

INTERNATIONAL SURGICAL
ANATOMY TEACHING
SERIES

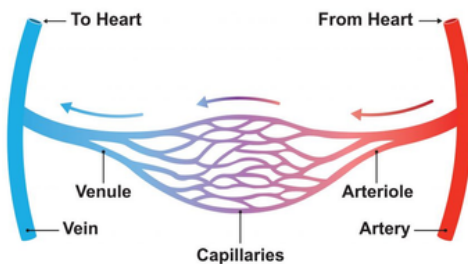


ISATS HANDOUT 2025/26

Vascular Anatomy

VASCULAR ANATOMY

Objectives: Understand the path of the major arteries and veins within the body coupled with their respective branches. Apply anatomical knowledge in the context of a vascular emergency and the associated surgical treatment.

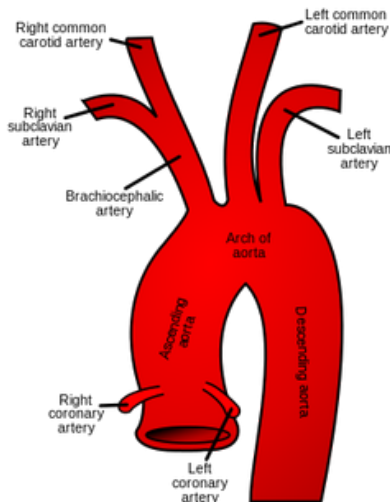


Vascular Flow

- Vascular network run from:
Arteries → arterioles → capillaries → venules → **veins**
- Capillaries act to dissipate high arterial pressure into veins

Aorta

- Outflow tract for left ventricle
- Three salient branches:
 - **Brachiocephalic** trunk, which gives rise to
 - Right subclavian artery
 - Right common carotid artery
 - Left **common carotid artery**
 - Left **subclavian artery**

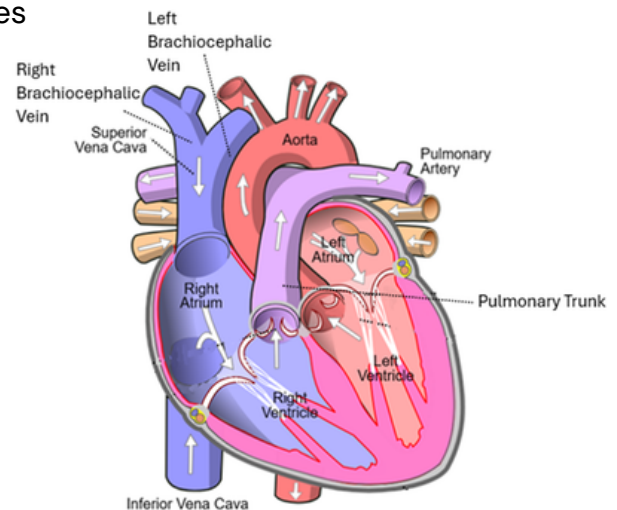


Vena cava

- Drains systemic venous blood into right atrium
- Two main inflows:
 - Superior vena cava
 - Tributaries are left and right **brachiocephalic** veins
 - Inferior vena cava

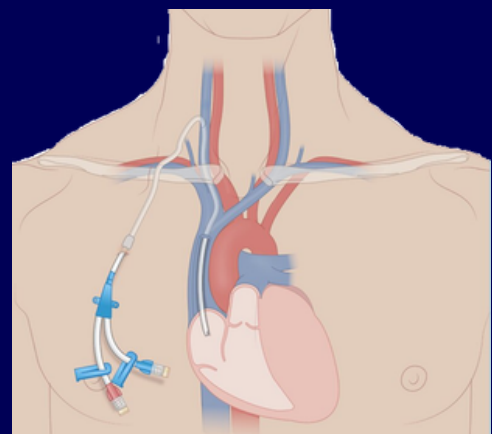
Pulmonary trunk

- Transports deoxygenated blood from right ventricle to lungs.
- Bifurcates into left and right pulmonary arteries



Tributaries of brachiocephalic veins

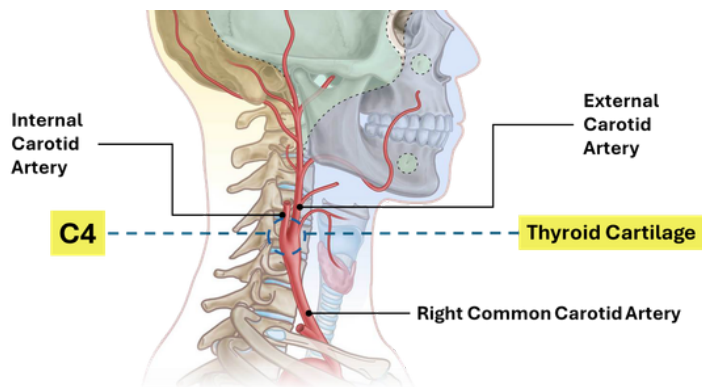
- Brachiocephalic veins begin with the confluence of the internal jugular vein (IJV) and subclavian veins
- IJV and subclavian vein junction known as the **venous angle**
 - **Right venous angle** facilitates drainage of right lymphatic duct
 - **Left venous angle** facilitates drainage of left thoracic duct
- Right brachiocephalic vein more vertically oriented than left counterpart



Right brachiocephalic vein's vertical orientation facilitates easier approach for central line insertions

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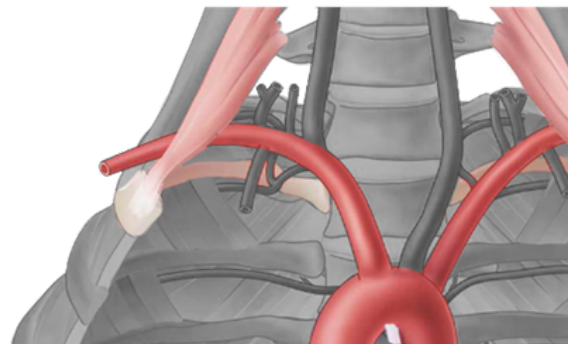
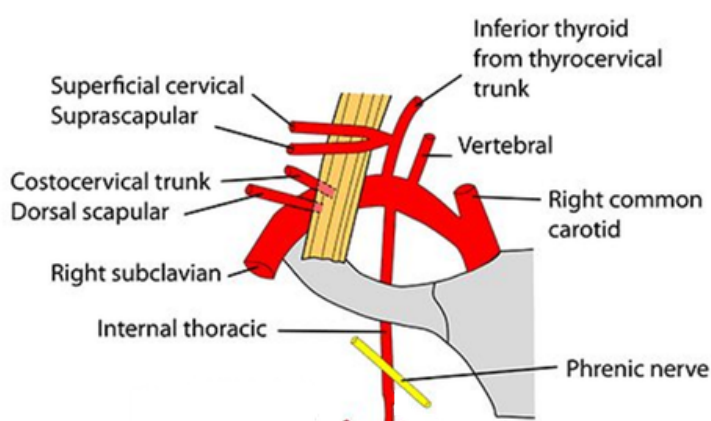


Carotid arteries

- The common carotid artery (CCA) runs in **the carotid sheath**
- At the level of C4 (posteriorly) and laryngeal prominence (anteriorly), the CCA bifurcates into:
 - The internal carotid artery (ICA) -- continues to run inside the sheath
 - The external carotid artery (ECA) -- exits the sheath to supply the neck
- The common carotid bifurcates at **C4!**

Subclavian Artery

- Split into three parts:
 - Part 1 – **Medial** to scalenus anterior
 - Part 2 – **Posterior** to scalenus anterior
 - Part 3 – **Lateral** to scalenus anterior, medial to 1st rib



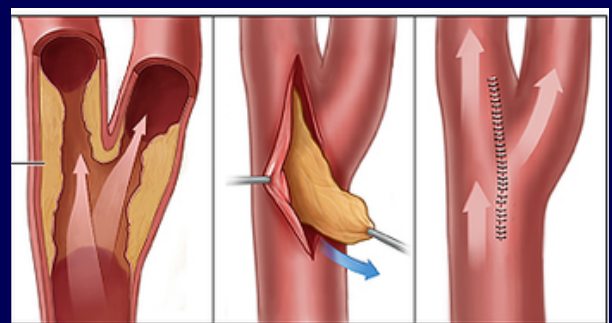
Branches of Subclavian

- Part 1 – **Vertebral artery, Internal thoracic artery, thyrocervical trunk**
- Part 2 – **costocervical trunk**
- Part 3 – **dorsal scapular artery**

Mnemonic – VIT C and D

Carotid endarterectomy

- Atheromatous plaque build-up in carotid arteries, specifically ICA, can lead to transient ischaemic attacks and cause 20% of strokes.
- Mechanical removal of carotid artery plaques is known as carotid endarterectomy – occurs if >50% of vessel occluded if symptomatic or >70–90% if asymptomatic.
- Associated with lower periprocedural stroke rate in patients > 70 years of age compared to carotid artery stenting

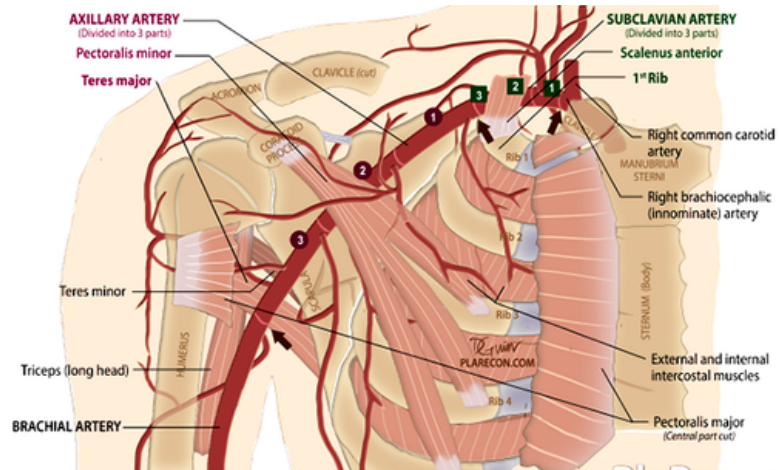


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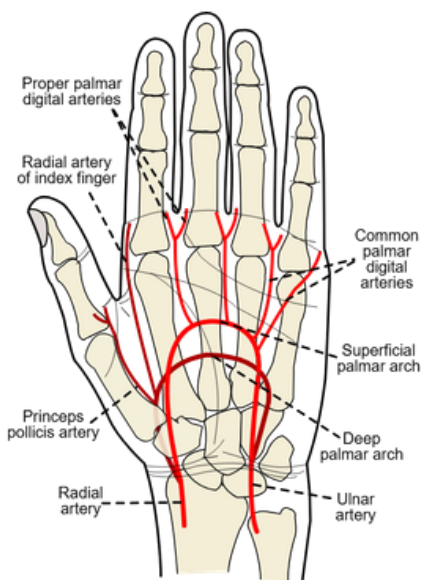
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Upper Limb Arterial Supply

- Axillary artery has three parts
 - Part 1 – proximal (1st rib) to pectoralis minor
 - Branch: Superior thoracic artery
 - Part 2 – Posterior to pectoralis minor
 - Branch: Thoracoacromial + Lateral thoracic artery
 - Part 3 – Pectoralis minor to teres major
 - Branch: Humeral circumflex artery (Anterior + Posterior) & subscapular artery



Subclavian artery → Axillary artery → Brachial artery
 First landmark – lateral border of the first rib
 second landmark – inferior border of teres major muscle

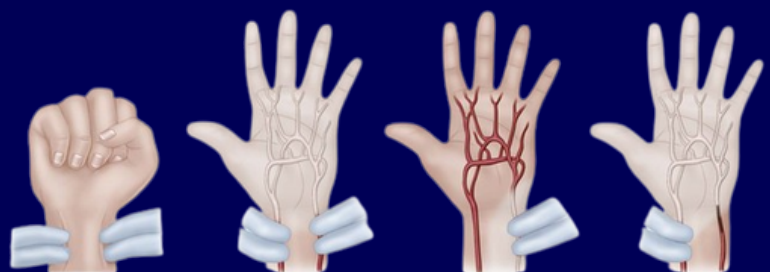


Axillary continues as Brachial artery which gives rise to two main branches – the radial and ulnar artery

- Radial and Ulnar anastomose giving rise to
 - Deep palmar arch
 - radial + deep palmar branch of ulnar
 - Superficial palmar arch
 - ulnar + superficial palmar branch of radial

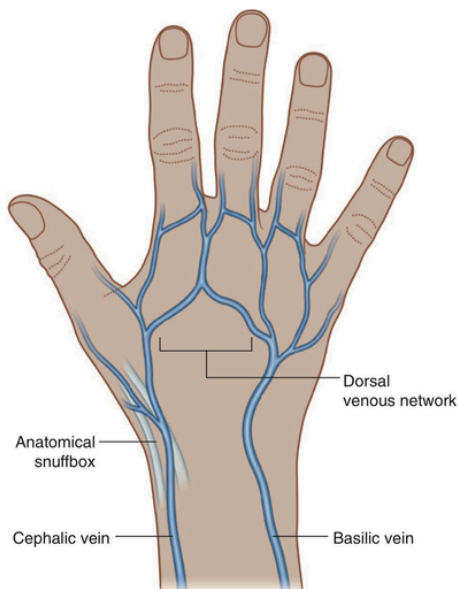
Allen's Test

- The brachial artery bifurcates to radial and ulnar arteries at the cubital fossa.
- The radial and ulnar arteries form a network of deep and superficial palmar arches, respectively.
- **Allen's test** is used to evaluate the patency of the collateral circulation to the hand through the radial and ulnar arteries.



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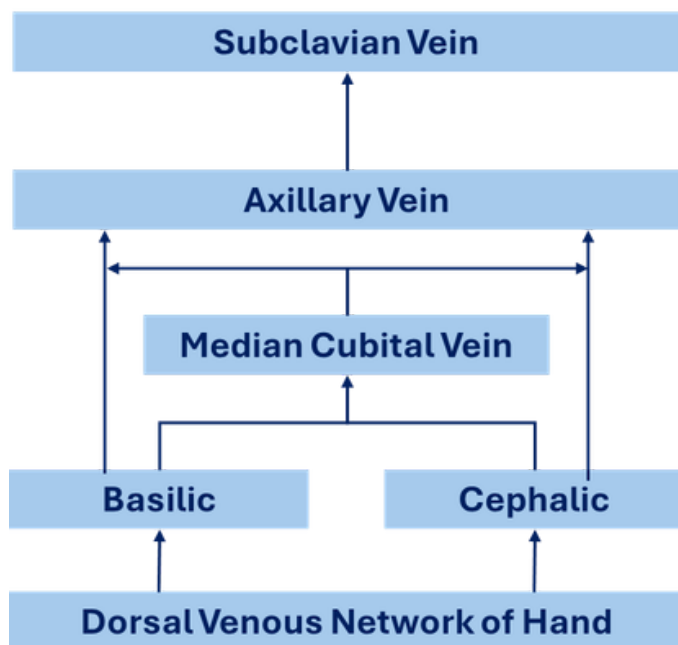
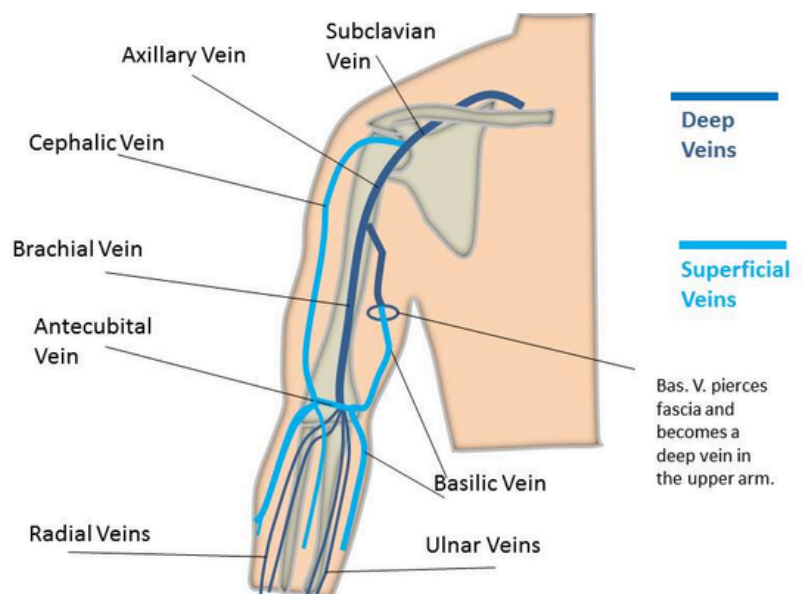
Upper Limb Venous Supply

Superficial Veins:

Palmar venous supply → Basilic or Cephalic → Axillary → Subclavian

Basilic and Cephalic (superficial veins) anastomose to form Median Cubital Vein

- Median cubital vein is the common site for venesection



Deep veins:

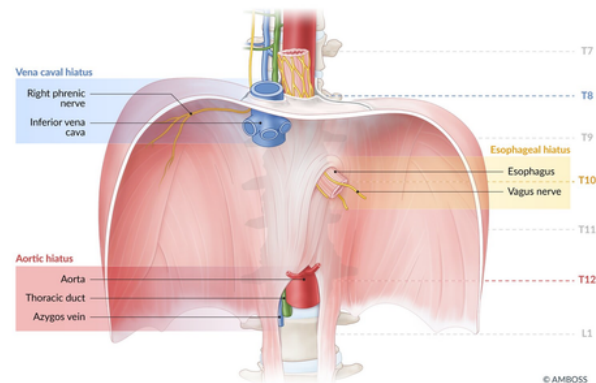
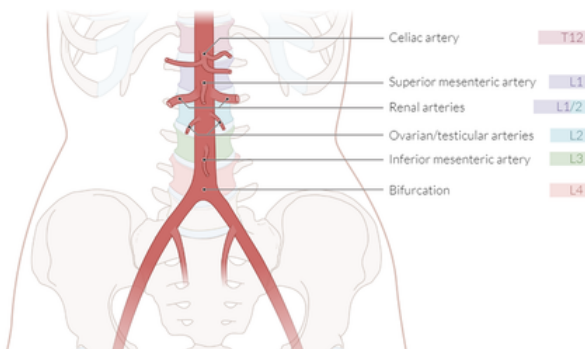
Radial and Ulnar → Brachial vein → Axillary → Subclavian

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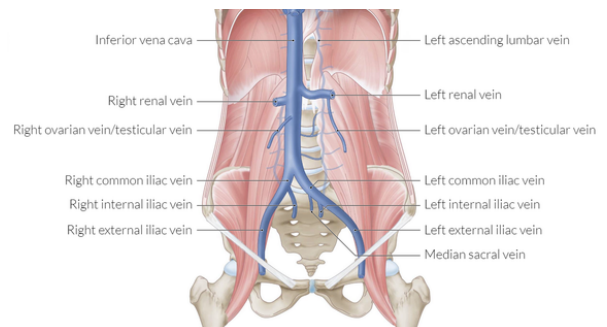
The diaphragm separates the thoracic and abdominal cavity.

Vertebral levels at which structures traverse the diaphragm		
I ate (8)	IVC + right phrenic nerve	T8
10 Oranges	Oesophagus + anterior and posterior vagal trunks	T10
At 12	Aorta, thoracic duct + azygous vein	T12



Abdominal aorta

- Four main branches of abdominal aorta:
 - T12: **Coeliac trunk**
 - L1: **Superior mesenteric artery**
 - L3: **Inferior mesenteric artery**
 - L4: bifurcation into common iliac artery



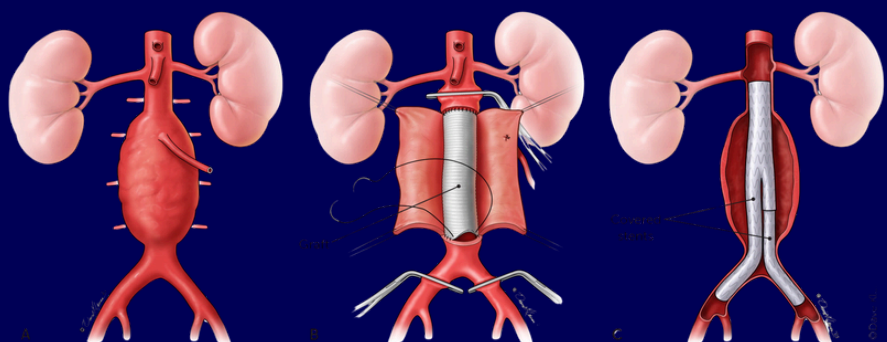
Inferior vena cava

- Inferior vena cava has six tributaries:
 - Common iliac veins
 - Lumbar veins
 - Right renal vein
 - Right suprarenal vein
 - Hepatic veins (x3)

Abdominal Aortic Aneurysm

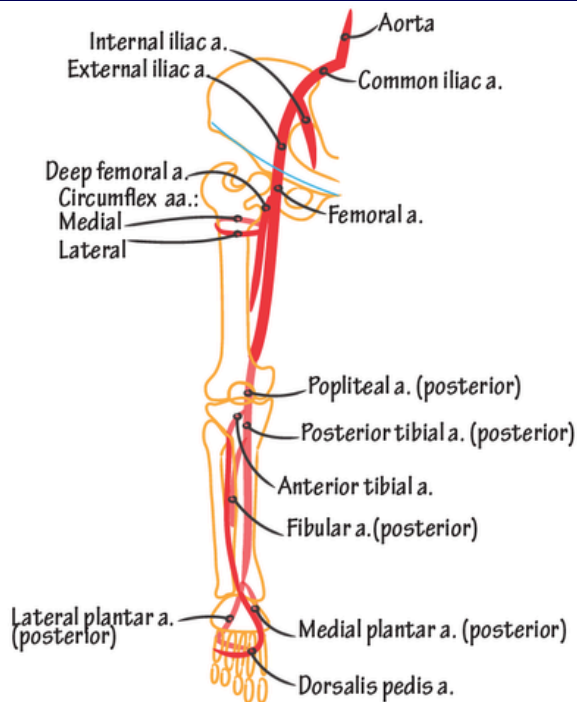
- Full thickness focal dilatations of the blood vessel wall resulting in weakness in the vessel wall. This results in a risk of vessel wall rupture.
- The most common site for this to happen is **proximal to the L4 bifurcation of the aorta** (infrarenally). It can sometimes include the **common iliac arteries** and extend to the **renal arteries** above.
- The normal diameter of the aorta is 3cm. An aneurysm in the aorta is defined as an enlargement of 1.5 times.

This aorta has to be monitored. If it increases in size or grows in size, it may be eligible for vascular surgical repair
Treatment is by open surgery or endovascular repair (EVAR)



VASCULAR ANATOMY

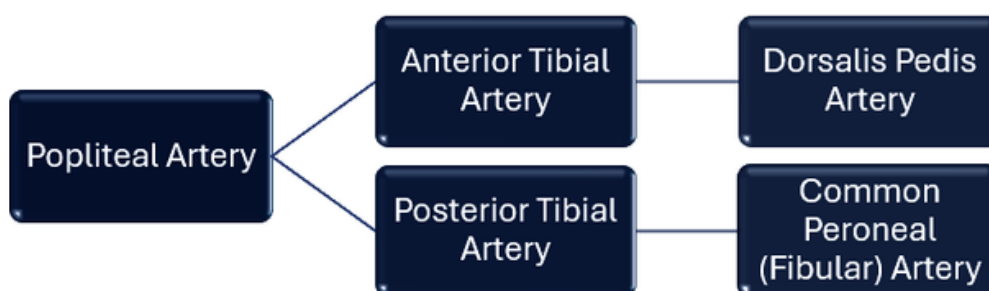
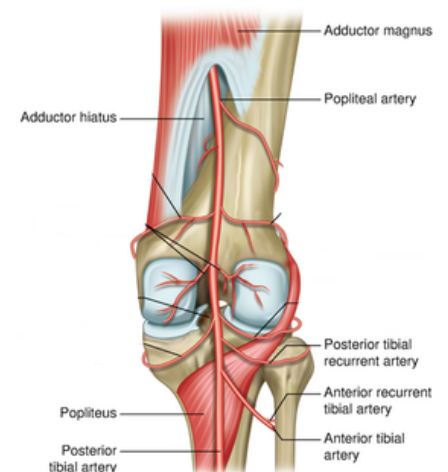
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Lower limb Arterial Supply

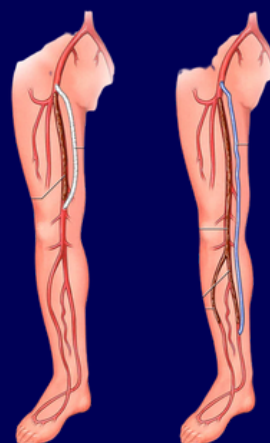
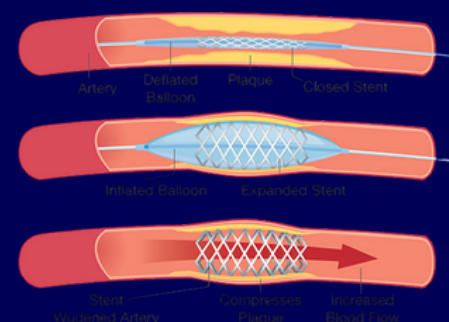
- Passing under the inguinal ligament the External iliac artery → femoral artery
- Through adductor hiatus Femoral artery → Popliteal artery
- Femoral artery gives off **lateral** and **medial femoral circumflex artery**
- **Medial femoral circumflex artery** supplies 82% of femoral head (Dewar et al., 2016). Damage leads to avascular necrosis of femoral head.

Common iliac → (Internal &) External iliac artery → Femoral artery → Popliteal artery



Peripheral Arterial Disease

- Atherosclerosis or plaque build up leading to stenosis or occlusion of the peripheral arteries
- Symptoms include 'intermittent claudication' – pain upon walking that subsides at rest.
- Interventional management includes **angioplasty, bypass graft and in severe cases amputation**

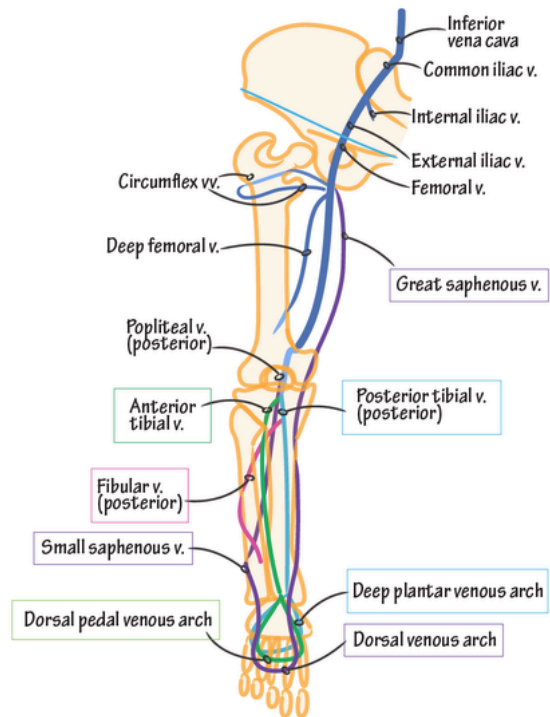
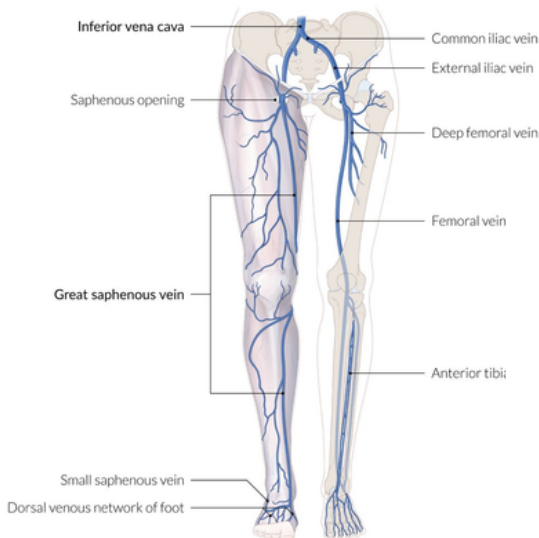


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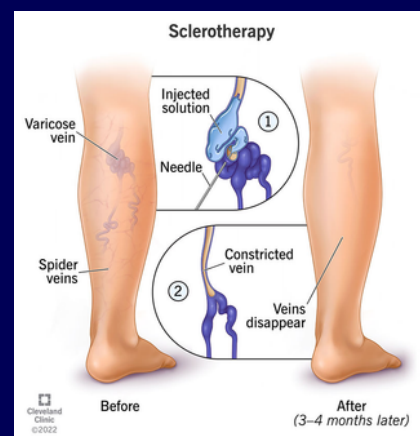
Lower limb Venous Supply

- Dorsal venous arch drains bilaterally into:
 - **Greater saphenous vein** (Medially)
 - **Lesser saphenous vein** (Laterally)
- **Greater saphenous vein** joins femoral vein at **saphenofemoral junction**
- **Lesser saphenous vein** joins the anterior and posterior tibial veins to form popliteal vein which drains into the Femoral vein
- Femoral vein drains into the External Iliac vein



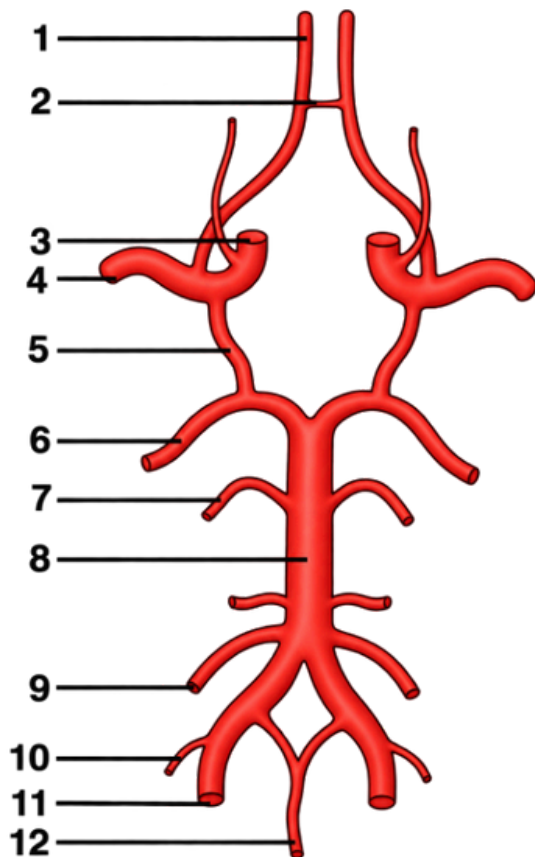
Chronic Venous Insufficiency

- Chronic venous insufficiency refers to the presence of dysfunctional venous valves in the superficial veins of the lower limbs
- Dysfunctional venous valves → stasis of blood → engorgement of veins → edema, stasis dermatitis, venous ulcers
- Interventional management includes **sclerotherapy** (chemical ablation).



VASCULAR ANATOMY

Test yourself

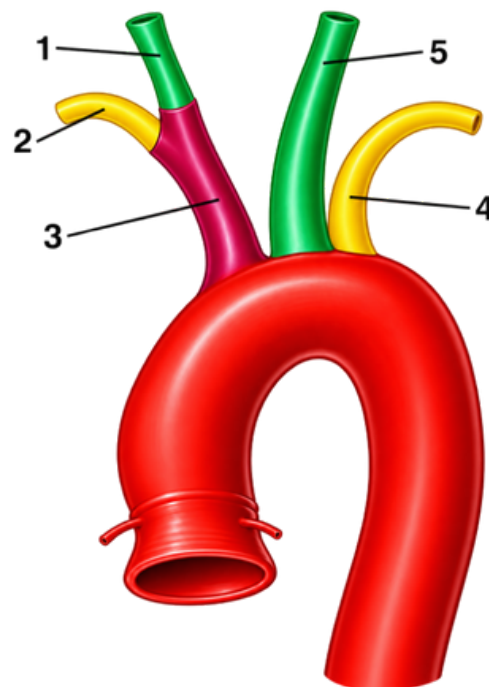


1) Label the arteries comprising the Circle of Willis

- 1)
- 2)
- 3)
- 4)
- 5)
- 6)
- 7)
- 8)
- 9)
- 10)
- 11)
- 12)

2) Label the branches of the Aortic Arch

- 1)
- 2)
- 3)
- 4)
- 5)



VASCULAR ANATOMY

Test yourself

MCQ 1

A patient undergoes surgery in the axilla. The surgeon identifies the axillary artery posterior to pectoralis minor. Which part of the axillary artery is this?

- A. First part
- B. Second part
- C. Third part
- D. Brachial artery
- E. Subclavian artery

MCQ 2

During an upper limb operation, the surgeon follows the brachial artery into the cubital fossa. Into which two arteries does it normally divide?

- A. Axillary and radial arteries
- B. Subclavian and radial arteries
- C. Ulnar and brachial arteries
- D. Radial and profunda brachii arteries
- E. Radial and ulnar arteries

MCQ 3

A patient presents with acute abdominal pain caused by intestinal ischaemia. Occlusion of which artery would most directly compromise the blood supply to the jejunum and ileum?

- A. Coeliac trunk
- B. Inferior mesenteric artery
- C. Superior mesenteric artery
- D. Left gastric artery
- E. Superior rectal artery

MCQ 4

A patient with portal hypertension develops dilated veins in the oesophagus. Which vessel forms part of the venous system carrying blood from the gastrointestinal tract to the liver?

- A. Inferior vena cava
- B. Hepatic vein
- C. Renal vein
- D. Hepatic portal vein
- E. Gonadal vein

MCQ 5

A patient has presented following a fall while ice-skating, complaining of left arm pain. X-ray examination reveals a break to the surgical neck of the humerus; this causes damage to which of the following vessels?

- A. Thoracoacromial artery
- B. Subscapular artery
- C. Brachial artery
- D. Axillary artery
- E. Circumflex humeral arteries

MCQ 6

A patient requires an autologous vein graft for vascular reconstruction. Which vein is commonly harvested from the lower limb for this purpose?

- A. Lesser saphenous vein
- B. Great saphenous vein
- C. Femoral vein
- D. Popliteal vein
- E. Anterior tibial vein

VASCULAR ANATOMY

Test yourself

OSCE Station – Case Based Discussion

A 24-year-old woman presents to the emergency department following a tibial fracture sustained during a football match. She develops progressively worsening pain in her lower leg, which appears disproportionate to the initial injury. The leg becomes tense and swollen and she develops altered sensation in the foot. Compartment syndrome is suspected and urgent surgical assessment is arranged.



- Q1. Which major artery supplies the lower limb before dividing into the anterior and posterior tibial arteries?
- Q2. Which artery gives rise to the peroneal (fibular) artery?
- Q3. How can increased pressure within a muscle compartment compromise the blood supply to the limb?
- Q4. Which clinical features would suggest that the compartment syndrome is progressing?
- Q5. What is the definitive surgical treatment for acute compartment syndrome?
- Q6. Why is urgent treatment important in acute compartment syndrome?

Answers
Labelling. Part 1: 1) anterior cerebral, anterior communicating, 3) internal carotid, 4) middle cerebral, 5) posterior communicating, 6) posterior cerebral, 7) pontine, 8) basilar, 9) anterior inferior cerebellar, 10) posterior inferior cerebellar, 11) vertebral, 12) anterior spinal. Part 2: 1) right common carotid, 2) right subclavian, 3) brachiocephalic trunk, 4) left subclavian artery, 5) left common carotid
MCQs: 1) B, 2) E, 3) C, 4) D, 5) E, 6) B
CBD: 1) The popliteal artery, which continues from the femoral artery and divides into the anterior tibial and posterior tibial arteries. 2) The posterior tibial artery gives rise to the peroneal (fibular) artery. 3) Increased compartment pressure can compress blood vessels restricting blood flow, reducing tissue perfusion and causing ischaemia. 4) Progressively worsening pain, tense swelling, pain on passive muscle stretch, sensory disturbance and in severe cases weakness or loss of pulses. 5) Emergency surgical fasciotomy to release the pressure within the affected compartment. 6) Prolonged vascular compromise can result in muscle and nerve ischaemia, tissue necrosis and permanent functional impairment. Early decompression is therefore essential.