/ligament/tendon
- Surrounding skin – cold, blue grey



# PRE GANGRENE

Changes in tissue which indicates that blood supply is inadequate to keep the tissue alive

- *Rest pain*
- *Colour changes*
- *Oedema*
- *Hyperaesthesia*

With or without ischaemic ulceration



## GANGRENE

- Macroscopic death of tissue with superadded putrefaction
- Common site is distal part of limb
- Others:
  - Appendix
  - Loop of intestine
  - Testis
  - Gall bladder



# CLINICAL FEATURES



- Colour changes
- Absence of pulsation
- Loss of sensation
- Loss of function
- Line of demarcation
- Lack of venous return

# CLINICAL TYPES OF GANGRENE

- DRY GANGRENE



- WET GANGRENE



## WET GANGRENE

- ✓ Occurs when venous as well as arterial occlusion is present
- ✓ Or when artery is suddenly occluded as in ligature or embolus
- ✓ Or in diabetes
- ✓ Infection and putrefaction is always present
- ✓ Affected part becomes swollen, discoloured and epidermis may be raised as blebs
- ✓ Crepitus may be palpated due to infection by gas forming organisms



## DRY GANGRENE

- Gradual slowing of blood stream as in atheromatous occlusion
- Affected part becomes dry, desiccated and mummified
- Discoloration of affected part





# SEPARATION OF GANGRENE

- Line of demarcation between viable and dying tissues
- Band of hyperaemia or hyperaesthesia
- Development of a layer of granulation tissue
- Ulceration follows & final line of demarcation develops



# FONTAINE CLASSIFICATION OF LIMB ISCHAEMIA

| STAGE     | FEATURES                                                                                    |
|-----------|---------------------------------------------------------------------------------------------|
| Stage I   | Asymptomatic                                                                                |
| Stage II  | Intermittent claudication<br>IIa- Well compensated > 200m<br>IIb- Poorly compensated < 200m |
| Stage III | Rest pain                                                                                   |
| Stage IV  | Ulceration or gangrene                                                                      |

# CRITICAL LIMB ISCHEMIA

- ☐ Persistent ischemic rest pain
- ☐ requiring regular analgesics for >2 weeks
- ☐ with or without ulceration or gangrene of the feet or toes
- ☐ Ankle systolic pressure < 50mm Hg or Toe systolic pressure < 30mm Hg and
- ☐ Ankle brachial pressure index < 0.3



# HISTORY

- Age and gender
- Limbs affected
- Bilateral or unilateral
- Mode of onset
- Pain
- Effects of warmth and cold
- Impotence
- Paresthesia

- Superficial phlebitis
- Involvement of other arteries
  - Chest pain, transient blurring of vision, weakness of body, abdominal pain, decreased urine output
- Diabetes ,hypertension, dyslipidemia
- Smoking
- Family history of atherosclerosis



# CLINICAL EXAMINATION

CRISTOSS GREGORY  
Roll No. 45

# INSPECTION

## SIGNS OF CHRONIC ISCHAEMIA

- THINNING OF SKIN
- DIMINISHED GROWTH OF HAIR
- LOSS OF SUBCUTANEOUS FAT, SHININESS
- TROPHIC CHANGES IN NAILS
- MINOR ULCERATIONS
- MUSCLE ATROPHY

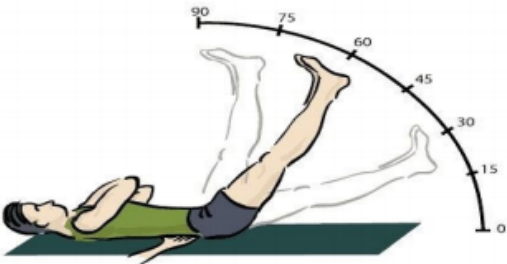


# BUERGER'S POSTURAL TEST

The patient is asked to raise his legs one after the other keeping the knees straight

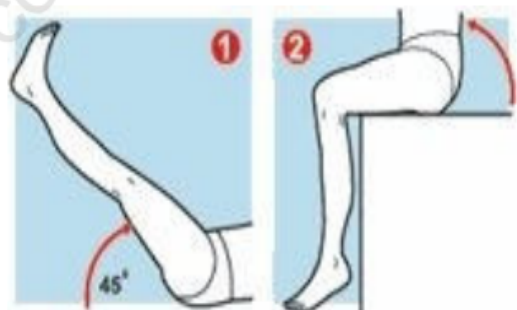
Ischemic limb – certain degree will cause marked pallor

**BUERGER'S ANGLE-** angle between limb and horizontal plane at which pallor appears  
**<30 - SEVERE ISCHAEMIA**



## CAPILLARY FILLING TIME

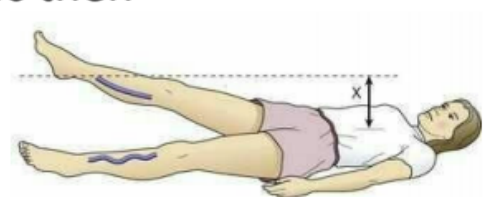
- After elevating the legs, patient is asked to sit up and hang his legs
- Time taken for the foot to become pink
- >20-30 sec indicate severe ischaemia





## VENOUS REFILLING

- After keeping the leg elevated for 30 sec then laid flat on bed
- Normal refilling-<5 seconds
- Ischaemia-veins collapse & guttered at 10-15



## FUCHSIG'S CROSSED LEG TEST

- Sits with the legs crossed one above the other
- The crossed leg- show oscillatory movements of the foot
- Synchronous to popliteal pulse
- If popliteal artery blocked-movements absent



## PALPATION

- Skin Temperature  
palpated with back of fingers  
temp is cold at ischemic site

## CAPILLARY REFILLING TIME

- Tip of the nail pressed for few seconds and the pressure released
- Time taken blanched area become pink
- Normal -2-3 seconds
- Longer in case of ischemic limb



# VENOUS REFILLING/HARVEYS SIGN

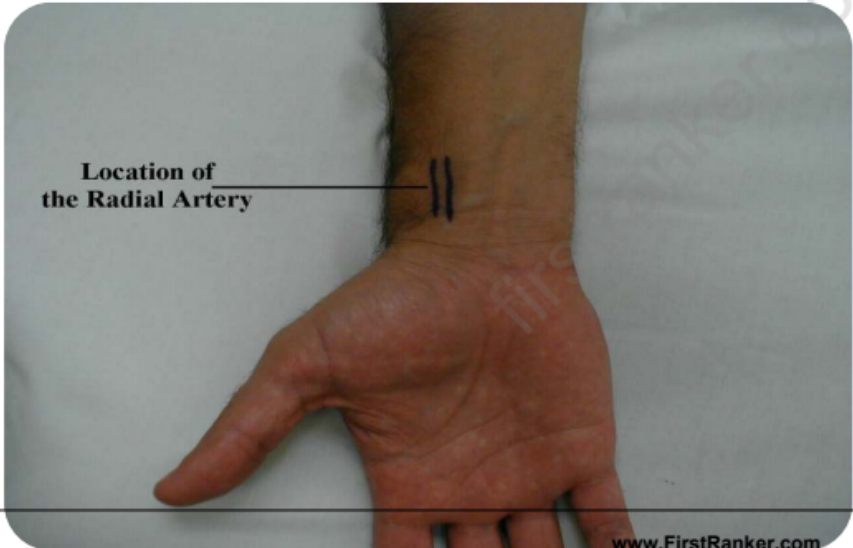
- Two index finger- side by side on a vein-pressed firmly
- the finger nearer to the heart is moved proximally so as to empty
- Distal pressure released
- Refilling observed
- **POOR- ISCHAEMIA**



# PALPATION OF BLOOD VESSELS



# LOCATION OF RADIAL PULSE



Felt at the wrist on lateral  
aspect against lower end  
of front of **radius**



**LOCATION  
OF ULNAR  
PULSE**

**Felt at the wrist on medial  
aspect against lower end of  
front of **ulna****





**LOCATION  
OF  
BRACHIAL  
PULSE**

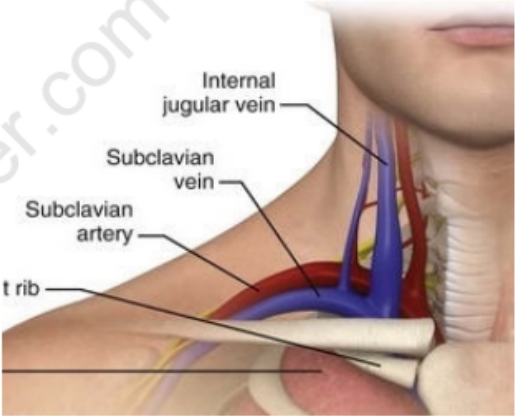
**Felt in front of **elbow**, just  
medial to the biceps brachii  
tendon**

**AXILLARY  
PULSATION**

Felt in the apex of the axilla  
against shaft of the **humerus**



**SUBCLAVIAN  
PULSATION**



**Felt against the first rib just  
above the middle of clavicle**



**SUPERFICIAL  
TEMPORAL  
ARTERY  
PULSATION**

**Felt in front of the tragus of the ear  
against the **zygomatic bone**.**



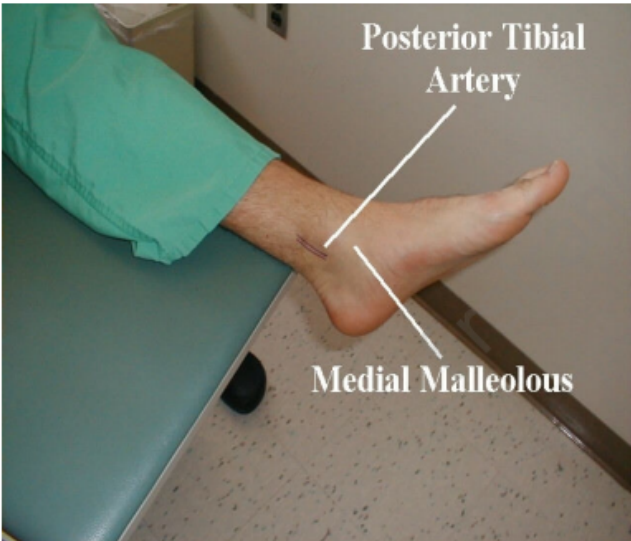
**DORSALIS  
PEDIS ARTERY  
PULSATION**

Felt just lateral to tendon of extensor hallucis longus at the proximal end of first web space, felt against **navicular** and middle cuneiform bones.



**ANTERIOR  
TIBIAL  
ARTERY  
PULSATION**

**Felt anteriorly in midway between the malleoli against the lower end of the **tibia** just above the ankle joint, lateral to extensor hallucis longus tendon**



POSTERIOR  
TIBIAL ARTERY

Pulsation is felt against **calcaneum** just behind medial malleolus midway between it and tendo-achilles

# POPLITEAL ARTERY

1. Knee flexed to 40 degrees with heel resting on couch. Examiner's thumb placed over tibial tuberosity and fingers placed over lower part of popliteal fossa.
2. Patient is prone. Examiner feels along the line of artery with fingertips after flexing the knee passively with another hand





**FEMORAL  
PULSATION**



At the groin just below inguinal ligament midway between the symphysis pubis and the anterior superior iliac spine against the **neck of femur**

## COLD AND WARM WATER TEST

- Raynaud's disease
- Asked to put hand in ice cold water-Hands become white
- Then hands put in hot water-Hands become blue due to cyanotic congestion



# ELEVATED ARMS TEST

- Thoracic outlet syndrome suspected
- Shoulder is abducted to 90 degree, arms externally rotated , hands opened and closed for 5 min
- Fatigue, pain, numbness, paresthesia, tingling sensation in forearms and fingers



## ALLENS TEST

- To test the patency of radial and ulnar arteries
- Clench the fist tightly, radial and ulnar arteries obliterated for 1 min now the fist is opened and hand appears white
- Relieving the pressure on either of the arteries if artery is patent the hand will regain normal colour



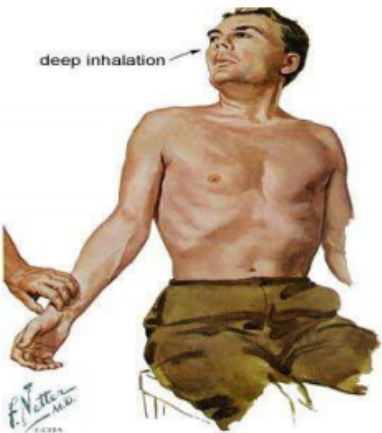
## COSTOCLAVICULAR COMPRESSIVE MANOEUVRE

- Radial pulse is felt shoulders moved backwards and downwards
- This compresses the subclavian artery leading to disappearance of radial pulse



# ADSONS TEST

- Positive in case of cervical rib and scalenus anticus syndrome
- Patient asked to take a deep breath and turn head to the affected side radial pulse is diminished due to compression of subclavian artery



# AUSCULTATION

## Arterial bruit

- Due to turbulent blood flow through a stenotic arterial segment.
- Transmitted distally along artery





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# INVESTIGATIONS



**DARSANA RAJ**  
**Roll No.45**



# NON INVASIVE INVESTIGATIONS



# GENERAL INVESTIGATIONS

❖ **BLOOD ROUTINE** – Hemoglobin, TC, DC, Platelet count, ESR

❖ **RISK FACTORS**

*DM* - FBS, PPBS, HbA1C

*ATHEROSCLEROSIS* - Lipid profile

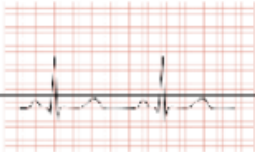
❖ **CHEST X RAY**

❖ **PULMONARY FUNCTION TESTS**

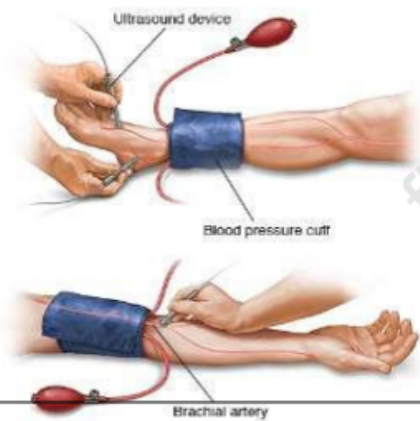
❖ **BASELINE ECG, EXERCISE ECG**

❖ **ECHOCARDIOGRAM**

❖ **RENAL FUNCTION TEST**



# ANKLE BRACHIAL PRESSURE INDEX(ABPI)

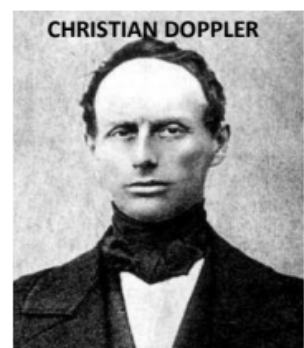


• **ABPI = Ankle systolic pressure  
Brachial systolic pressure**

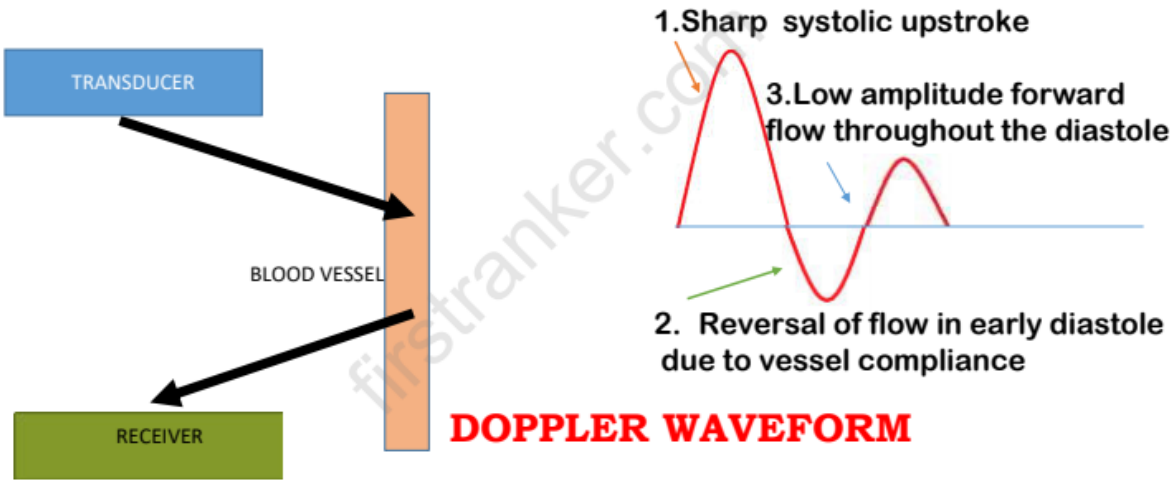
- $\geq 1$  - NORMAL**
- $< 0.9$  – CLAUDICATION**
- $< 0.5$  – REST PAIN**
- $< 0.3$  – IMMINENT NECROSIS**
- $> 1.4$  – CALCIFIED VESSEL**

## DOPPLER ULTRASOUND

- Indicates moving blood
- Can assess systolic pressure in small vessels
- Measure segmental difference in BP in limb

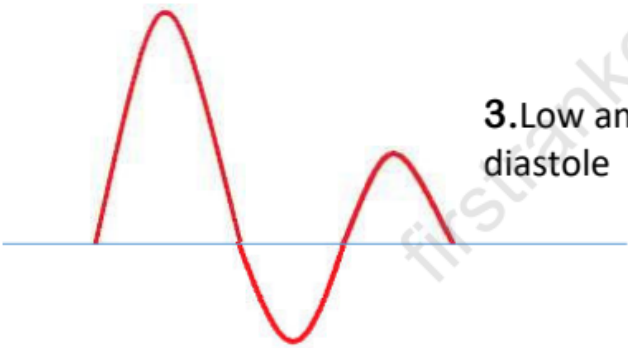


# PRINCIPLE : DOPPLER SHIFT



# DOPPLER WAVEFORM

1.Sharp systolic upstroke

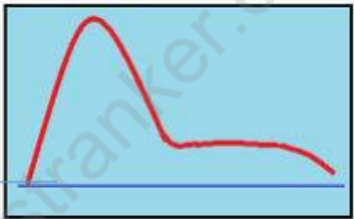
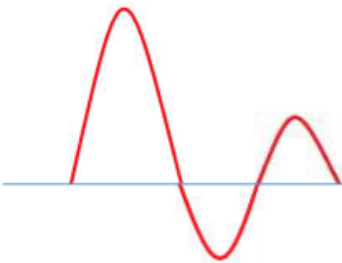


3.Low amplitude forward flow throughout the diastole

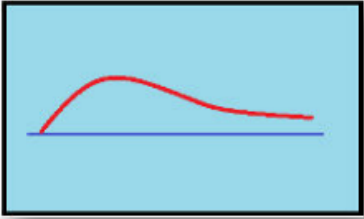
2. Reversal of flow in early diastole due to vessel compliance

**PROGRESSIVE**

**SEVERE DISEASE**



**BIPHASIC PATTERN/  
MULTIPHASIC PATTERN**  
Diastolic reversal lost



**MONOPHASIC PATTERN**  
Blunting of arterial waveform  
& Increased diastolic flow

## DUPLEX SCANNING

- Doppler + **B mode ultrasound**(images vessels)
- Second beam insonates imaged vessel
- Doppler shift is assessed

**Colour doppler:** colours indicate change in direction and velocity of flow.

- **MORE COST EFFECTIVE AND SAFE COMPARED TO ANGIOGRAPHY**

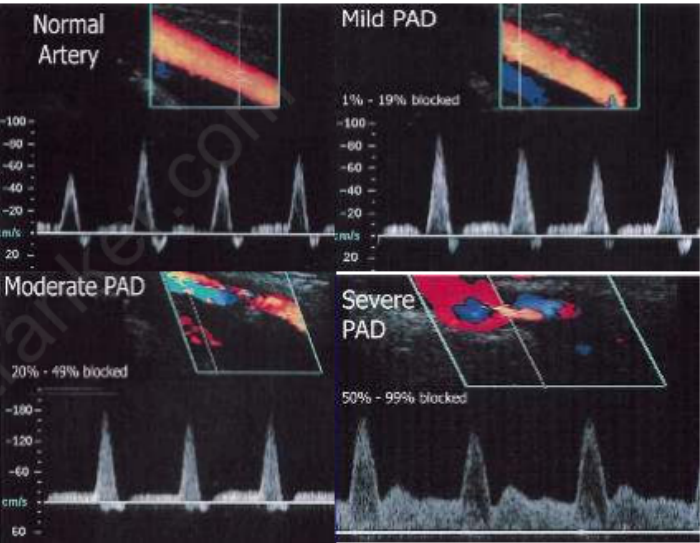




➤ **Blue**-flow away from the transducer

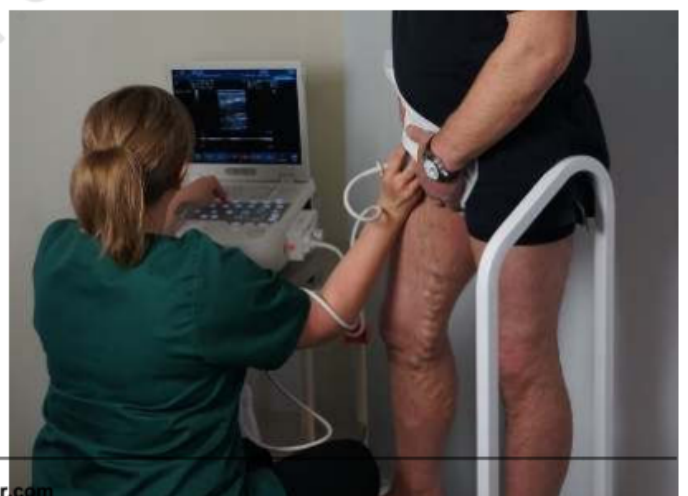
➤ **Red**-flow towards transducer

Brighter the colour, faster the velocity

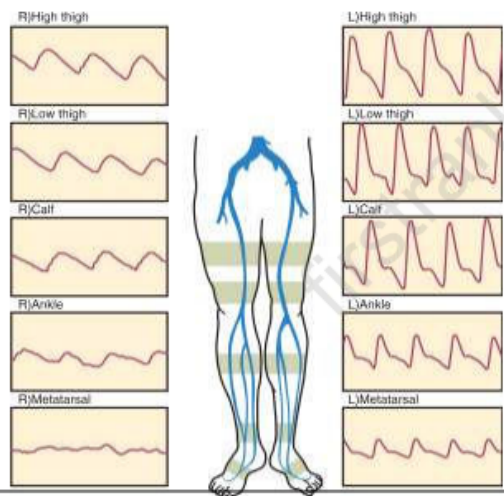


## USES OF DUPLEX

- a) Precise anatomical localisation of lesions
- b) Quantitative severity of disease
- c) Assess plaque morphology



# SEGMENTAL PLETHYSMOGRAPHY



- Non invasive
- Detect changes in blood volume between systole and diastole
- **Photoplethysmography**  
cutaneous microcirculation

# INVASIVE INVESTIGATIONS

## DIAGNOSTIC ARTERIOGRAPHY

- **Gold standard** investigation prior to intervention
- Involves injection of radiopaque solution into arterial tree
- **Retrograde percutaneous catheterization**  
(**Seldinger technique**) commonly used
- Usually involves femoral artery



# CONTRASTS USED

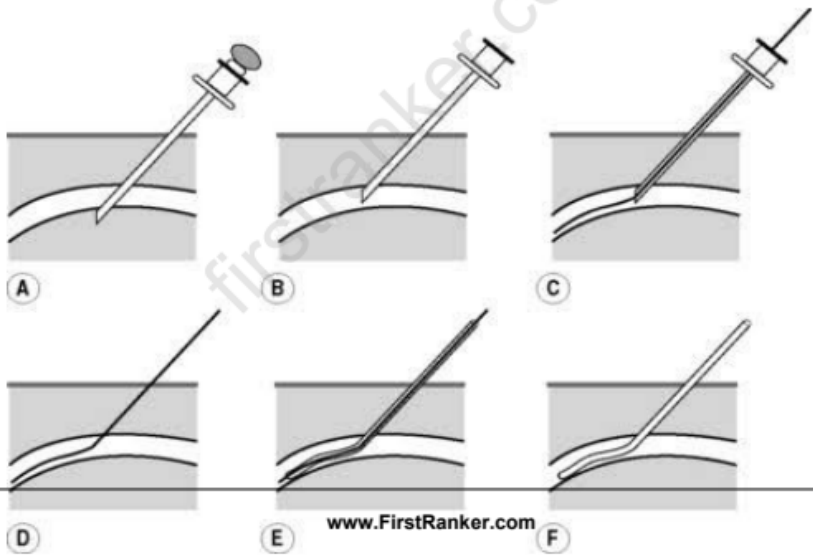
→ Sodium diatrizoate  
(Hypaque45)

→ Meglumine diatrizoate

→ Ionohexal

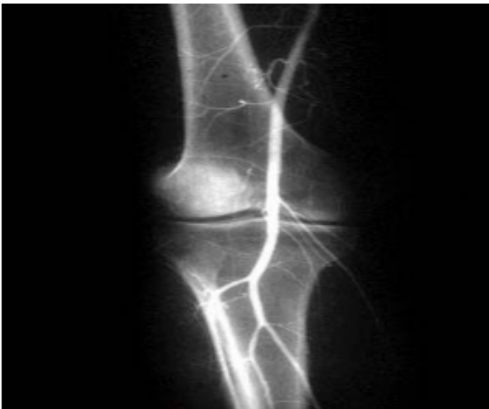


# SELDINGER TECHNIQUE



# ARTERIOGRAPHIC INFORMATION

- ❖ Site of occlusion
- ❖ Extent & Nature of occlusion
- ❖ Patency of vessel proximal/distal to occlusion
- ❖ State of collateral circulation





# COMPLICATIONS

## Puncture site or Catheter related

- Hemorrhage
- Pseudoaneurysm
- AV fistula
- Thrombosis&  
Embolism
- Neurological  
complications

## Contrast agent related

- Anaphylactoid
- Allergic reactions
- Vasodilation
- Nephrotoxicity

## DIGITAL SUBTRACTION ANGIOGRAPHY

- ❖ Employs computer system to digitise angiographic image
- ❖ Precontrast images subtracted from contrast image
- ❖ Remove extraneous background → clarity
- ❖ Intra- arterially or intravenously(multilevel occlusion)
- ❖ **Disadvantages** : cost factor and availability
- ❖ **Complications** : anaphylaxis, bleeding, thrombosis

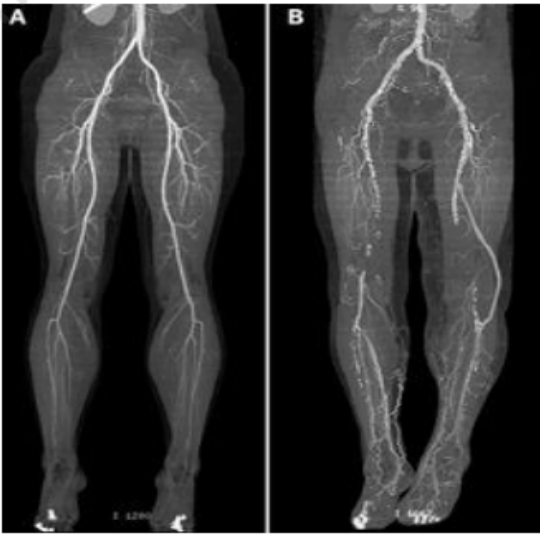


Figure 23-6. Digital subtraction angiography (DSA) provides excellent visualization of intravascular circulation with intra-

# CT ANGIOGRAPHY

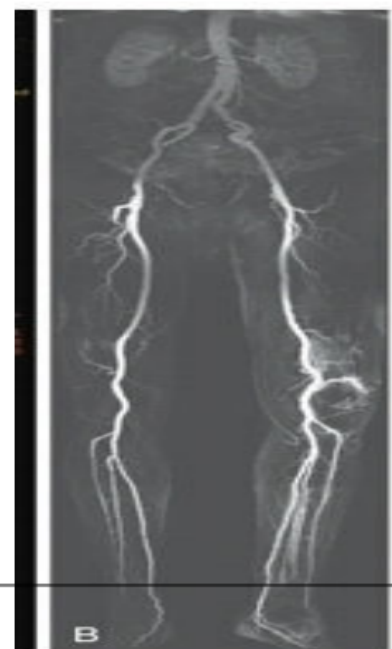
- Contrast dependant
- Rendered in 3D format, can be rotated and viewed in different directions
- **Disadvantage:** Exposure to radiation
- **Advantage:** More rapid than MRA

It shows entire vessel



## MAGNETIC RESONANCE ANGIOGRAPHY

- **Principle:** Rearrangement of protons in a strong magnetic field & multiplanar imaging
- **Dye used:** *Gadolinium*
- **Contraindications:** Patients with pacemakers, intracerebral shunts, cochlear implants
- **Disadvantages:** Poor visibility of peripheral circulation & collateral circulation



## INVESTIGATION FOR VASOSPASM

- Method : nerve block with local anaesthetic
- Nerve block relieves sympathetic vasospasm → rise in skin temperature
- Rise in skin temperature recorded & compared with mouth temperature.
- **Brown's vasomotor index =**

$$\frac{\text{Rise in skin temperature} - \text{rise in mouth temperature}}{\text{Rise in mouth temperature}}$$

- Sympathectomy done only when index is **3.5 or more**.



# Medical MANAGEMENT OF POVD

DEEPAK PETER  
Roll No. 47

## GENERAL MEASURES

- STOP SMOKING

Smoking → Progression of atheroma → Bypass graft failure

- CARE OF FOOT ( **CHIROPODY** )

- Well fitting footwear

- Heel raise

---

- Avoid exposure to more cold & warm temperature , trauma

# Taking care of your feet in diabetes

- 

**1** Wash your feet daily with lukewarm water and soap.
- 

**2** Dry your feet well especially between the toes.
- 

**3** Apply moisturising lotion, but do not apply between the toes.
- 

**4** Check your feet for blisters, cuts, redness, etc. If present, consult your doctor.
- 

**5** Trim your nails straight across and file the edge with a nail file.
- 

**6** Change socks daily; avoid dirty and tight socks.
- 

**7** Never walk barefoot either indoors or outdoors.
- 

**8** Examine your shoes daily for cracks, stones, nails which may irritate feet.



- Control of diabetes and hypertension, hyperlipidemia
- Reduction of weight
- Regular exercise(Walking within limits of disability)



## Buergers position and Exercise

Regular graded isometric exercises up to the point of claudication improves the collateral circulation.

In buergers position head end of bed is raised foot end of bed is lowered to improve circulation

## SPECIFIC DRUGS

- **ASPIRIN** Nonselective COX inhibitor
- **CLOPIDOGREL** Antiplatelet drug
- **CILOSTAZOL** PDE-3 inhibitor
- **PENTOXIPHYLLINE** Reduces blood viscosity , improves RBC flexibility
- **XANTHINOL NICOTINATE** Vasodilator
- **PGE1** vasodilator

## SPECIFIC DRUGS

### ■ Low dose aspirin

Nonselective COX inhibitor

-Antithrombotic & analgesic

-May also be used after bypass surgery or angioplasty

-Dose : 75 mg OD

-Side effects like nausea , vomiting, epigastric distress



■ **Clopidogrel**

Antiplatelet drug

P2Y<sub>12</sub> receptor blocker

Dose : 75 mg OD

Utilized for checking restenosis for stented coronaries

Most important adverse effect : Bleeding

Action lasts for 5 -7 days due to irreversible receptor blockade



[www.abany.com](http://www.abany.com) - 0524038



## ■ Cilostazol

PDE-3 inhibitor

Indicated for intermittent claudication in patients with no rest pain or heart failure

Dose : 100 mg BD, 30 min before or 2 hour after food

Most common side effect – Headache

More effective than Pentoxifylline

■ **Pentoxiphylline**

Weak PDE inhibitor

Reduces blood viscosity , improves RBC flexibility

Dose : 400 mg BD-TDS

Mainly used in intermittent claudication

Available as **TRENTAL-400**

Side effects like nausea , vomiting but well tolerated



■ **Xanthinol nicotinate**

Compound of xanthine & nicotinic acid

Vasodilator

Dose : 300-600 mg TDS oral

Available as **COMPLAMINA** tab





## PGE1

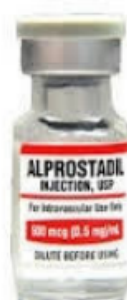
Potent vasodilator , inhibitor of platelet aggregation

Dose: 5-30 ng/kg/min

Administration : IV infusion: 100 mcg/500 ml NS

Infused slowly for 10 hours per day for 5 days

Eg:alprostadil



# SURGICAL MANAGEMENT OF POVD

DEEPAK ROY

Roll no.48

# Approach to surgical management- TransAtlantic Inter-Society Consensus (TASC) Classification

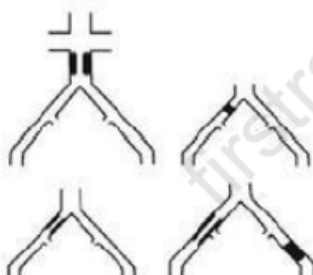
## Type A lesions



### TYPE A LESIONS

- Unilateral or bilateral stenoses of CIA
- Unilateral or bilateral single short (3 cm) stenosis of EIA

## Type B lesions



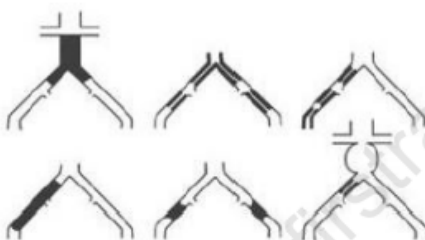
### TYPE B LESIONS

- Short (3 cm) stenosis of infrarenal aorta
- Unilateral CIA occlusion
- Single or multiple stenoses totaling 3–10 cm involving the EIA not extending into the CFA
- Unilateral EIA occlusion not involving the origins of internal iliac or CFA

Type C lesions



Type D lesions



#### TYPE C LESIONS

- Bilateral CIA occlusions
- Bilateral EIA stenoses 3–10 cm long not extending into the CFA
- Unilateral EIA stenosis extending into the CFA
- Unilateral EIA occlusion that involves the origins of internal iliac and/or CFA
- Heavily calcified unilateral EIA occlusion with or without involvement of origins of internal iliac and/or CFA

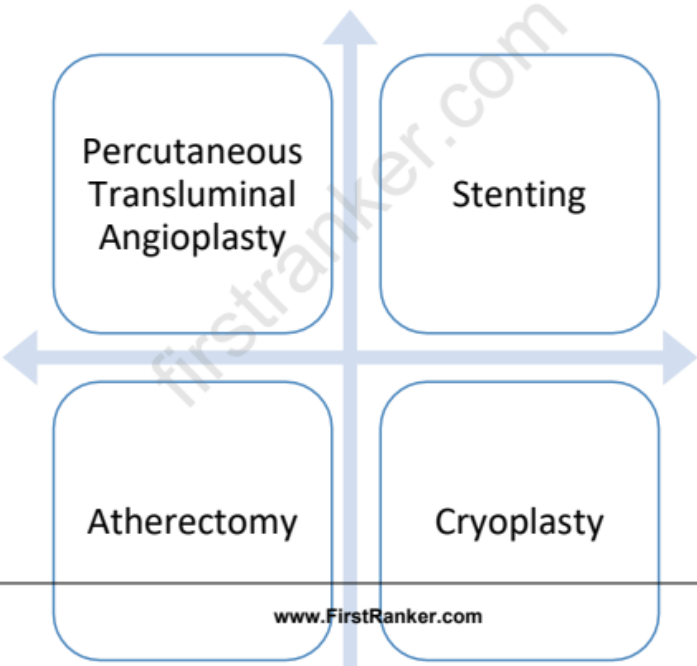
#### TYPE D LESIONS

- Infrarenal aortoiliac occlusion
- Diffuse disease involving the aorta and both iliac arteries requiring treatment
- Diffuse multiple stenoses involving the unilateral CIA, EIA, and CFA
- Unilateral occlusions of both CIA and EIA
- Bilateral occlusions of EIA
- Iliac stenoses in patients with AAA requiring treatment and not amenable to endograft placement or other lesions requiring open aortic or iliac surgery

## Based on TASC

- **Type A lesions - Endovascular treatment**
- **Type B lesions - Endovascular treatment**
- **Type C lesions – Surgery**
- **Type D lesions - Surgery**

# ENDOVASCULAR PROCEDURES

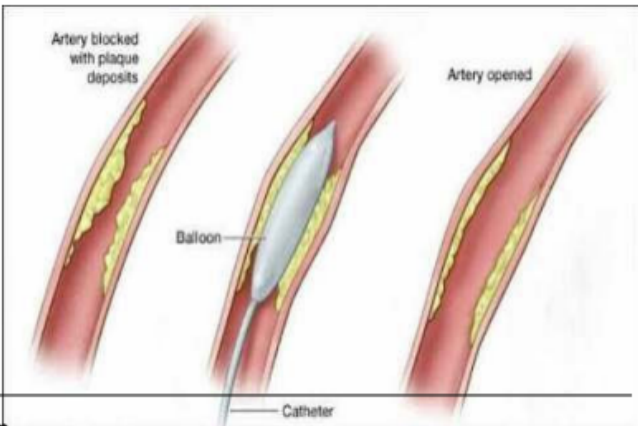


# PERCUTANEOUS TRANSLUMINAL BALLOON ANGIOPLASTY ( PTA )

- Done when Stenosis <5cm

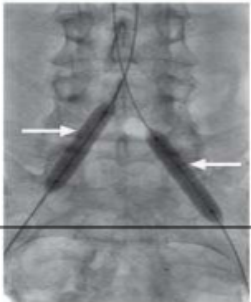
## INDICATIONS

- Incapacitating Claudication
- Rest pain
- Limb salvage in limb threatening ischemia
- Vasculogenic Impotence



## STEPS

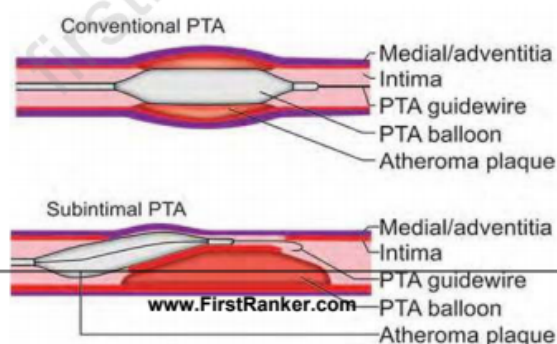
- Angiogram
- Introduce guidewire & balloon catheter
- Balloon inflated
- Plaque ruptures
- Satisfactory dilation confirmed by angiogram





## TYPES OF PTA

- **Conventional** : balloon is inflated along the lumen to break the plaque circumferentially
- **Sub intimal** : balloon is inflated after passing sub intimal plane to break the plaque

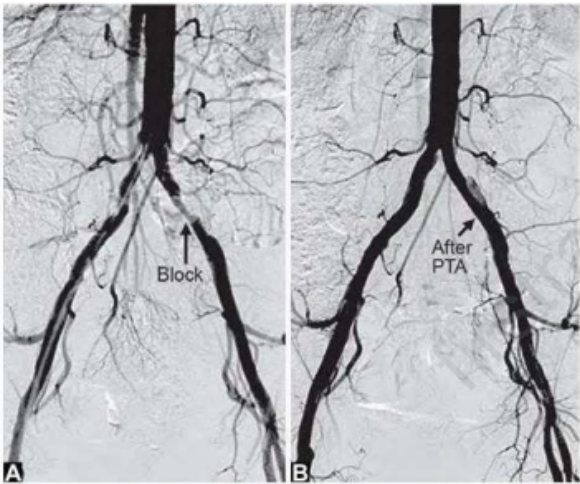


## ADVANTAGES:

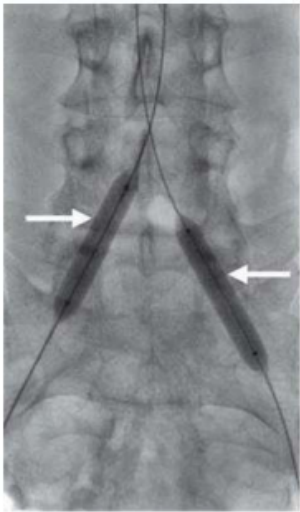
- Faster Recovery
- No general anesthesia
- Saphenous veins are preserved
- May be combined with surgery

## COMPLICATIONS

- Re-stenosis
- Haematoma
- Haemorrhage & Pseudoaneurysm
- Thrombosis and distal embolism



**Figs 1.357A and B:** DSA showing left sided aortoiliac block and correction after doing PTA.



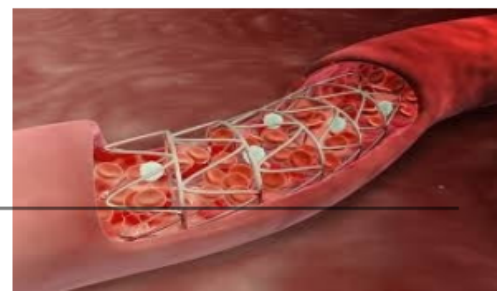
**Fig. 1.356:** Percutaneous transluminal balloon angioplasty (PTA).  
Note the inflated balloons on both side iliac arteries.

## STENTING

Expandable device at the site of occlusion

To prevent re-stenosis

(elastic recoil, constrictive remodeling and intimal hyperplasia)



• IDEAL INTRAVASCULAR STENT

- High radiopacity
- Minimal or no foreshortening
- Longitudinal flexibility
- Radial elasticity
- Retrievability
- High expansion ratio



# TYPES OF STENTS

## 1. Balloon expandable stents

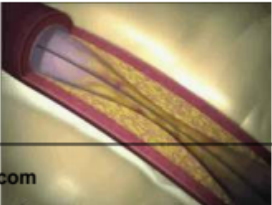
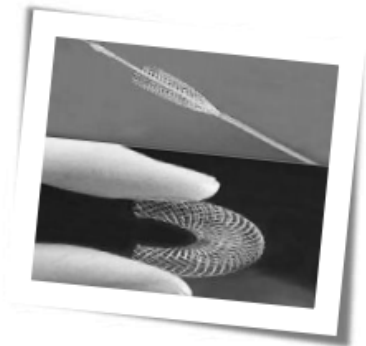
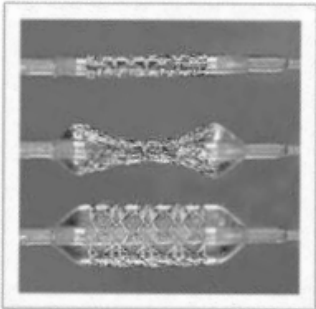
Stent has high tensile strength and crush resistance once inflated.

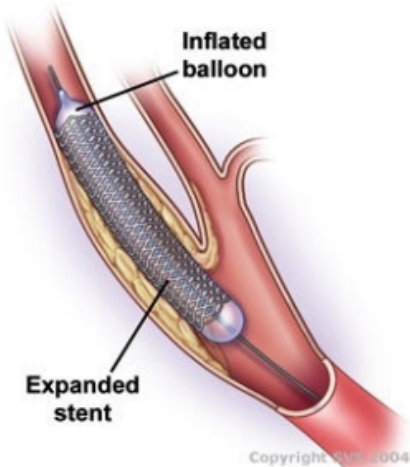
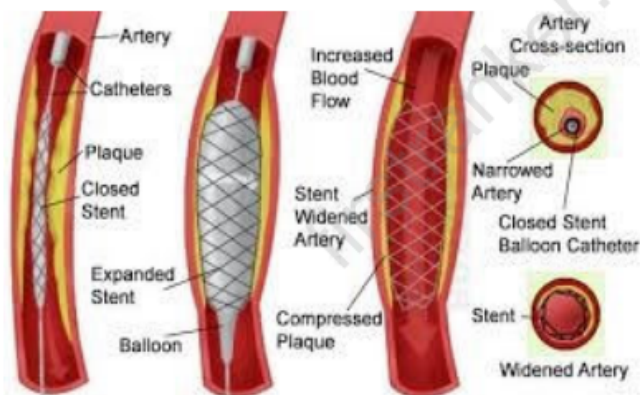
-E.g. : Palmaz stent , Strecker stent

## 2. Self expandable stent

It is made of stainless steel ( The Wallstent ) or Nitinol alloys.

## 3. Drug eluting stents





## DRUG ELUTING STENTS

- DES releases drug to block cell proliferation
- Drugs like **paclitaxel** , **sirolimus**
- Superior to bare metal stents





## COMPLICATIONS OF STENTING

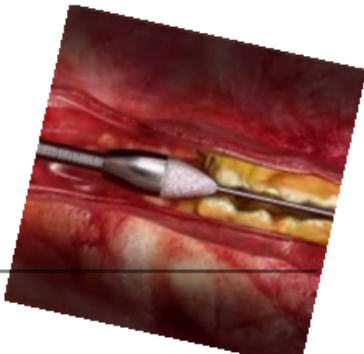
- Allergic reactions
- Bleeding
- Blockage of artery
- Stent thrombosis



# ATHERECTOMY



- Physical removal of atheromatous plaque
- Through open surgery or percutaneous route
- The obstructing fibrous plaque is pulverized into micro particles and washed away
- Typically a balloon or stent procedure follows



# TYPES OF ATHERECTOMY



## CRYOPLASTY

- Balloon angioplasty + cryotherapy.
- In **Cryoplasty**, Balloon catheter filled with liquid nitrous oxide reaches the blockade
- Liquid N<sub>2</sub>O evaporates into a gas
- Balloon inflates & freezes surrounding tissues
- Induce apoptosis in smooth muscle cells



# **SURGICAL PROCEDURES IN POVD**

**DEEPTHI ROY S**  
**Roll No.49**

# INDICATIONS

Surgical operations are reserved for patients with severe symptoms where angioplasty has failed or is not possible

TASC 

- Type A lesions - Endovascular treatment
- Type B lesions - Endovascular treatment
- Type C lesions - Surgery
- Type D lesions - Surgery

## SURGICAL METHODS:

- [redacted]  $\Rightarrow$  MC method
- Endarterectomy
- Profundoplasty
- Sympathectomy
- Amputations  $\Rightarrow$  last resort

## SURGICAL BYPASS GRAFTING

- What is bypass graft??

A native vein(mostly LSV) or a prosthetic material is used for bypassing obstruction in the vessel

- This method is employed when there is **segment of artery is occluded with distal ends patent.**



## MATERIALS USED:

### NATURAL GRAFT

- Long saphenous vein graft
- Short saphenous vein graft
- human umbilical vein graft

### SYNTHETIC GRAFT

- PTFE(polytetrafluoroethylene)
- Dacron Graft

gives best result

If LSV not available, short saphenous vein may be used

# LONG SAPHENOUS VEIN

Can be used as:

## Reverse graft

- Saphenous vein is dissected out, reversed & sutured above and below to respective arterial segments
- Why Reversed? to nullify action of valves
- Less patency

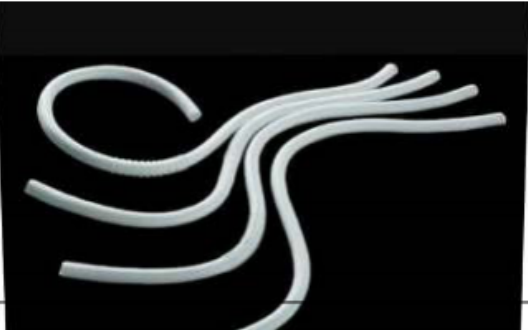
*Most useful and successful*

## Insitu graft

- Saphenous vein intact in same position, sutured above and below blocked region after arterialisation.
- Arterialisation-venous Valves are removed with valvulotomy instrument.
- Better long term patency

# SYNTHETIC GRAFT

- PTFE (polytetrafluoroethylene) → Low risk of disintegration with infection
- Dacron Graft- woven/knitted Low thrombogenicity
- Low tissue reaction



# BYPASS PROCEDURES

*In LOWER LIMB, can be classified into:*

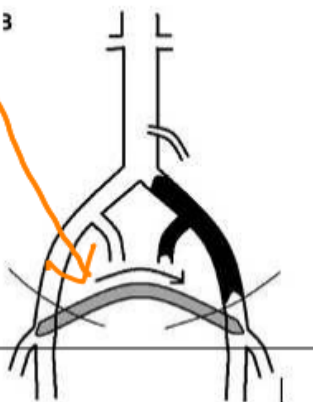
## Anatomical procedures

- Bypass procedure that preserves normal anatomical pathways
  - Aortofemoral bypass
  - Femoropopliteal bypass



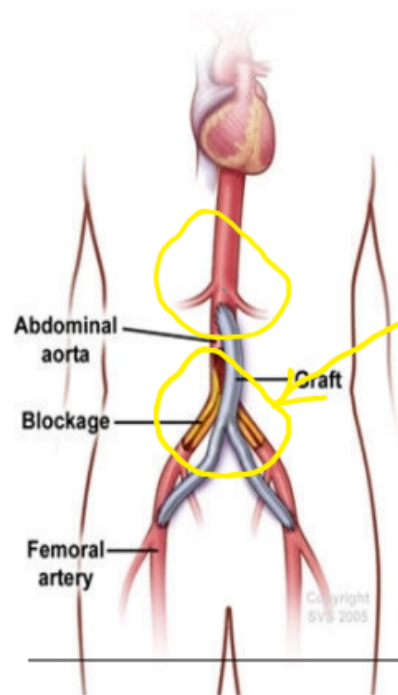
## Extraanatomical procedures:

- These are procedures that circumvents "normal" anatomical pathways.
  - Femorofemoral
  - Iliofemoral
  - Axillofemoral
  - Axillobifemoral



# AORTOFEMORAL BYPASS

- Done in Aortoiliac occlusion
- surgical bypass is from the infra-renal abdominal aorta to both femoral arteries.



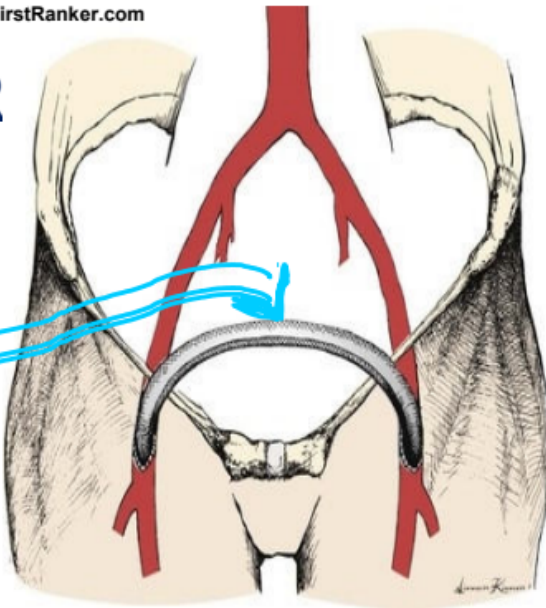
# FEMOROPOPLITEAL BYPASS

- Indication- disease in **superficial femoral artery** with **profunda femoris occlusion**
- Bypass is from femoral to popliteal artery



# FEMOROFEMORAL CROSSOVER GRAFT

- Operation of choice in unilateral iliac occlusion.
- The graft is placed in a **tunnel** which can either be a subcutaneous suprapubic tunnel or behind the rectus muscle
- PTFE graft is usually used ,Anastomosed end to side

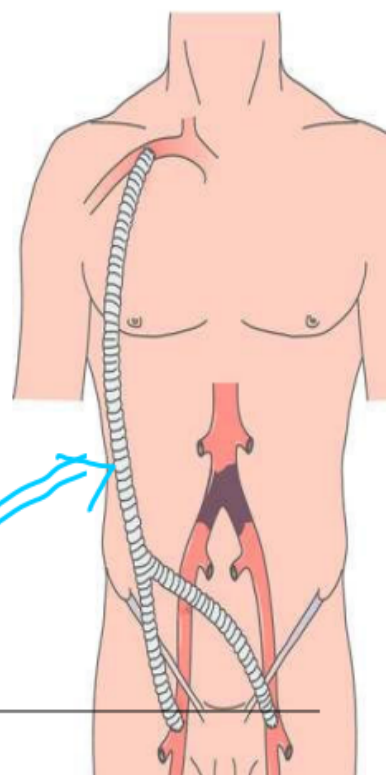


# AXILLO FEMORAL & AXILLOBIFEMORAL BYPASS

Axillofemoral-

- From axillary artery to femoral artery
- in bilateral iliac occlusion with pregangrenous limb on one side

Axillobifemoral bypass





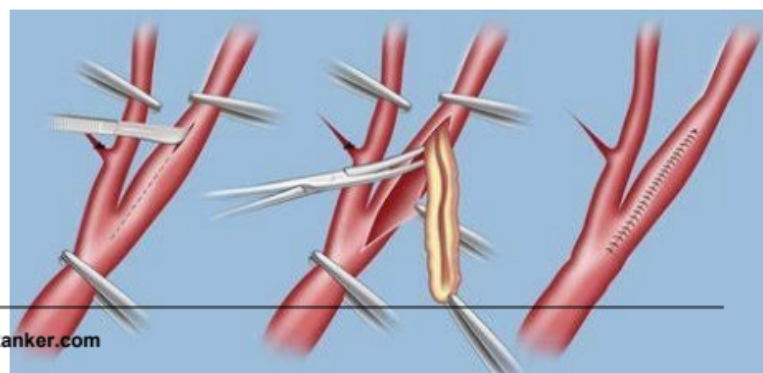
*Problem with graft:*

- *Leak*
- *Infection*
- *Thrombosis*
- *Cost is more*
- *Not easily available*
- *Reblock*

## ENDARTERECTOMY

- It is the removal of thrombus, along with diseased intima through an **arteriotomy**
- Done mostly in carotid, aortoiliac obstruction

**Disobliteration /  
reboring**



# OPEN METHOD

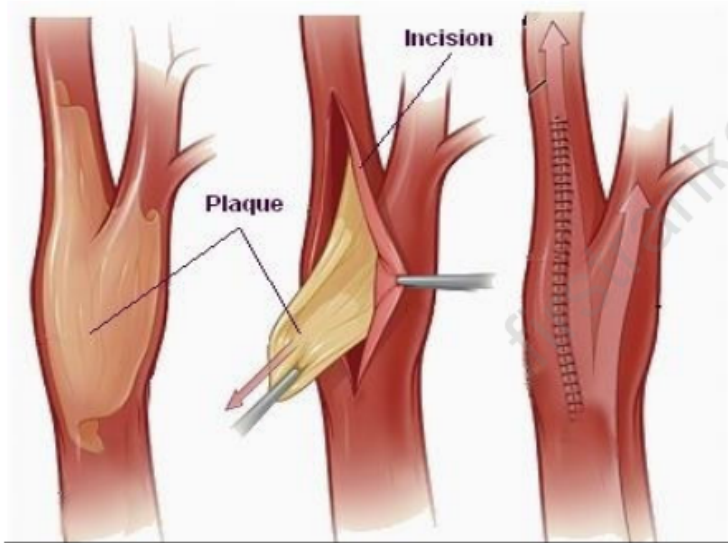
Arteriotomy done along entire diseased segment



Thrombus removed along with diseased intima– endarterectomy



Arteriotomy closed with suture and patient heparinised



Endarterectomy Procedure

# SEMI CLOSE METHOD

two arteriotomies at either ends of  
level of obstruction

↓  
Endarterectomy done with  
endarterectomy stripper

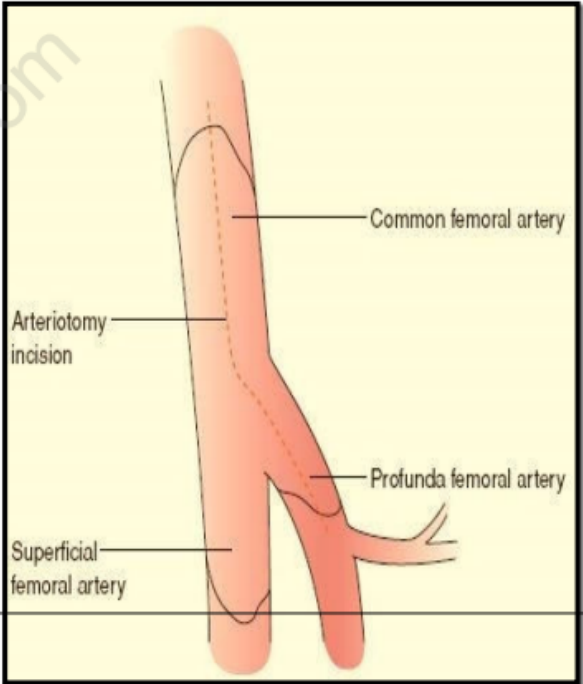
↓  
closure of arteriotomies



Advantage of endarterectomy- it avoids prosthetic graft & its complications  
Problem is- Reocclusion & stenosis

# PROFUNDOPLASTY

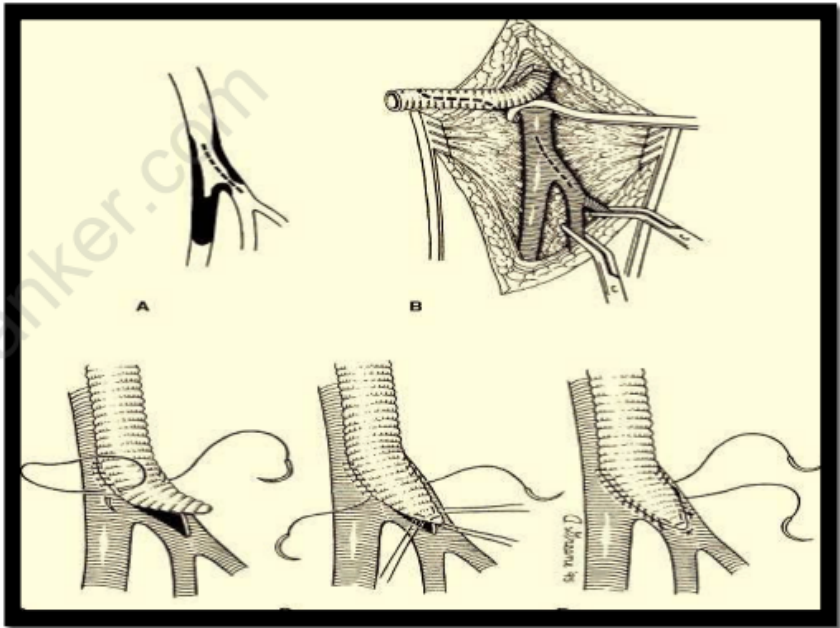
- Done when there is localized **block in the opening of Profunda femoris artery**.
- **Incision in common femoral artery and carried down into profunda femoris.**
- Profunda femoris is opened, thrombus if present, is removed.
- Opening is widened with vein or dacron grafts.



• Importance—

Opens collaterals across knee joint to open through profunda femoris, so gives **good blood supply below knee level and may prevent above knee amputation.**

(if below knee amputation, better outcome with prosthesis)



## SYMPATHECTOMY

- Surgical cutting of sympathetic nerve trunk or removal of a ganglion to relieve a condition affected by its stimulation.
- Principle- when sympathetic stimulation is removed, it **increases cutaneous blood supply** thereby promoting healing of ulcer and skin flaps in amputation.

INDICATIONS:

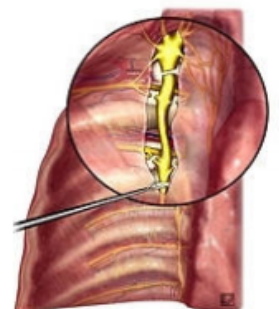
- This should be done if there is no chance for direct arterial surgery or angioplasty. **It has no role in treatment of intermittent claudication.**

| In Upper Limb                                                                                                                                                                                        | In Lower Limb                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Cervical rib with vascular manifestation</li><li>• Raynaud’s phenomenon</li><li>• Hyperhydrosis</li><li>• Upper Limb vasospasm</li><li>• Causalgia</li></ul> | <ul style="list-style-type: none"><li>• Thromboangiitis obliterans</li><li>• <b>Promote healing of cutaneous ulcer</b></li><li>• To change level of amputation and make flaps to heal better after amputation</li></ul> |



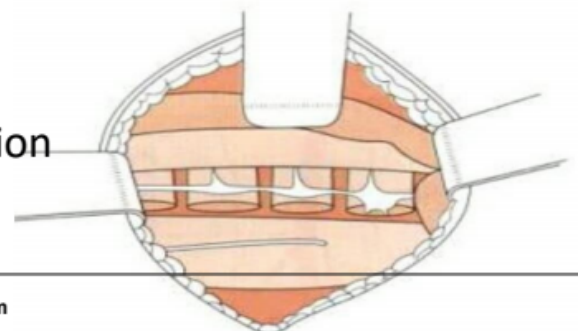
## CERVICODORSAL SYMPATHECTOMY

- Removal of 2<sup>nd</sup> and 3<sup>rd</sup> thoracic ganglia which contains cells of postganglionic fibers supplying upper limb



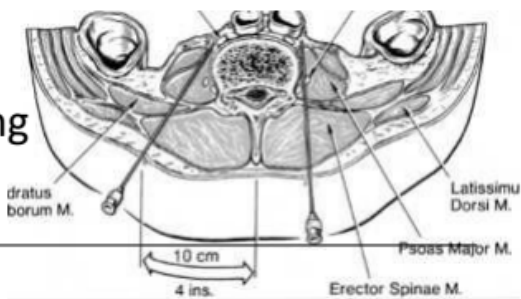
## LUMBAR SYMPATHECTOMY

- L2,L3,L4 ganglia removed
- If L1 removed, it leads to failure of ejaculation



# CHEMICAL SYMPATHECTOMY

- 5ml phenol in water is injected lateral to vertebral bodies of 2<sup>nd</sup> to 4<sup>th</sup> lumbar vertebrae.
- This procedure is contraindicated in patients taking anticoagulants



# AMPUTATION



## AMPUTATION

- Amputation should be considered when part of a limb is **dead, deadly OR a dead loss**
- Limb is dead when arterial occlusion is severe enough to cause gangrene



**Amputation is inevitable when arterial surgery and conservative treatment fail**

# TYPES OF AMPUTATIONS

## MAJOR AMPUTATION

- *Below knee amputation*
- *Above knee amputation*

## MINOR AMPUTATION

Amputation of a toe or part of foot

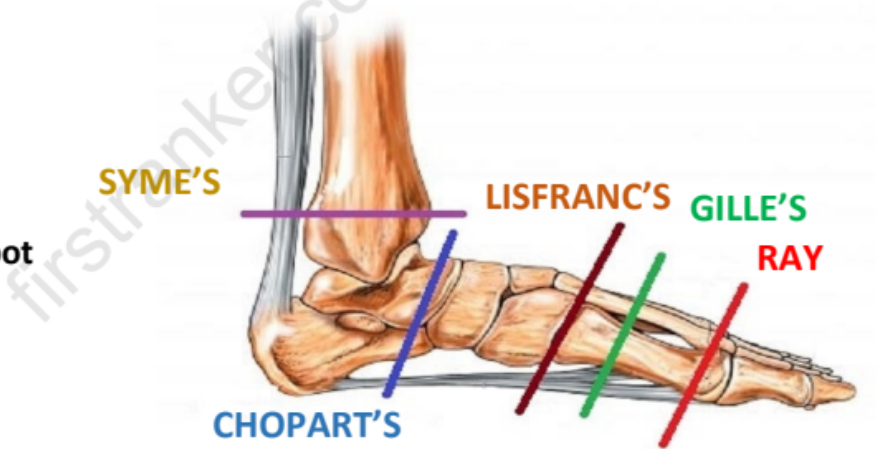
Eg: Ray Amputation

Gillies' Amputation

Lisfranc's Amputation

Chopart's amputation

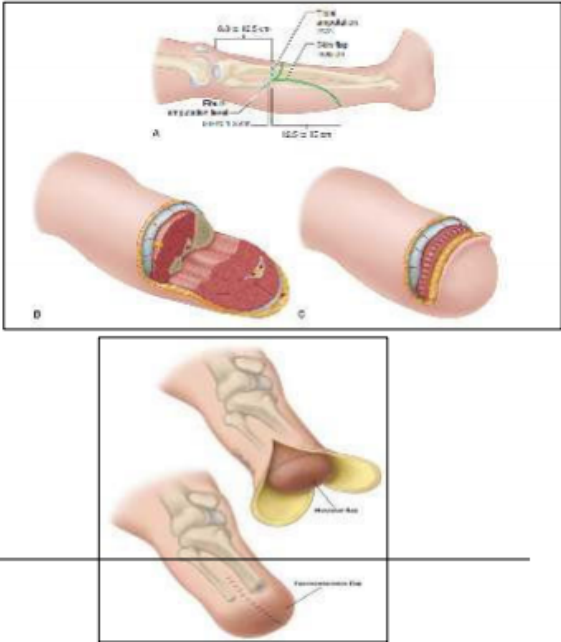
Syme's amputation



# MAJOR AMPUTATION

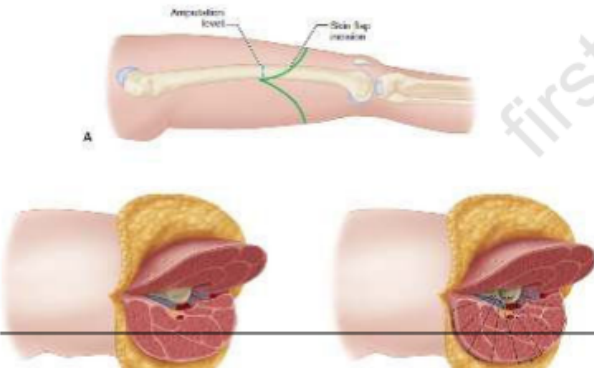
## BELOW KNEE AMPUTATION / BURGESS AMPUTATION

- Preserves knee joint and gives best chance of walking again with prosthesis.
- 2 types of skin flap are used-
  - long posterior flap
  - skew flap
- Stump length- 14-17cm from knee joint



# ABOVE KNEE AMPUTATION

- Done in ischemia, sepsis, trauma, gangrene which is spreading above
- Equal curved anterior and posterior flaps are used
- Ideal femur stump length- 25cm from tip of trochanter



# GUILLOTINE AMPUTATION

- Done either in **emergency conditions** like severe sepsis, gas gangrene, and machinery entrapment Or for the control of infection before a second definitive higher amputation
- Here all tissues are divided at same level
- Wound is left open at the end of the stump





# PROSTHESIS

It is an artificial device that helps in replacement of whole or a part of missing extremity.

## COMMONLY USED PROSTHESES

- Above knee amputation – suction type prosthesis
- Below- knee amputation – PTB(patellar tendon bearing), SACH prosthesis
- Syme's amputation – elephant boot, Canadian syme's prosthesis
- Partial foot amputation- shoe fillers

**ADVANTAGES :**

- Function of parts relatively retained
- Cosmetic

**DISADVANTAGES**

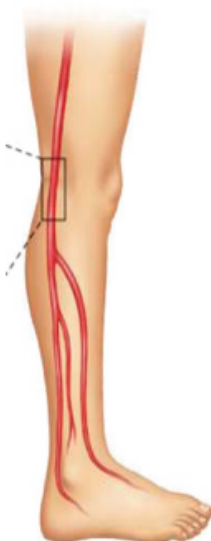
- Infection
- Pressure ulcers
- Joint disability



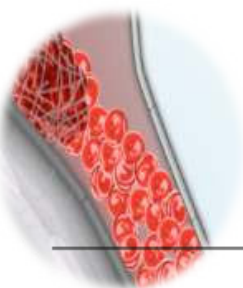
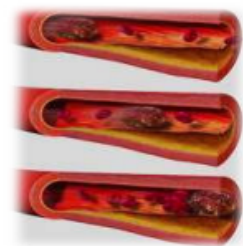
# ACUTE LIMB ISCHEMIA

**DEEPU KRISHNAN M**  
**Roll No.50**

## DEFENITION



- Acute limb ischemia is any sudden decrease or worsening in limb perfusion causing a potential threat to viability of extremity.
- The term is applicable up to 2 weeks of an initiating event.



# PATHOPHYSIOLOGY

- Arterial narrowing → Decreased blood flow → Ischemia
- Acute ischemia causes endothelial injury with luminal obliteration.
- **Golden period is 6 hours** beyond which irreversible changes and loss of limb.



## ETIOLOGY

- Embolism is the most common cause
- Other causes-
  - Trauma
  - Thrombosis of a native artery – especially in hypercoagulable states
  - Thrombosis of a bypass graft- at the site of anastomosis



## CLINICAL PRESENTATION OF ACUTE LIMB ISCHEMIA

- PAIN
- PALLOR
- PARAESTHESIA – anaesthesia
- PULSELESSNESS
- PARALYSIS
- POIKILOTHERMIA - cold limb



**Marble white  
right foot in  
acute limb  
ischaemia**





RUTHERFORD CLASSIFICATION OF  
SEVERITY OF ACUTE LIMB ISCHAEMIA

| CATEGORY | TISSUE                 | DESCRIPTION                                  | SENSORY LOSS           | MUSCLE WEAKNESS | DOPPLER SIGNAL                             |
|----------|------------------------|----------------------------------------------|------------------------|-----------------|--------------------------------------------|
| I        | viable                 | No pain.                                     | –                      | –               | audible                                    |
| Ila      | Marginally threatened  | Salvageable                                  | Digital sensory loss + | none            | Arterial signal inaudible                  |
| Ilb      | Immediately threatened | Salvageable with immediate revascularization | +                      | +               | Arterial signal inaudible                  |
| III      | Irreversible injury    | Not salvageable                              | profound               | profound        | Both arterial and venous signals inaudible |

## INVESTIGATIONS

- ✓ Coagulation Studies- PT, APTT, platelet count
- ✓ Angiography—Gold Standard
- ✓ ECG, Echocardiography
- ✓ Blood sugar
- ✓ Doppler arterial study



# TREATMENT

## General Measures

- ❖ Reassure the patient
- ❖ Relief of pain



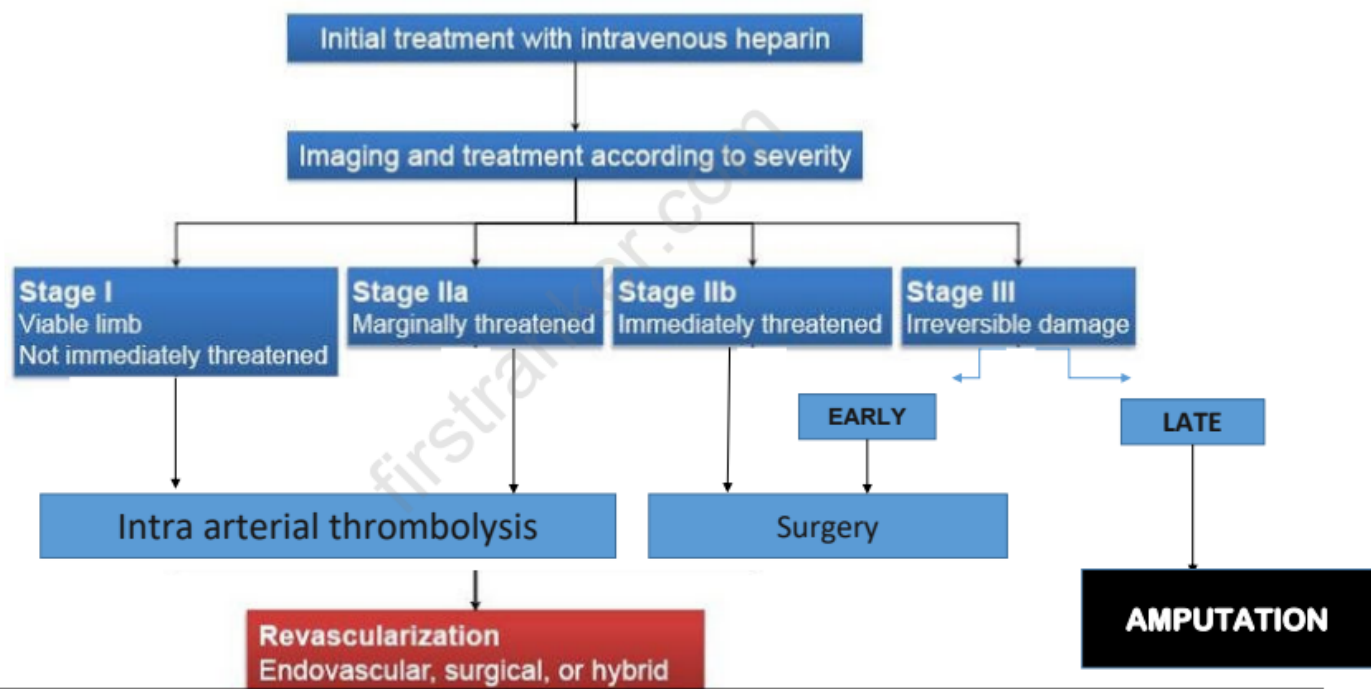
## Simple measures to improve existing perfusion:

- ❖ Oxygen inhalation, IV infusion of fluid
- ❖ Avoid extremes of temperature
- ❖ Avoid pressure over heels
- ❖ Keep the foot dependent
- ❖ Correct hypotension



Heparin therapy -5000 U IV bolus given to reduce extension of thrombus and maintain patency of surrounding vessels.





# ENDOVASCULAR TREATMENT

- **Thrombolysis** is the first-line treatment in patients with acute limb ischemia – in **Cat I and IIa**
- **Intra-arterial thrombolysis**
- A narrow catheter is passed into the occluded vessel.
- Tissue plasminogen activator (TPA) is infused.
- Not done in limb threatened with gangrene

**Thrombolysis**

Thrombolytic  
medications

Clot

Catheter



# CONTRAINDICATIONS for thrombolysis



- ✓ Recent stroke, major surgery trauma
- ✓ Active blood diathesis
- ✓ History of GI bleeding/active peptic ulcer
- ✓ Pregnancy

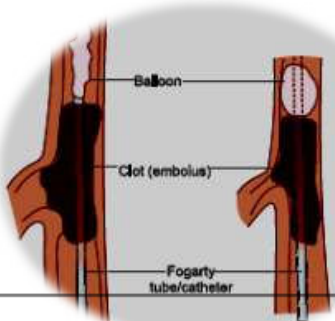


# SURGICAL TREATMENT

## Indications:

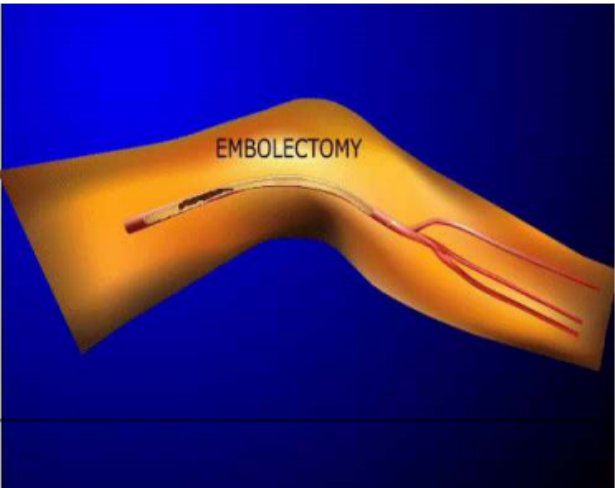
- ☐ Immediately limb-threatening ischemia is preferentially treated surgically.
- ☒ Cat IIb and early class III

✓ Embolectomy



# EMBOLECTOMY

- ❖ Thrombus is extracted by passing a **Fogarty balloon catheter**.
- ❖ Repeat till back bleeding occurs.
- ❖ Angiogram at end to ensure flow is restored
- ❖ Post op anticoagulation





## **COMPLICATIONS OF ARTERIAL REPERFUSION**

- REPERFUSION INJURY
- COMPARTMENT SYNDROME
- MUSCLE NECROSIS
- LOWER LEG SWELLING



# COMPARTMENT SYNDROME

- Sudden ischemia followed by revascularization causes edema in the skeletal muscles
- Common in the anterior compartment of calf.
- Local muscle necrosis and nerve damage due to pressure, renal failure secondary to liberation of muscle breakdown products.
- Muscle weakness, sensory changes, leg pain aggravated by dorsiflexion of toes.
- Management : **Fasciotomy**



# SUMMARY

**POVD** - Clinical condition characterized by stenosis or occlusion in the aorta or arteries of limbs.

**Causes**- Atherosclerosis, Non Atherosclerotic Causes- Buerger's disease, Raynaud's syndrome

**Clinical features** – Claudication, Rest Pain, Ulceration, Gangrene

**Investigations**- Duplex And Angiography

**Management**-General And Pharmacological Measure-control of risk factors-drugs like aspirin, Clopidogrel

**Endovascular Management**- Percutaneous Transluminal Angioplasty, atherectomy, stenting, cryoplasty

**Open surgical procedures**- bypass graft, endarterectomy, profundoplasty, sympathectomy, amputation

**Acute Limb Ischemia**- sudden decrease in limb perfusion causing a potential threat to viability of extremity

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Arterial disorders are a cause of morbidity, mortality and financial loss in our societies(because mostly associated with mi and stroke)

By eliciting a good clinical history and palpating for peripheral pulsations, anatomic site of disease can be diagnosed and effectively managed.



