

## Peripheral artery disease (PAD)

- Occurs due to **atherosclerosis** causing stenosis of arteries
- Pain comes on **walking** and relieved by **rest**

### Features

- **Intermittent claudication** which is cramping pain felt in the **calf, thigh** or **buttock** after walking
- **Absent** femoral, popliteal or foot **pulses**
- Rest pain in the more severe cases
- **Ulcers** and **gangrene** if the disease progresses

### Risk factors

- HTN
- DM
- Smoking
- High cholesterol (1<sup>ry</sup> prevention → *advice to exercise*, 2<sup>ry</sup> prevention → *atorvastatin*)

### Investigations

- **Doppler US** → 1<sup>st</sup> choice
  - Used to measure the pressure at which detectable flow ceases using a compression cuff to determine the ankle-brachial pressure index (ABPI)
- **Color flow duplex US**
  - Assess stenosis of the vessel
- **MR/CT angiography**
  - Used only if considering intervention
  - Used to assess the extent and location of stenosis and quality of distal vessels
  - MR/CT angiography has largely replaced digital subtraction angiography

### Management

- Address risk factors for cardiovascular disease
  - Quit smoking
  - Treat hypertension and high cholesterol
  - Prescribe an antiplatelet to prevent progression and to reduce cardiovascular risk → **75mg Clopidogrel** (if not tolerated → *aspirin*)
- **Encourage walking** beyond the distance which pain occurs
- **Naftidrofuryl oxalate**, only if patient doesn't want revascularization and if exercise fails to improve symptoms
- If severely affecting the patient's life and disease is limited to a single arterial segment → **percutaneous transluminal angioplasty (PTA)**, a balloon is inflated in the narrowed segment
- If severely affecting the patient's life and atheromatous disease is extensive but distal run-off is good (i.e. distal arteries filled by collateral vessels) → **surgical reconstruction** (arterial reconstruction with a bypass graft)

• For 2ry prevention → **Atorvastatin 80 mg**

## Thromboangiitis obliterans (Buerger's disease)

- Usually **young men** (around 40 years) + **smoking** history
- It has a **progressive nature** compared to acute peripheral artery disease (PAD)
- Clinically, it presents with **severe claudication** and **rest pain**
- **Ulcers** could be present
- Treatment involves **smoking cessation**

*Buerger's disease* → young + heavy smoker

*PAD* → old + atherosclerosis

## Acute limb ischemia

- Surgical emergency requiring **revascularization** within **4-8h** to save the limb. It's usually due to **thrombosis** in situ, **emboli** or **graft occlusion**
- Emboli commonly arise from the heart (**Atrial fibrillation**, **mural thrombus**) or **aneurysm**

### Features

- The **6 Ps** of acute ischemia (pale, pulseless, paralyzed, paraesthetic and perishingly cold)

- DVT **doesn't** cause ischemia of the limb as DVT is thrombosis of a vein and veins don't supply organs
- Pain in DVT is **constant**
- **Acute limb ischemia** is similar to **Compartment \$** except it develops gradually in the latter

## Abdominal aortic aneurysm

### Etiology/risk factors

- **Atheroma** (severe **atherosclerotic** damage of the aortic wall)
- Family history
- Increasing age
- Hypertension, smoking
- Syphilis
- Ehler's Danlos
- Marfan's syndrome

Commonest risk factor for the following conditions

- **Abdominal aortic aneurysm** → *Atheroma*
- **Aortic dissection** → *Hypertension*
- **Coarctation of the aorta** → *refractory HTN*
- **Marfan's \$** → *collagen abnormality*
- **Ehler's Danlos** → *elastin abnormality*

### Investigations

- US → *unstable*
- CT → *stable*

## Ruptured aortic aneurysm

- Ruptured AAA should be considered in any patient with **hypotension** and **atypical abdominal symptoms**

### Classical triad

1. *Back/flank pain*
2. *Hypotension*
3. *Pulsatile abdominal mass*

### Management

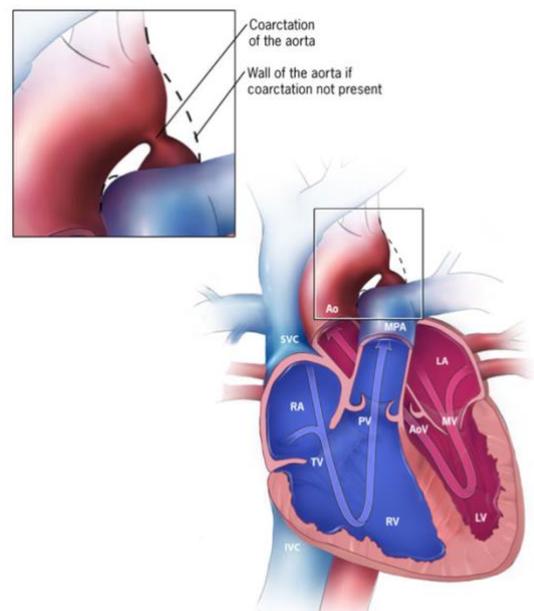
- **Immediate IV fluid** to raise systolic blood pressure to **90 mmHg**
  - Minimum required BP for organ perfusion is preferred since increasing blood pressure increases the risk of blood leakage
- **Laparotomy**

## Coarctation of the aorta

- If COA presents late, it's usually **asymptomatic** and the diagnosis is usually suspected on examination, prompted often by the presence of a **murmur** or **refractory HTN**

### Clinical features of late COA

- **Headache**
- **Nosebleeds** (usually from high BP)
- BP is **high** in the *arms* and **low** in the *legs*
- **LL muscle weakness**, or **cold feet** due to poor blood supply
- Pulses distal to the obstruction are **diminished** and delayed (e.g. femoral pulses are hard to feel, absent foot pulses)



## Thoracic aortic dissection

- Occurs in **poorly controlled hypertensive** patients (>70% have a history of HTN)
- Episode **resembles a myocardial infarction** with sudden onset of very severe, tearing chest pain that radiates to the **back** and may **migrate down** shortly after starting
- **Unequal pulses** in the *upper* extremities
- **Paraplegia** may occur due to decreased blood flow in spinal arteries

### Risk factors

- **Hypertension** → *most important*
- Smoking and raised cholesterol
- Marfan's  $\Sigma$ , Ehlers-Danlos  $\Sigma$

- Blood pressure findings in aortic dissection can either be **high** (as HTN is a risk factor for aortic dissections), or **low** (due to blood loss and cardiac tamponade)

### Investigations

- **X-ray** → *widened mediastinum*
- **ECG & cardiac markers** → to rule out MI
- **CT angiography (spiral)** → *Definitive diagnosis*
- **Trans-esophageal echo** → appropriate in a hemodynamically unstable patient

### Management

- Dissections of the **ascending** aorta → treated **surgically**
- Dissections of the **descending** aorta → treated **medically** with control of hypertension in the ICU

### Stanford classification

#### Type A

- Ascending aorta (2/3 of cases)
- Surgical management, but blood pressure should be controlled to a target systolic of **100-120 mmHg** whilst awaiting intervention

#### Type B

- Descending aorta, distal to the left subclavian origin, 1/3 of cases
- Reduce blood pressure with intravenous **labetalol**

### DeBakey classification

#### Type I

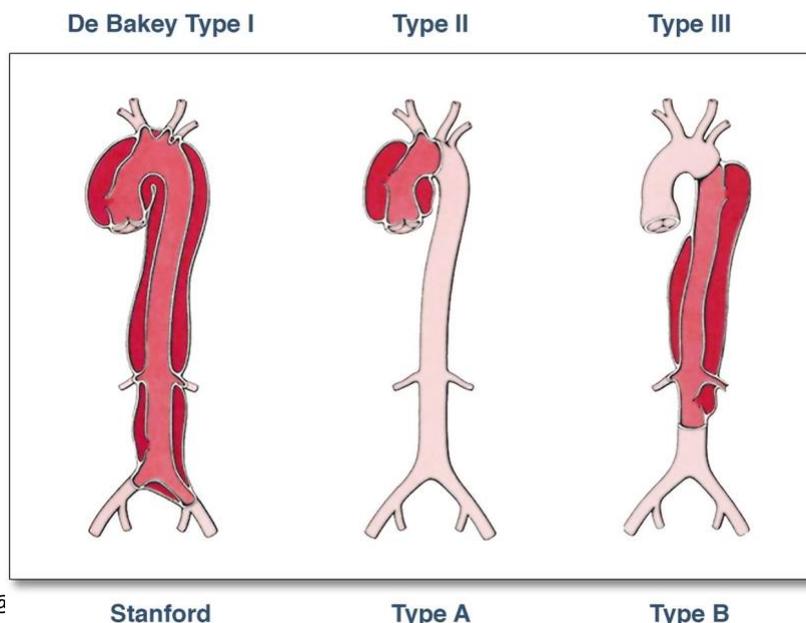
- Originates in **ascending aorta** – propagates to at least the **aortic arch** and possibly beyond it **distally**

#### Type II

- Originates in and is confined to the **ascending aorta**

#### Type III

- Originates in **descending aorta** – rarely extends proximally but will extend **distally**



## Femoral artery aneurysm

- Asymptomatic
- Discovered on routine examination accidentally
- May experience a **pulsating** lump or swelling on thigh or **radiating pain**
- Rarely causes numbness in legs due to nerve compression

**Femoral artery aneurysm** → pulsatile

**Femoral hernia** → pulseless

**Saphena varix** → pulseless, saphenous vein dilatation at its junction with femoral vein in the groin, worm like bag that subside on lying down and bulges with cough

## Renovascular disease

- Defined as **stenosis of the renal artery** or one of its branches
- The two main causes are **atherosclerosis** and **fibromuscular dysplasia**

### Signs

- BP resistant to treatment
- Worsening renal function after **ACE-inhibitors/ARBs** in bilateral renal artery stenosis

### Tests

- **Ultrasound**: Renal size asymmetry (affected side is smaller), Disturbance in renal blood flow on Doppler US
- **CT/MR angiography** are more sensitive
- **Renal angiography** is '*gold standard*', but perform only after CT/MR angiography as it is invasive

- When someone is started on ACE-inhibitors, **U&E** are usually checked 7-10 days after starting treatment, and at least annually

### Treatment

- Comprehensive **antihypertensive** regimens, **transluminal angioplasty** with/without stent replacement or revascularization surgery

## Inferior vena cava syndrome

- Symptoms resulting from the **obstruction** of the IVC

### Causes

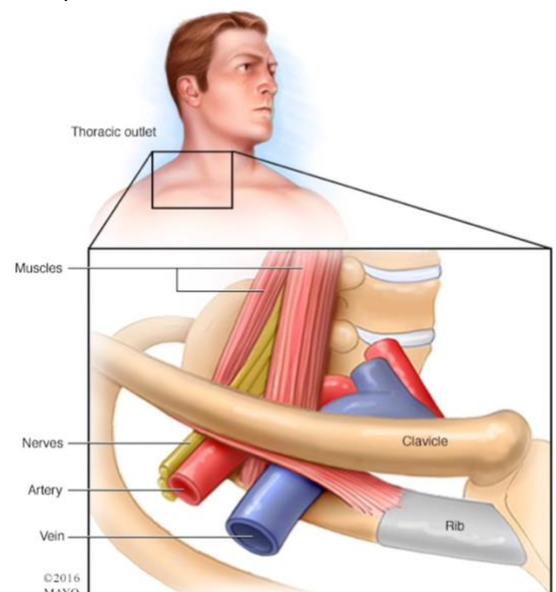
- Physical invasion (tumors, most commonly **RCC**)
- Compression (seen in pregnant women who lie in a supine position)
- Thrombosis (within the vein itself)

### Symptoms

- Edema LL
- Tachycardia

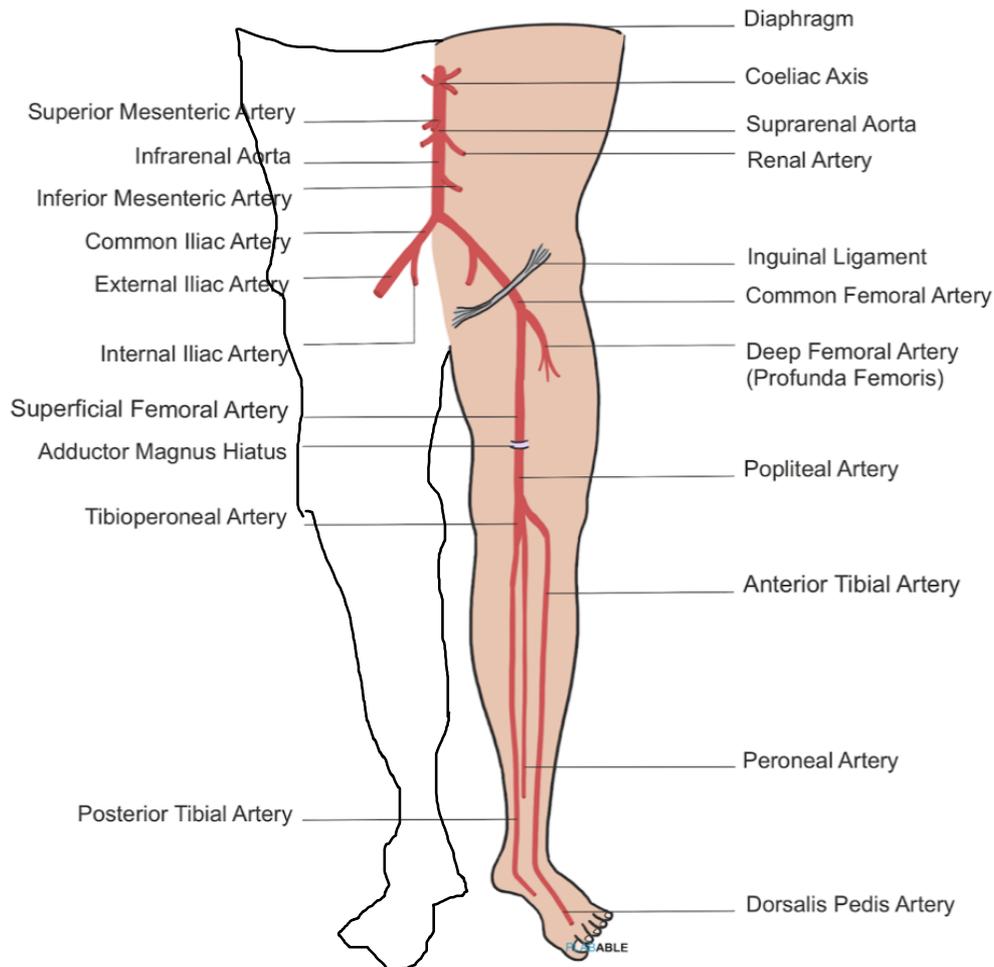
## Thoracic outlet syndrome

- Compression of the trunk of the **brachial plexus, subclavian artery or vein at the superior aperture of the chest**
- It results in **pain or numbness** in the **hand or forearm** often on the ulnar side
- It presents **unilaterally**
- It may lead to **weak radial pulse, forearm cyanosis or thenar muscles weakness**



## Vascular Surgery

### Lower limb arteries



### Claudication pain

- **Aorto-iliac (common iliac) obstruction** → *Buttocks and thighs*, associated with *absent femoral pulses* and *male impotence* (Leriche's S)
  - **External iliac** → starts *above* the inguinal ligament
  - **Femoral artery** → starts *below* the inguinal ligament
  - **Femoro-popliteal** → *below the knee*
- Remember, symptoms of occlusion have to occur distal to the level of occlusion

### Notes

- Carotid artery stenosis → TIAs or **thromboembolic stroke**
- Atrial fibrillation → usually presented with **major strokes**, residual symptoms or leads to **death**
- **Infantile** form of **COA** is associated with **PDA**
- Distal embolization of atherosclerotic debris from **Aneurysm** → may lead to **livedo reticularis** of the feet (mottled discoloration of the skin of the feet) → known as **“Blue toe \$”**
- **Complications of Marfan’s \$**
  - Aortic sinuses dilatations (90%) → may lead to Aortic aneurysms
  - Aortic dissection
  - AR
  - MVP (75%)
- **Acute limb ischemia** → 6Ps, Embolus, history of AF
- **DVT** → constant claudication pain
- **Varicose veins** → ugly legs
- **Lymphedema**
  - Localized fluid retention and tissue swelling caused by a compromised lymphatic system
  - Most common 2ry cause → Malignancy and cancer management, especially after regional LN dissection
  - Upper limb infection (may be elicited by an insect bite) after TTT of breast cancer is a risk factor