

INTERNATIONAL SURGICAL
ANATOMY TEACHING
SERIES

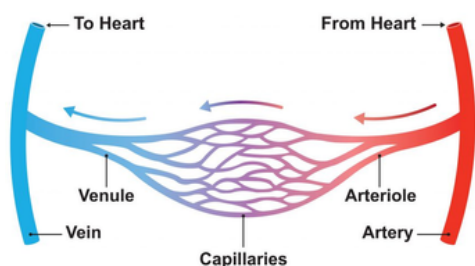


ISATS HANDOUT 2025/26

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.

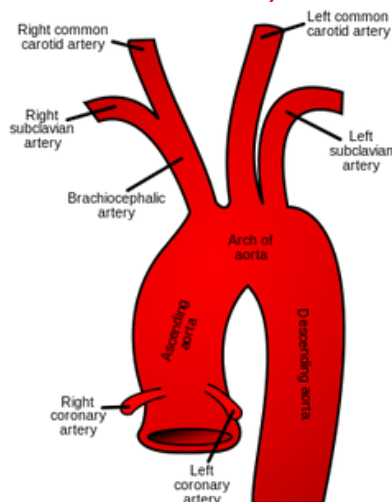


Vascular Flow

- 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**

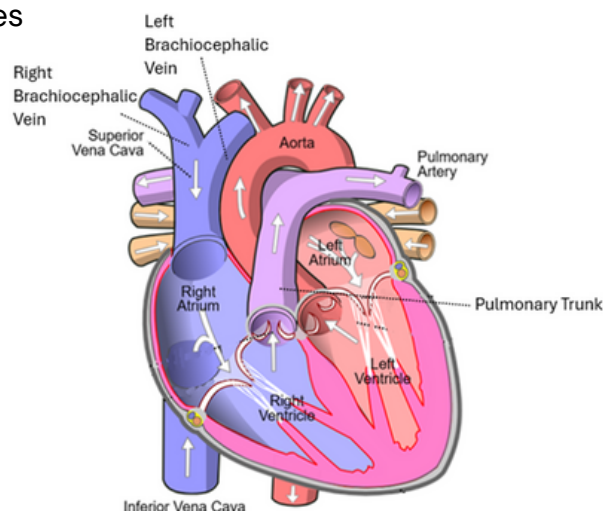


Vena cava

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

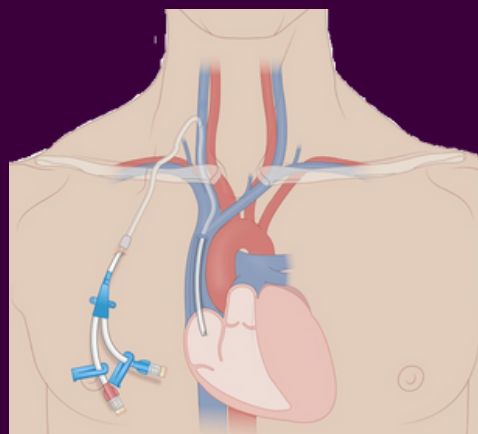
Pulmonary trunk

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



Tributaries of brachiocephalic veins

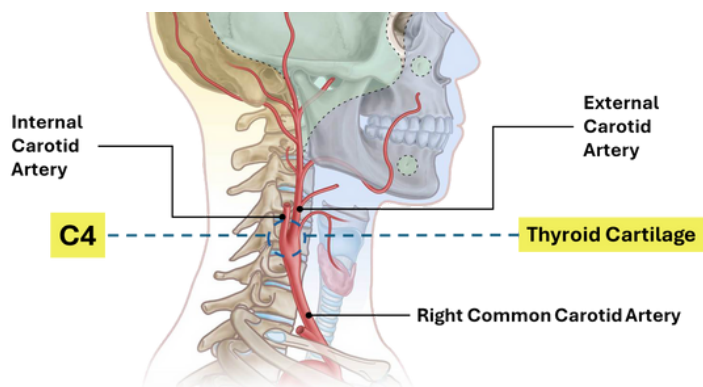
- Brachiocephalic veins begin with the confluence of the internal jugular vein (IJV) and subclavian veins
- IJV and subclavian vein junction known as the **venous angle**
 - **Right venous angle** facilitates drainage of right lymphatic duct
 - **Left venous angle** facilitates drainage of left thoracic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



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

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.

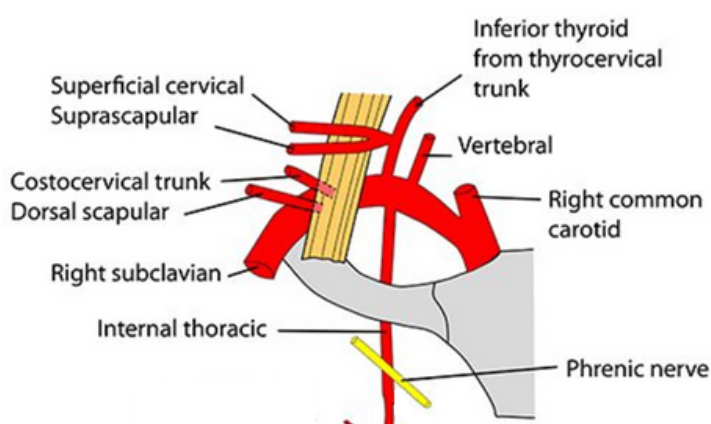
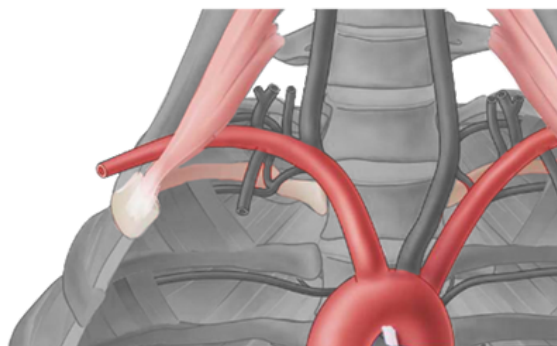


Carotid arteries

- 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 bif**our**cates 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



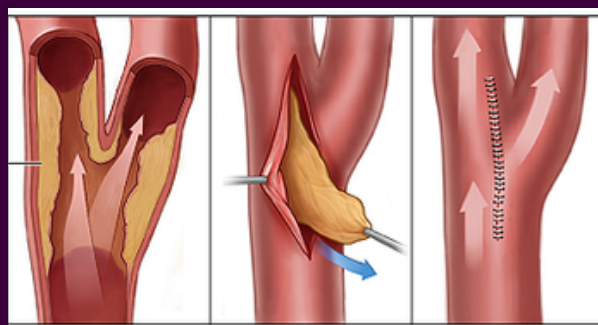
Branches of Subclavian

- 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

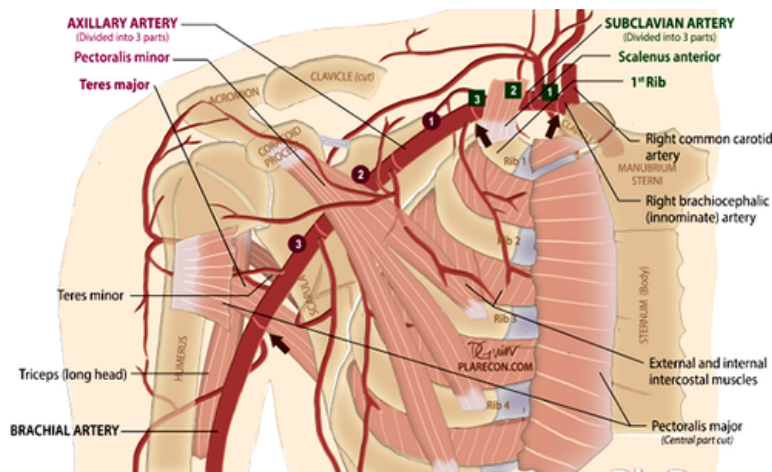


VASCULAR ANATOMY

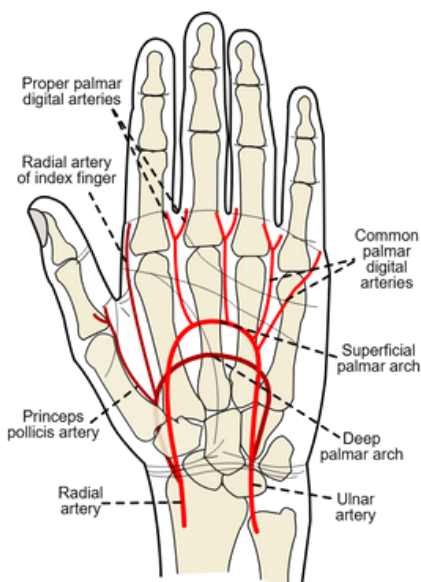
Objectives: Understand the path of the major arteries and veins within the body coupled with their respective branches. Apply anatomical knowledge in the context of a vascular emergency and the associated surgical treatment.

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

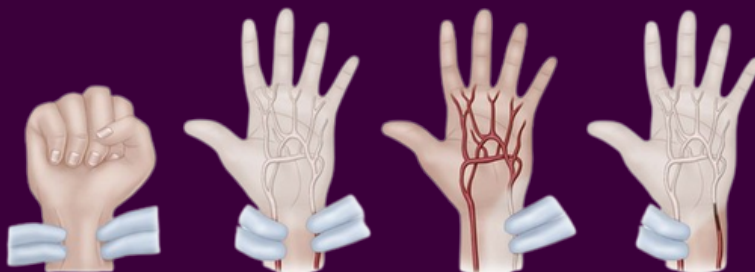


Axillary continues as Brachial artery which gives rise to two main branches – the radial and ulnar artery

- 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

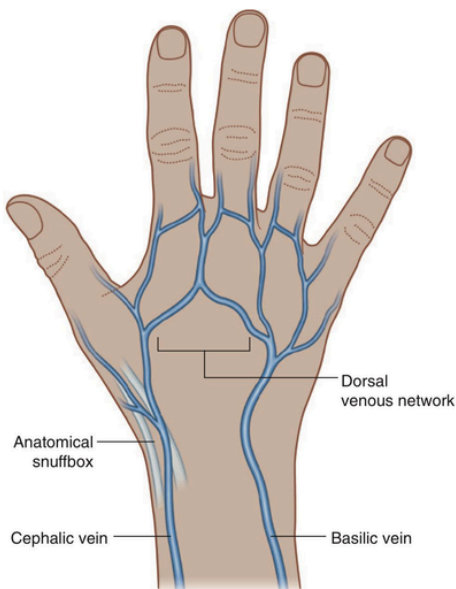
Allen's Test

- 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.



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.



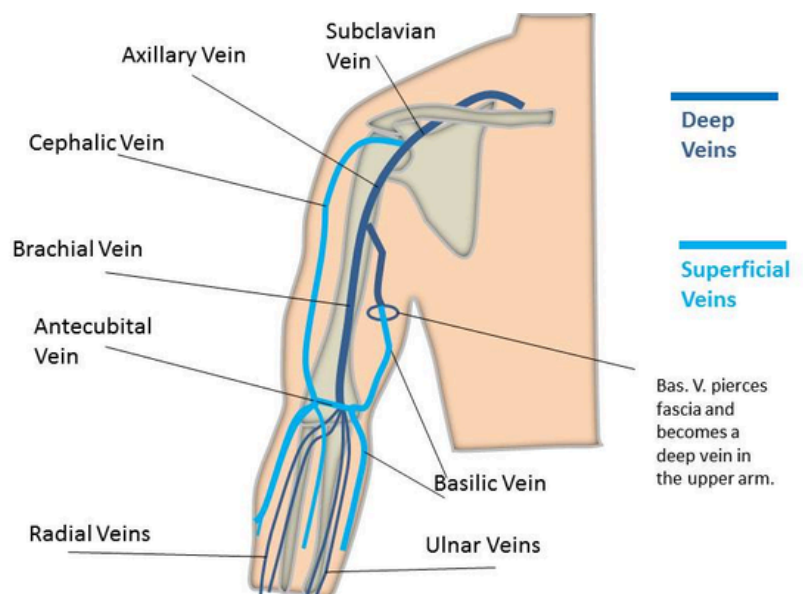
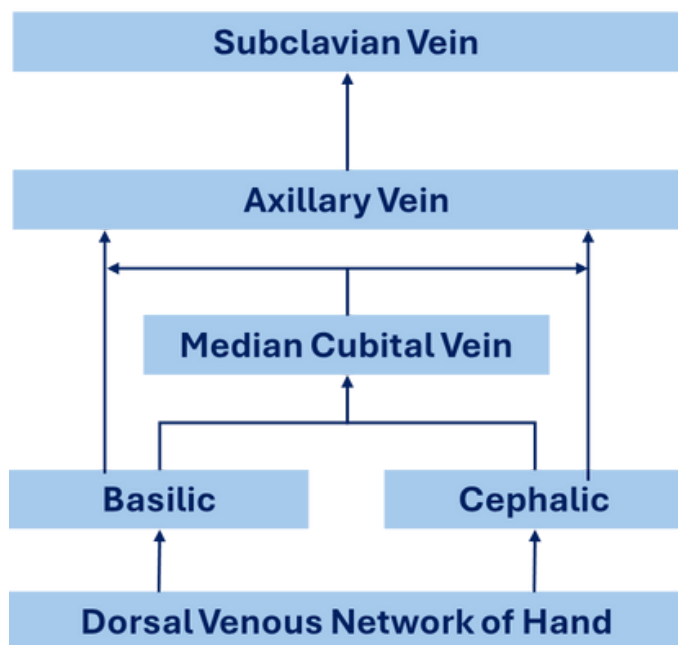
Upper Limb Venous Supply

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:

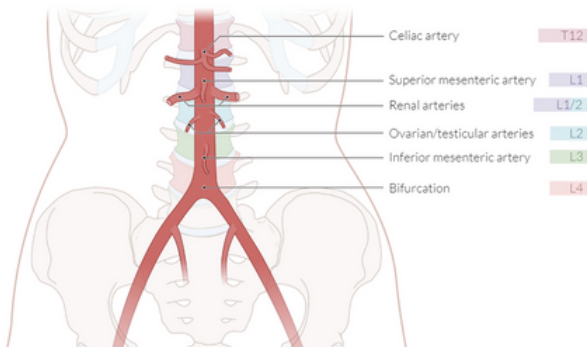
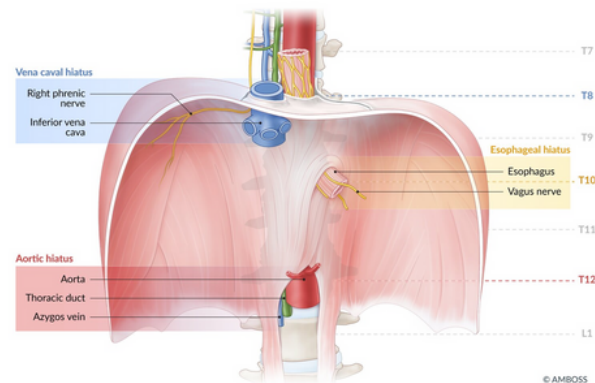
Radial and Ulnar → Brachial vein → Axillary → Subclavian

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.

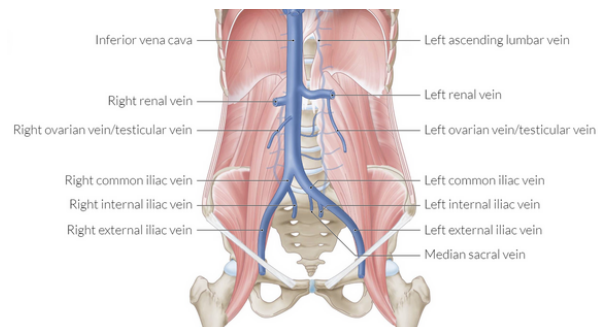
The diaphragm separates the thoracic and abdominal cavity.

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



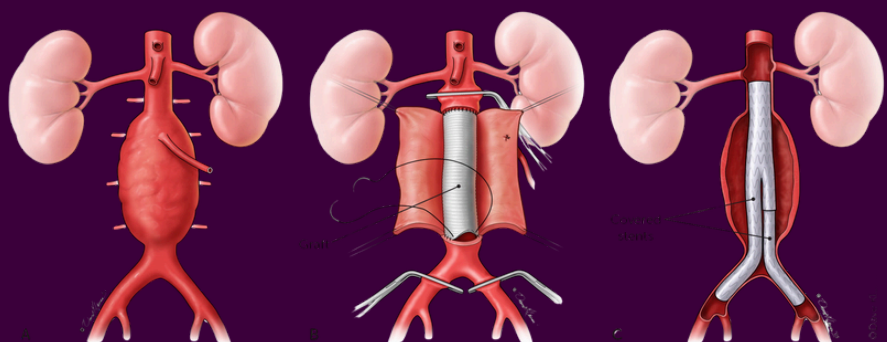
Inferior vena cava

- Inferior vena cava has six tributaries:
 - Common **i**liac veins
 - L**umbar veins
 - Right **r**enal vein
 - Right **s**uprarenal vein
 - H**epatic veins (x3)

Abdominal Aortic Aneurysm

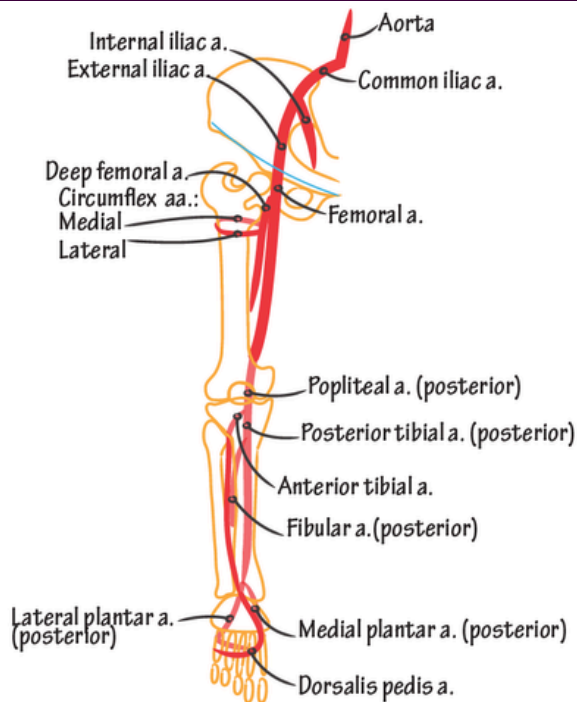
- Full thickness focal dilatations of the blood vessel wall resulting in weakness in the vessel wall. This results in a risk of vessel wall rupture.
- The most common site for this to happen is **proximal to the L4 bifurcation of the aorta** (infrarenally). It can sometimes include the **common iliac 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

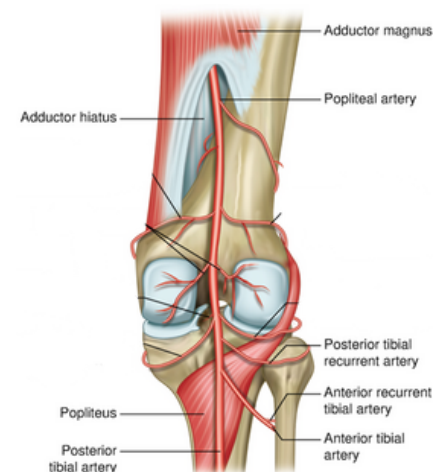
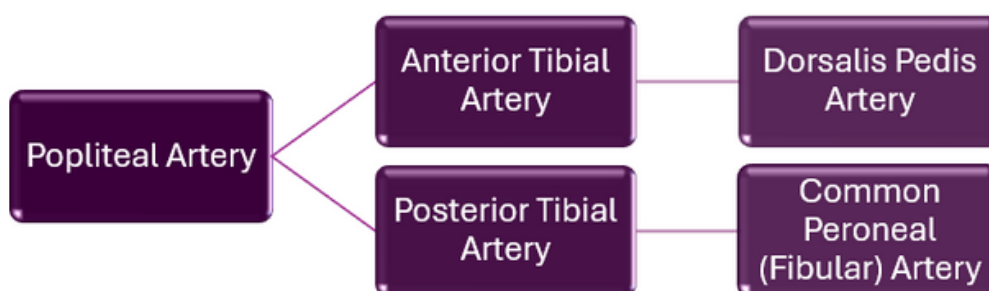
Objectives: Understand the path of the major arteries and veins within the body coupled with their respective branches. Apply anatomical knowledge in the context of a vascular emergency and the associated surgical treatment.



Lower limb Arterial Supply

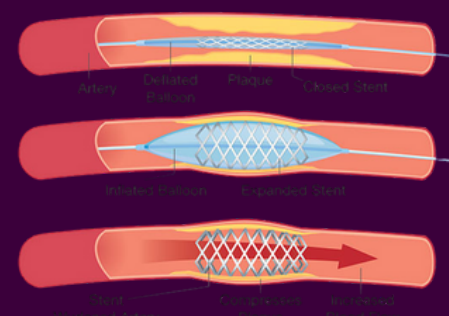
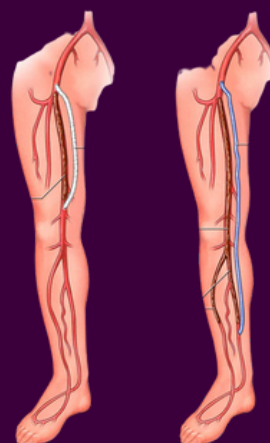
- Passing under the inguinal ligament the External iliac artery → femoral artery
- Through adductor hiatus Femoral artery → Popliteal artery
- Femoral artery gives off **lateral** and **medial femoral circumflex artery**
- **Medial femoral circumflex artery** supplies 82% of femoral head (Dewar et al.,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

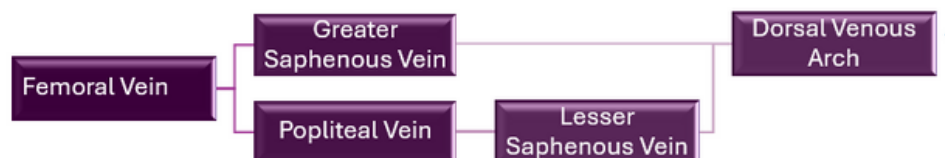
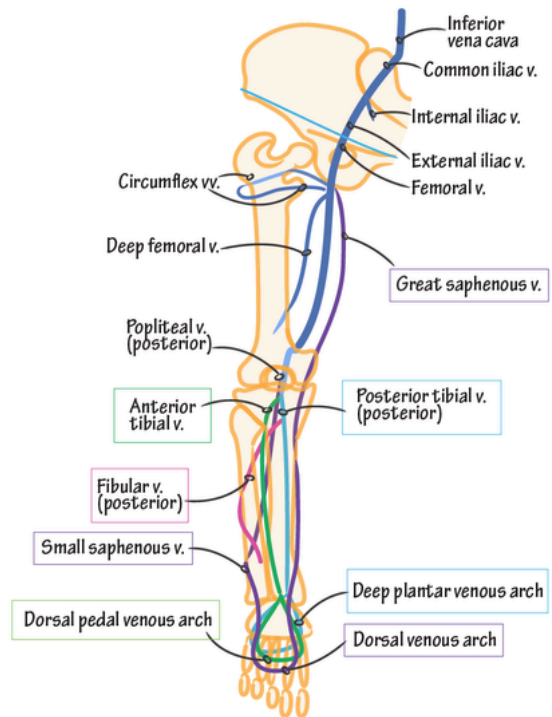
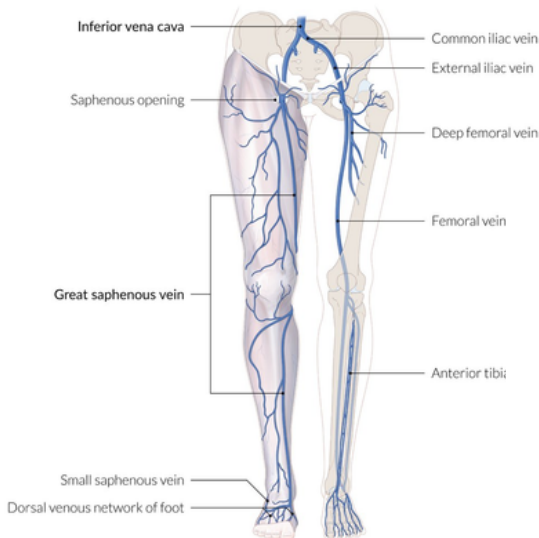


VASCULAR ANATOMY

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.

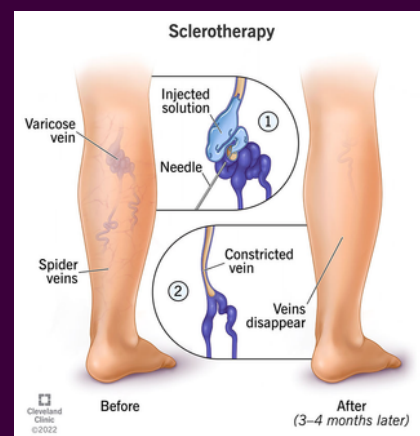
Lower limb Venous Supply

- 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



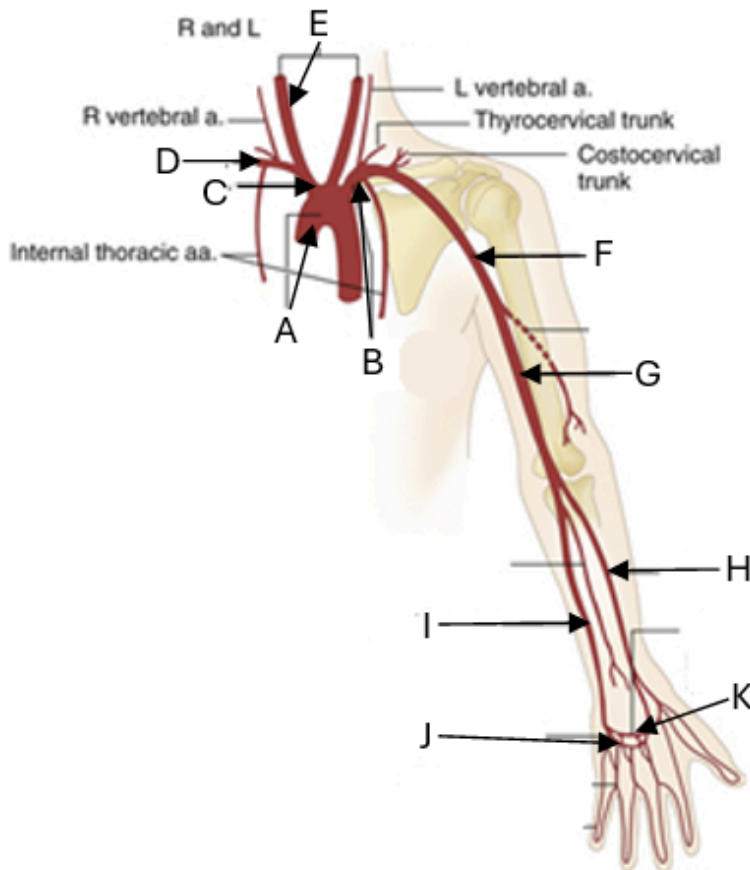
Chronic Venous Insufficiency

- 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 your Knowledge

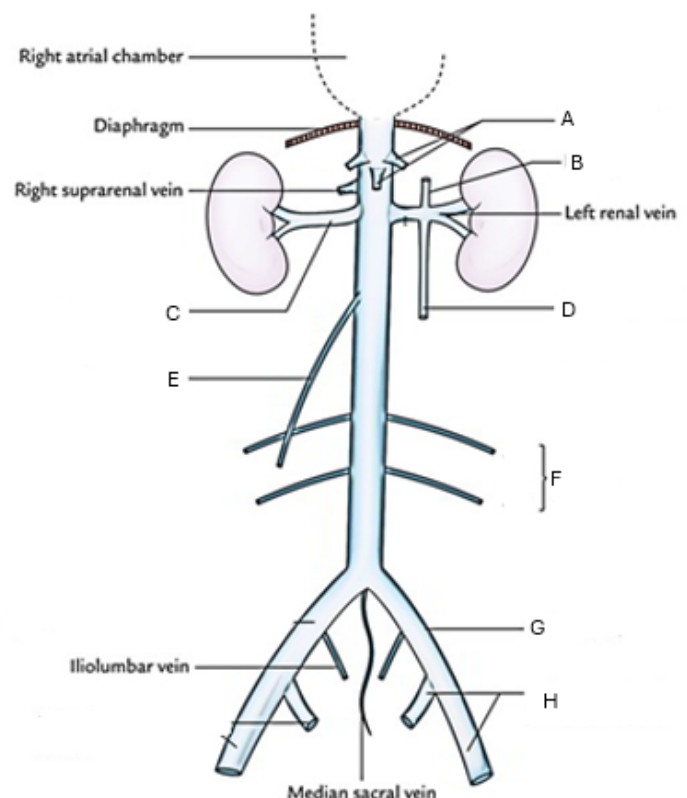


1) Label the arteries of the upper limb

- A
- B
- C
- D
- E
- F
- G.....
- H.....
- I.....
- J.....
- K.....

2) Label the branches of the Inferior Vena Cava

- A
- B
- C
- D
- E
- F
- G.....
- H.....



VASCULAR ANATOMY

Test your Knowledge

MCQ 1

Which of the following arteries branches off the abdominal aorta at the level of L2?

- A. Middle suprarenal arteries
- B. Superior Mesenteric Artery
- C. Common Hepatic Artery
- D. Inferior Mesenteric Artery
- E. Gonadal arteries (ovarian/testicular arteries)

MCQ 2

A 41 year old has been brought into the Emergency Department after being found on the pavement intoxication – history confirms the patient suffers from chronic alcoholism. On examination the patient complains of right hip pain and imaging reveals avascular necrosis of the femoral head. Damage to which vessel most likely leads to Avascular Necrosis?

- A. Femoral artery
- B. Inferior gluteal artery
- C. Middle circumflex artery
- D. Obturator artery
- E. Lateral circumflex artery

MCQ 3

Which of the following arteries is not a branch of the superior mesenteric artery?

- A. Right colic
- B. Middle colic
- C. Left colic
- D. Inferior pancreaticoduodenal artery
- E. Ileocolic artery

MCQ 4

Which of the following vessels are not a direct tributary of the Inferior Vena Cava?

- A. Right suprarenal vein and left gonadal vein
- B. Lumbar veins and right suprarenal vein
- C. Left gonadal vein and left renal vein
- D. Left suprarenal vein and left gonadal vein
- E. Lumbar veins and hepatic veins

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 a central venous catheter which is inserted into the superior vena cava; the clinical accesses the SVC through which artery?

- A. Right internal jugular vein
- B. Right brachiocephalic vein
- C. Left brachiocephalic vein
- D. Left internal jugular vein
- E. Internal thoracic vein

VASCULAR ANATOMY

Test Your Knowledge

OSCE Station – Case Based Discussion

A 70-year patient has presented to the Emergency Department complaining of sudden onset severe abdominal pain, characterised as sharp/stabbing scoring 9/10, presenting with with nausea and vomiting and diarrhoea. On examination there is diffuse abdominal tenderness, however, pain seems to be greater than expected in relation to palpation. Bowel sounds are present. The patient seems slightly delirious and has a background of atrial fibrillation, hyperlipidaemia and TII DM. The patient is reviewed and starts showing signs of abdominal guarding.



Q1. What risk factors in the history of this patient are contributing to her current condition?

Q2. Explain the pathophysiology of this condition.

Q3. What are the differential diagnoses in this patient?

Q4. How would you confirm the diagnosis and assess the severity in this patient?

Q5. What are the interventional management options for this condition?

Q6. Discuss potential complications of untreated patient/delaying treatment.

Answers
Labelling 1. A) Aortic Arch, B) Left subclavian artery, C) Brachiocephalic Trunk, D) Right subclavian artery, E) Right common carotid artery, F) Axillary artery, G) Brachial artery, H) Radial artery, I) Ulnar artery, J) Superficial palmar arch, K) Deep palmar arch.
2. A) Hepatic vein, B) Left suprarenal vein, C) Right renal vein, D) Left gonadal vein, E) Right gonadal vein, F) Lumbar veins, G) Left common iliac vein, H) Left internal and External iliac veins
MCQs. 1) E, 2) C, 3) C, 4) D, 5) E, 6) B
OSCEs: 1) Atherosclerosis, age, TII DM, hypertension and smoking 2) Ischaemia to the bowel, most commonly due to arterial emboli resulting from atrial fibrillation or recent myocardial infarction. Arterial thrombosis due to atherosclerotic disease 3) Mesenteric venous thrombosis, ischaemic colitis, bowel obstruction, perforated bowel. Q4) Clinical examination and mesenteric angiography. 5) Fluid resuscitation initially and broad-spectrum antibiotics for cover, followed by embolectomy or bypass grafting. 6) Intestinal necrosis, sepsis, short bowel syndrome