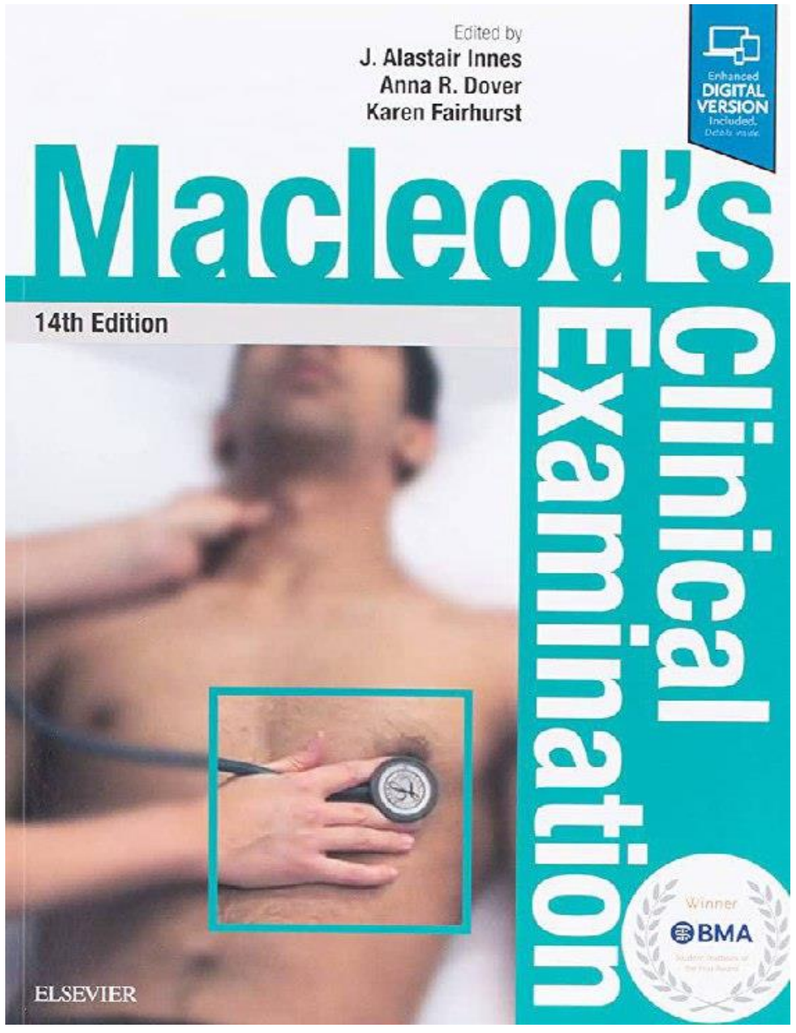


Outlines:

- Peripheral arterial system.
- Peripheral venous system.

Done By: M. ALALI, MD, PH.
Introductory: Section 2, CH.4: PV History & Examination.
Note: This summary contains all Macleod's important notes.

For Full Material, please JOIN this WhatsApp Community:

LEC 7: PVS History & Examination

PERIPHERAL ARTERIAL SYSTEM

Anatomy & physiology

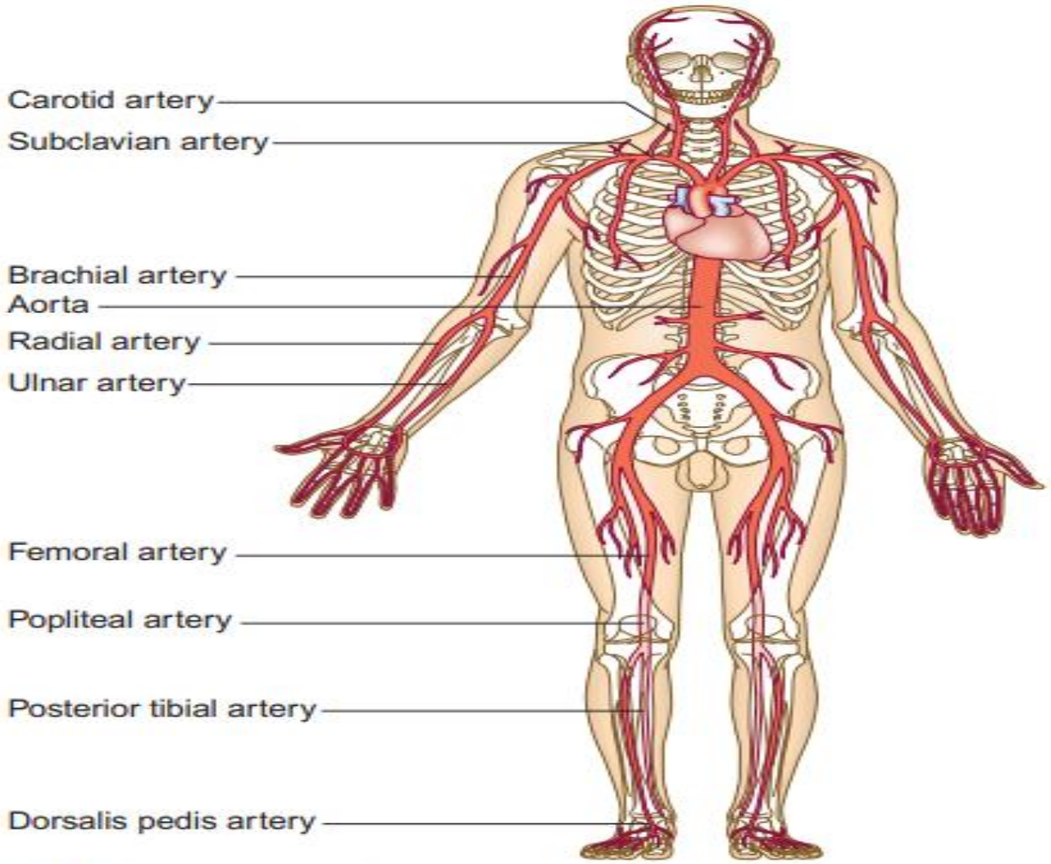


Fig. 4.31 The arterial system.

Main symptoms:

1. **Leg pain.** (Ischemia Acute VS. Chronic/ Compartment syndrome)
2. **Abdominal pain.**
3. **Digital ischemia.**
4. **Stroke.**

Leg pain:

1. **lower limb ischemia (Chronic).**

4.22 Fontaine classification of lower limb ischaemia

Stage	Description
I	Asymptomatic
II	Intermittent claudication
III	Night/rest pain
IV	Tissue loss (ulceration/gangrene)

The Fontaine classification **describes the progression of symptoms that occurs as the atherosclerotic burden increases and the blood supply to the limb diminishes**.

Asymptomatic ischemia:

*** How common?**

- Around **20%** of population **>60 YO.**
- Only **25%** is **symptomatic**.
- **Legs 8 X more** commonly affected than **arms**.

*** General cause?** **Atherosclerosis** of large & medium-sized vessels.

- Significant LLI = ABPI <0.9 at rest.

- **Mostly asymptomatic why??**
- Because they choose **not to walk very far, or -exercise tolerance is limited** by **other co-morbidity**.
- Although asymptomatic, **these patients have extensive atherosclerosis, putting them at high risk of major cardiovascular events**, and <u>should be treated with</u> **best medical therapy to reduce their mortality rate**.

- Furthermore, **PAD may affect the medical and surgical treatment for other conditions.** For example, wound healing may be impaired in the lower limb.

Intermittent Claudication

Most common symptom of PAD:

• **Def: Pain** in a group of muscles **on walking** due to **arterial insufficiency**.

- Typically; **Calf (femoral-popliteal disease).**

- **Thigh &/or buttock (Femoral or aorta-iliac obstruction).**

• **Tightness or 'cramp-like' pain.**

• Develops **after** relatively **constant distance** (**claudication distance**); often shorter if walking uphill, in the cold & after meals.

• **Disappears completely** within **a few minutes of rest** but **recurs on walking.**

• **Claudication** distance **VS**. **Total** walking distance.

• **Male** patients who have **bilateral common iliac or internal iliac artery occlusion may develop Leriche's syndrome**, involving **buttock claudication and erectile dysfunction**.

• **Claudication is a marker for widespread atherosclerotic disease**. With best medical therapy and supervised exercise programs, **50% will improve**, **30% will remain stable** and **only 20% will deteriorate further**.

• Two other types of claudication:

1. **Neurogenic:** due to **neurological & musculo-skeletal** disorders of **lumbar spine**.
2. **Venous:** due to **venous outflow obstruction** from the leg, following **extensive DVT**.

>> Both are much **less common than arterial** claudication, & can be distinguished on **Hx. & P/E,** see table (4.23).

- Any **intervention** for claudication is purely on the **basis** of **symptomatic relief**, since **only a small minority of patients progress** to critical limb ischemia.

- The patient's **age, occupation and comorbidities** are important in **determining the extent to which claudication limits their lifestyle**.

- **Postal worker VS. Elderly**???

4.23 The clinical features of arterial, neurogenic and venous claudication

	Arterial	Neurogenic	Venous
Pathology	Stenosis or occlusion of major lower limb arteries	Lumbar nerve root or cauda equina compression (spinal stenosis)	Obstruction to the venous outflow of the leg due to iliofemoral venous occlusion
Site of pain	Muscles, usually the calf but may involve thigh and buttocks	Ill-defined Whole leg May be associated with numbness and tingling	Whole leg 'Bursting' in nature
Laterality	Unilateral or bilateral	Often bilateral	Nearly always unilateral
Onset	Gradual after walking the 'claudication distance'	Often immediate on walking or standing up	Gradual, from the moment walking starts
Relieving features	On stopping walking, the pain disappears completely in 1–2 minutes	Bending forwards and stopping walking Patient may sit down for full relief	Leg elevation
Colour	Normal or pale	Normal	Cyanosed Often visible varicose veins
Temperature	Normal or cool	Normal	Normal or increased
Oedema	Absent	Absent	Always present
Pulses	Reduced or absent	Normal	Present but may be difficult to feel owing to oedema
Straight-leg raising	Normal	May be limited	Normal

- While absolute distances are important, it may be more helpful to ask specific questions about how symptoms affect the patient's lifestyle:

• **Can you walk to the clinic from the bus stop or car park without stopping?**

• **Can you do your own shopping?**

• **What are you unable to do because of the pain?**

Night:

'Patient goes to bed, falls asleep, but is then woken 1–2 hr's later with severe pain in the foot, usually in the instep'

• **Lying** down >> **No gravity** effects >> **poor perfusion**.

- **Dec. HR, BP & CO** >> occurs when **sleeping**.

Relieved by hanging legs out of bed or by getting up & walking around. However, on return to bed, pain recurs & pts often choose to sleep in a chair. → **Dependent edema, ↑ interstitial tissue pressure.** → **Further reduction in tissue perfusion & ultimately a worsening of pain.**

Rest pain:

- **Rest or night pain indicates severe, multilevel, lower limb PAD and is a 'red flag' symptom that mandates urgent referral to a vascular surgeon**, as <u>failure to</u> **revascularize the leg** usually leads to the **development of tissue loss** (**gangrene, ulceration**) and **amputation**.

Rest pain vs. Diabetic neuropathy

- **Both may be worse at night.**
- **Neuropathic pain:**

- Usually **not confined** to the **foot**.
- Burning, tingling or numbness (**dysesthesia**).
- <u>Not relieved by</u> **dependency**.
- Many patients **cannot even bear bedclothes pressure on their feet**.

Critical limb ischemia: Rest pain persisting > 2 weeks requiring opiate analgesia.

Tissue loss associated with ankle pressure of <50 mmhg or toe pressure < 30 mmhg, ABPI <0.4 & + VE Burger's test.

Tissue loss (ulceration &/or gangrene)

In severe LL PAD, even trivial injuries to feet fail to heal. → **This allows bacteria to enter, leading to gangrene &/or ulceration.** → **Without re-vascularisation; leads quickly to amputation &/or death**

Signs of lower limb PAD (Chronic limb ischemia)

- Absence of hair.
- Thin skin.
- Brittle nails.

2. Acute LLI:

- **Irreversible** damage **<u>unless</u>** circulation is restored within a **<u>few hours</u>**.

4.24 Signs of acute limb ischaemia

- Pallor
- Pulselessness
- Perishing cold
- Paraesthesia
- Pain (worse when muscle squeezed)
- Paralysis

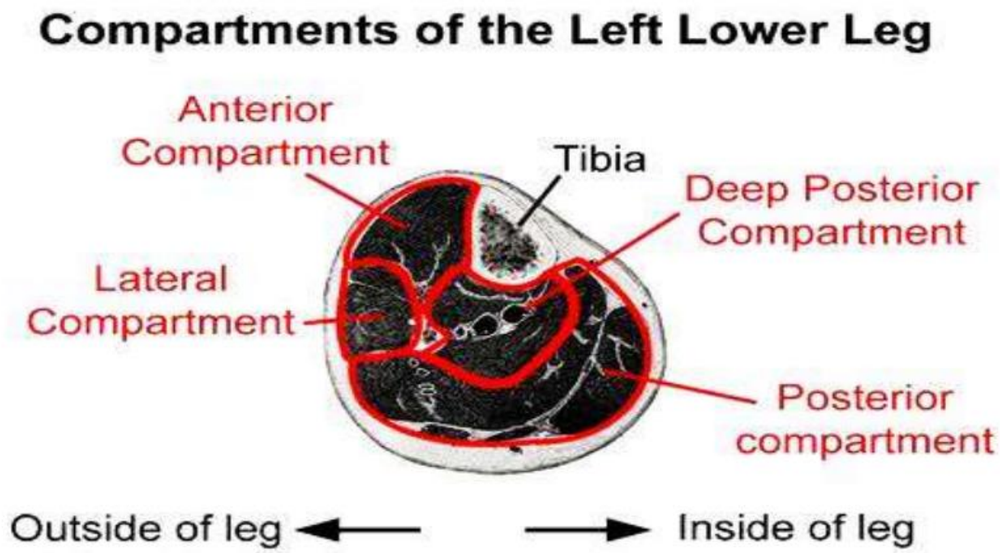
4.25 Acute limb ischaemia: embolus versus thrombosis in situ

	Embolus	Thrombosis
Onset and severity	Acute (seconds or minutes), ischaemia profound (no pre-existing collaterals)	Insidious (hours or days), ischaemia less severe (pre-existing collaterals)
Embolic source	Present	Absent
Previous claudication	Absent	Present
Pulses in contralateral leg	Present	Often absent, reflecting widespread peripheral arterial disease
Diagnosis	Clinical	Angiography
Treatment	Embolectomy and anticoagulation	Medical, bypass surgery, catheter-directed thrombolysis

3. Compartment Syndrome

- **Def. >> increased pressure within the fascial compartments** of the limb, **most commonly the calf**, which **compromises perfusion & viability of muscle & nerves**.

- **Causes: commonest >> 1. lower trauma**, (e.g., fractured tibia), **2. Reperfusion** following **treatment** of **acute LLI**.
- **Failure to recognize & treat >>** may require limb amputation!
- **The key symptom >> severe pain often unrelieved by opioids & exacerbated by active or passive movement**. **Peripheral pulses** are usually **present**.
- The **perfusion pressure** of a muscle is the difference between the mean arterial pressure and the pressure within the fascial compartment within which it lies.



Abdominal Pain

Mesenteric ischemia

The **three major visceral arteries** (**Celiac trunk, SMA & IMA**).

1. Chronic mesenteric arterial insufficiency:

- **2/3 must be critically stenosed or occluded as there is rich collateral circulation**.
- Severe **central abdominal pain typically develops 10–15 min post-prandial**. **"Scared of eating" + significant wt. loss.**
- **Diarrhea** may occur.
- **Confirmed by Angiography and may need laparotomy**.

2. Acute mesenteric ischemia:

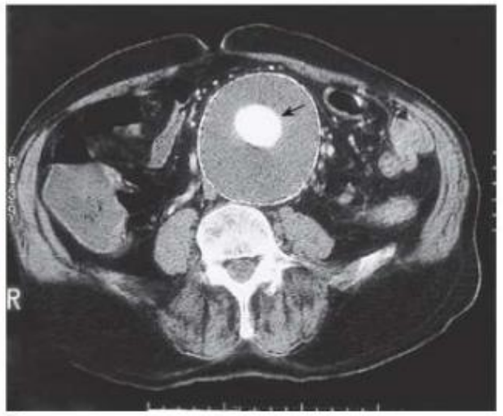
"Surgical emergency"

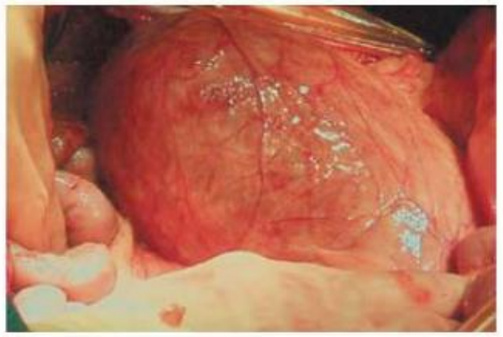
- Most commonly caused by an **embolus from the heart or by thrombosis in situ of a pre-existing atherosclerotic plaque in one of the mesenteric vessels**.
- **Severe abdominal pain out of proportion.**
- **Shock**.
- **Bloody diarrhea**.
- **Profound metabolic acidosis**.
- Rarely, **renal angle pain occurs from renal infarction or ischemia**, & is associated with **microscopic or macroscopic hematuria**.

Abdominal Aortic Aneurysm

- **Def**. >> **Abnormal focal dilatation** of aorta **at least 150% of its diameter**.
- **How common? 5% of men** aged **>65** YR'S (**3X more in men**).
- **Risk factors** >> **Smoking, HTN, familial/genetic element**.
- **Mostly asymptomatic until rupture** and usually **Diagnosed incidentally on CT scan or alternative imaging** done for other reasons symptoms &/or **back pain or awareness of abdominal pulsation**, observation **of ripples in the water when they are in the bath** (**wave sign**).
- The **classical features of AAA rupture** include **abdominal/back pain, pulsatile abdominal mass, syncope and shock (hypotension),** but these are not always present and **it is important to have a low threshold of suspicion and consider early referral and/ or CT imaging**.

AAA





Digital limb ischemia

Blue toes

• Blue toe syndrome **occurs when there is atheroembolism from an AAA or alternative proximal embolic source** (such as popliteal aneurysm or atherosclerotic plaque).

• **Patchy bluish discoloration appears over the toes and forefoot of one or both feet**.

• There is usually a **full set of pedal pulses**.

• **Symptom should be taken seriously**, as small emboli may herald the risk of **major embolus leading to acute limb ischemia and even limb loss**.

Vasospastic Symptoms

(**Reynaud's phenomenon**): Digital **ischemia** induced by **cold**.

Three phases:

• **Pallor:** due to digital art. **spasm &/or obstruction**.

• **Cyanosis**: due to **deoxygenation** of static **venous blood** (May be absent).

• **Redness**: due to **reactive hyperemia**.

Patients > 40YO with **unilateral Raynaud's phenomenon have underlying PAD unless proven otherwise**, especially if they have risk factors (**Smoking, DM**).

• **Primary (Raynaud's disease)** >> idiopathic digital artery vasospasm.

• **Secondary (Raynaud's syndrome).**

• **Self-limiting** ... Tissue loss in minority.

6.38 Diseases associated with secondary Raynaud's syndrome

- Connective tissue syndromes, e.g. systemic sclerosis, CREST (calcinosis, Raynaud's phenomenon, oesophageal dysfunction, sclerodactyly, telangiectasia) and systemic lupus erythematosus
- Atherosclerosis/embolism from proximal source, e.g. subclavian artery aneurysm
- Drug-related, e.g. nicotine, beta-blockers, ergot
- Thoracic outlet syndrome
- Malignancy
- Hyperviscosity syndromes, e.g. Waldenström's macroglobulinaemia, polycythaemia
- Vibration-induced disorders (power tools)
- Cold agglutinin disorders

Complete the history

Past medical history:

- Is the patient have **established peripheral vascular disease**?
- Ask about **previous investigations, operations or procedures**. Is there a **history of other atherosclerotic conditions such as coronary artery disease or cerebrovascular disease**?
- **Risk factors for atheroma** (smoking, hypercholesterolemia, HTN, DM)?

Family Hx:

- **Premature arterial disease**?
- Other vascular disease (**AAA**), **CVA**?

Drugs:

- **Antiplatelet**, **lipid lowering**, **antihypertensive** & **diabetes** therapies.

Social history:

- Take a **smoking** history.
- Enquire about **occupation** and **activities** of **daily living**.
- How are the patient's symptoms **impacting on quality of life or employment?**

Physical examination general

Face and neck	
Corneal arcus and xanthelasma	Hypercholesterolaemia
Horner's syndrome	Carotid artery dissection or aneurysm
Hoarseness of the voice and 'bovine' cough	Recurrent laryngeal nerve palsy from a thoracic aortic aneurysm
Prominent veins in the neck, shoulder and anterior chest	Axillary/subclavian vein occlusion

* Signs of **anemia & cyanosis**.

* Abnormally **prominent pulsation in neck of elderly significant** >> normally **caused by tortuous arteries** rather than a **carotid aneurysm or carotid body tumor**.

4.26 Signs suggesting vascular disease

Sign	Implication
Hands and arms	
Tobacco stains	Smoking
Purple discoloration of the fingertips	Atheroembolism from a proximal subclavian aneurysm
Pits and healed scars in the finger pulps	Secondary Raynaud's syndrome
Calcinosis and visible nail-fold capillary loops	Systemic sclerosis and CREST (calcinosis, Raynaud's phenomenon, oesophageal dysfunction, sclerodactyly, telangiectasia)
Wasting of the small muscles of the hand	Thoracic outlet syndrome

- **Examine radial & brachial pulses**.
- Measure **BP in both arms**.

Abdomen	
Epigastric/umbilical pulsation	Aortoiliac aneurysm
Mottling of the abdomen	Ruptured abdominal aortic aneurysm or saddle embolism occluding aortic bifurcation
Evidence of weight loss	Visceral ischaemia

- **Aortic bifurcation >> at level of umbilicus**:

1. **Palpate over abdominal aorta** – for pulsatile mass (Below or above umbilicus = AAA vs. Iliac aneurysm).
2. **Listen over abdominal aorta.**

Specific physical examination (LL Examination):

A. Inspection:

- **Position of patient flat, elevate 45-degree**, dependent position.
- **Color changes / muscle wasting / hair distribution / scars from previous surgery / varicose vein / shiny skin / onycholysis / Venous guttering/ Fungal infection in between toes/ Swelling** …
- Look **specifically between toes for ulcers** [position, margin, depth & color] & **at heels for ischemic changes** (commonest site of 'pressure sores').

B. Palpation:

- **Muscle tenderness.**
- **Difference in temperature.**
- **Lower limb pulses.**
- **Capillary Refill.**
- **Special Tests (Burger's Test, ABPI).**

1. Femoral pulse:

1. Against **head of femur**.
2. Use **2 fingers** pads (index & middle).
3. **2.5*2.5 cm inferior & lateral to pubic tubercle**.

Note: Difficult to feel in **obese**.

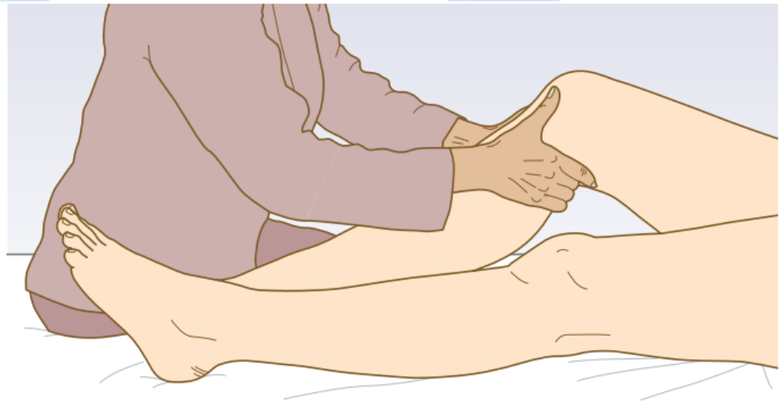
Check for **radio- femoral delay**.

Bilateral auscultation (for **bruit**) using the diaphragm.

2. Popliteal pulse:

Lying flat – knee flexion 30 degrees.

Both thumbs in front of the knee, other fingers behind & press firmly.



B

3. Posterior tibial pulse:

2 cm below & 2 cm behind medial malleolus.

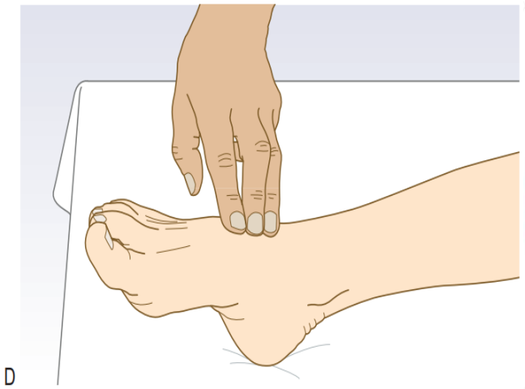
Pads of **middle three fingers.**

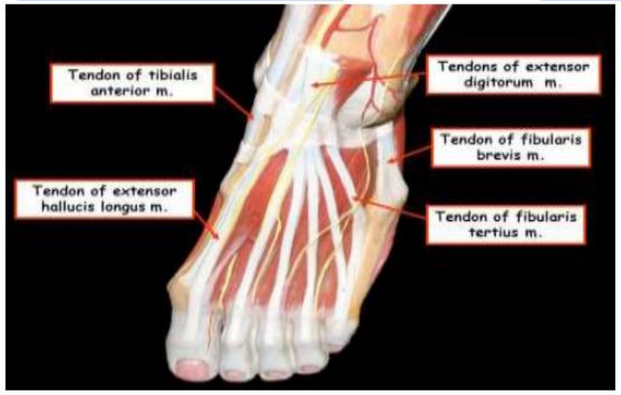
C

4. Dorsalis pedis pulse:

Pads of **three middle fingers**.

Middle of the **dorsum of the foot, lateral to extensor halluces longus tendon**.



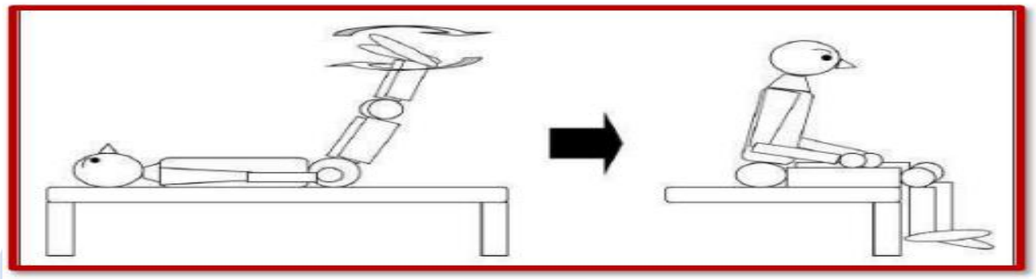


* ABPI:

- Routinely whenever **difficulty palpating lower pulses PAD is suspected**.
- **Ratio of highest pedal artery pressure to highest brachial artery pressure**.
- ABPI **> 1** in supine.
- **< 0.9 intermittent claudication**.
- **< 0.4 critical limb ischemia**.
- **ABPI in diabetic patient falsely reassuring due to non-compressibility and calcified vessels**.

* Burger's Test:

- **Patient lying supine**.
- **Raise** patient's **feet & support legs at 45°** for **2–3 minutes.**
  Watch for pallor with emptying or 'guttering' of superficial veins.
- **Ask** patient to **sit up & hang legs over bed's edge**. Watch for **reactive hyperemia on dependency**.
- **Loss of pallor** & **spreading redness is a positive test**.



Peripheral venous system

Anatomy

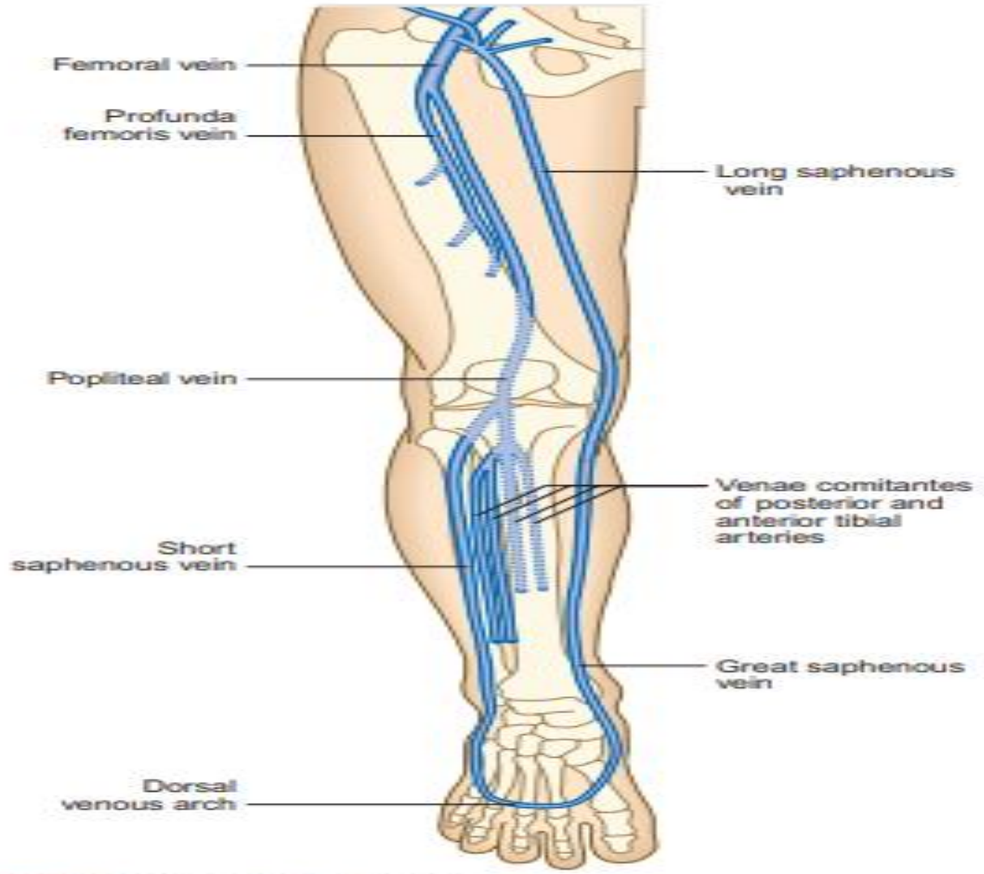
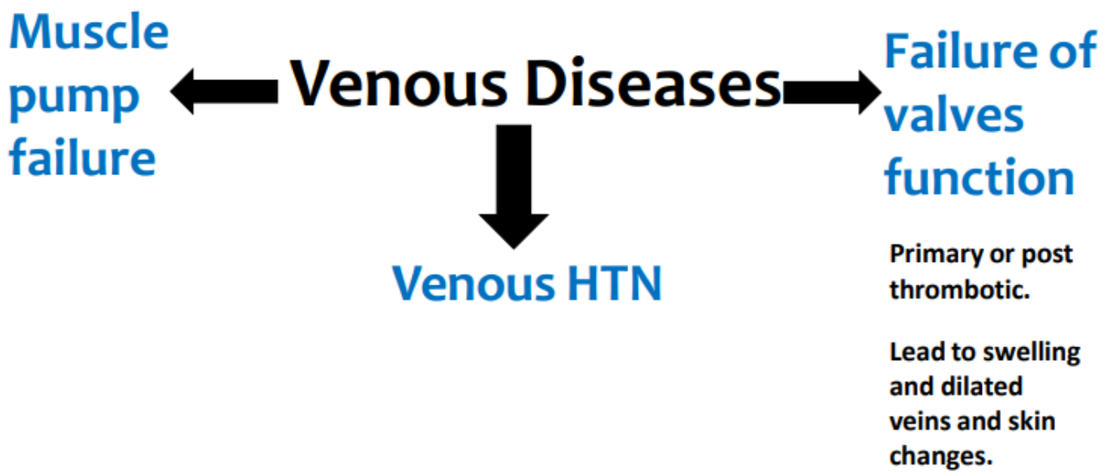


Fig. 4.36 Veins of the lower limb.

Venous Return

- **Passive** from head & neck.
- **Active** from lower limb, (Pressure on the sole of the foot + contraction of muscle (Calf, and to a lesser extent in the thighs, buttock).
- Blood is **returned** to the heart **from the peripheries** by a **network of deep (90%) and superficial (10%) veins.**
- **Valves** --- **prevent** backward flow (reflux).
- **The usual ambulatory venous pressure is < 20 mmHg**.



Clinically the patient usually presents with following diseases:

1. Varicose vein.
2. Superficial thrombophlebitis
3. DVT.
4. Chronic venous insufficiency & ulceration.

Clinically the patient usually presents with following symptoms:

1. Pain.
2. Limb swelling.
3. Skin changes.

1. Pain:

Varicose veins	Superficial thrombophlebitis	Varicose ulceration
1. **Uncomplicated:** Often complain of aching leg discomfort, itching and a feeling of swelling (Fig. 4.37A). Symptoms are aggravated by prolonged standing and are often worse towards the end of the day. 2. **Complicated:** Once established, DVT causes pain and tenderness in the affected part (usually the calf).	Red, painful area on the skin overlying the vein involved, and the vein may be palpable as a tender cord.	may be surprisingly painless; if there is pain, this may be relieved by limb elevation but it is extremely important to exclude coexisting arterial disease (Box 4.28). Graduated compression bandaging is the mainstay of treatment for a venous leg ulcer, but firstly exclude the arterial cause by ABPI.

Fig. 4.37 Lower limb venous disease. A Varicose veins and associated haemosiderin deposition. B Venous ulcer. *(A) From Metcalfe M, Baker D. Varicose veins. Surgery (Oxford) 2008; 26(1):4–7.*

2. Limb swelling:

• Swelling, or a feeling of swelling, even in the absence of visible signs, **may be associated with lower limb venous disease**.

• **Enquire about risk factors for DVT (Box 4.29).**

• In upper limb DVT the arm is **swollen** and the skin is **cyanosed** and **mottled**, **especially when dependent**. Look for **superficial distended veins** (**acting as collaterals**) in the upper arm, over the shoulder region and on the anterior chest wall (Fig. 4.38).

• **Symptoms** are often **exacerbated by activity**, especially when **holding the arm overhead**.

• There may be a **history of repetitive trauma** at the **thoracic outlet due to vigorous, repetitive exercise** (swimming, weight lifting, racquet sports).

• **Upper limb DVT** may also complicate **indwelling subclavian/jugular venous catheters**.

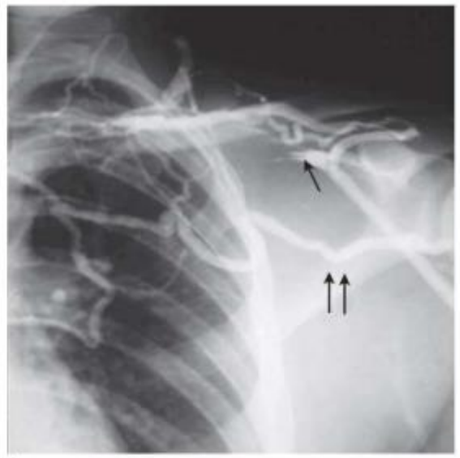


Fig. 4.38 Axillary vein thrombosis. A Angiogram. *Single arrow* shows site of thrombosis. *Double arrows* show dilated collateral vessels. B Clinical appearance with swollen left arm and dilated superficial veins.

4.29 Risk factors for deep vein thrombosis

- Obesity
- Smoking
- Recent bed rest or operations (especially to the leg, pelvis or abdomen)
- Recent travel, especially long flights
- Previous trauma to the leg, especially long-bone fractures, plaster of Paris splintage and immobilisation
- Pregnancy or features suggesting pelvic disease
- Malignant disease
- Previous deep vein thrombosis
- Family history of thrombosis
- Inherited thrombophilia, e.g. factor V Leiden
- Recent central venous catheterisation, injection of drug
- Use of oral contraceptive or hormone replacement therapy

3. Skin changes:

• Chronic venous insufficiency is often associated with **bluish discoloration of the distal extremity**.

• **Varicose eczema** leads to **red, itchy, dry areas of skin** over lower leg.

• **Venous hypertension extravasation** of **blood components** into surrounding causes tissues, leading to **hemosiderin deposition**, which is seen as **a brown discoloration of the skin**, primarily **around the medial aspect of the lower third of the leg**. **Lipodermatosclerosis** occurs when there is an **inflammatory response to the hemosiderin** and **causes red/purple discoloration** and **induration of the skin**.

• In atrophied blanche (**Healed ulcer**), there are **multiple, small, white, scarred areas within the affected skin**.

Chronic venous ulceration:

• In developed countries, about **70–80% of lower limb ulceration is primarily due to venous disease**. Other causes include **pyoderma gangrenosum, syphilis, tuberculosis, leprosy (Hansen's disease), sickle cell disease and tropical conditions**.

• Chronic venous ulceration (see Fig. 4.37B) **usually affects the medial aspect of the calf.**

• Ulcers are **shallow and pink** (**granulation tissue**) or **yellow/green (slough) in color**, with an **irregular margin**, and are usually **associated with other skin changes of chronic venous insufficiency** (varicose eczema, Lipodermatosclerosis).

Superficial venous thrombophlebitis

• This condition affects up to **10% of patients with:**

Severe varicose veins and is more common during Pregnancy.

• **Recurrent superficial venous thrombophlebitis**, especially that **affecting different areas sequentially and non-varicose veins**, may be **associated with underlying malignancy**. It may propagate into the deep system, leading to **DVT and pulmonary embolism**.

Examination:

• **General inspection:** For patient condition + risk factor.

• **Leg inspection:** For skin color changes / swelling / dialed vein.

• **Palpation:** temperature / tenderness/ pitting edema/ leg circumference (**10 cm below tibial tuberosity**).

• **Edema** …… check the **JVP** (bilateral edema with raised JVP suggest cardiac disease or pulmonary HTN).