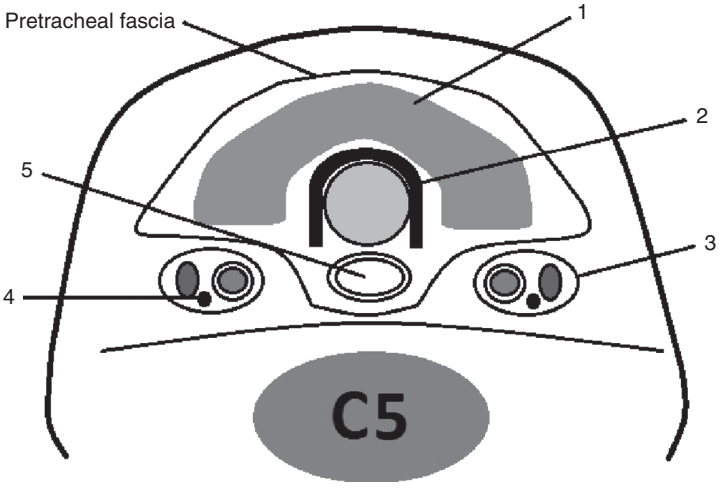
Section 1 Anatomy

1. Trachea

Candidate's instructions

Look at this cross-section taken at the level of C5. Answer the following questions.



Questions

1. Label the structures 1–5.
2. What are the proximal and distal borders of the trachea?
3. What forms the wall of the trachea?
4. Which type of mucosa lines the trachea?
5. What lies immediately posterior to the trachea?
6. Which major vascular structures traverse the trachea anteriorly?
7. What is the blood supply to the trachea?
8. What is the nerve supply of the trachea?

Answers

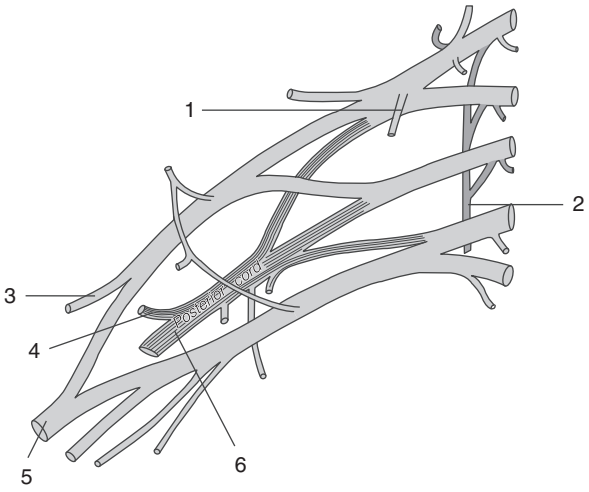
1. 1. Thyroid gland
   2. Thyroid cartilage
   3. Carotid sheath
   4. Vagus nerve
   5. Oesophagus
2. The trachea begins proximally at the lower border of the cricoid cartilage (C6) and terminates distally at the sternal angle (T4) where it bifurcates into the two main bronchi.
3. The walls are composed of fibrous tissue reinforced by 15–20 incomplete semicircular cartilaginous rings.
4. The trachea is lined by respiratory epithelium. Histologically, this is ciliated pseudostratified columnar epithelium.
5. The oesophagus lies posteriorly with the recurrent laryngeal nerve running in a groove between the trachea and oesophagus.
6. The brachiocephalic artery and the left brachiocephalic vein traverse the trachea anteriorly. Abnormal vascular anatomy can potentially cause life-threatening bleeding if not identified prior to tracheostomy.
7. The arterial supply is from the inferior thyroid artery, which arises from the thyrocervical trunk. Venous drainage is via the inferior thyroid veins, which drain into the right and left brachiocephalic veins.
8. The nerve supply is predominantly via the recurrent laryngeal branch nerves (branches of the vagus nerve) with an additional sympathetic supply from the middle cervical ganglion.

This could be an unmanned station with a diagram that requires labelling. Human subjects may be used; therefore, you should be able to recognise anatomical landmarks and explain the path of nerves, blood vessels and muscles and their relations to the trachea.

2. Brachial plexus

Candidate's instructions

The following is a diagram of the brachial plexus. Please follow the instructions and answer the questions carefully.



Adapted from Gray H. *Gray's Anatomy*. 1918. Image in the public domain.

Questions

1. Label the structures 1–6.
2. What are the origins of the brachial plexus?
3. Describe the course of the brachial plexus until it reaches the clavicle.
4. What are the branches of the lateral cord?
5. What are the branches of the medial cord?
6. How would you perform a block of the plexus using an axillary approach?
7. Which nerves may be missed using the axillary approach?
8. What complications are associated with supraclavicular nerve blocks?

Answers

1. 1. Nerve to subclavius
   2. Long thoracic nerve
   3. Musculocutaneous nerve
   4. Axillary nerve
   5. Median nerve
   6. Radial nerve
2. The brachial plexus arises from the anterior primary rami of C5, C6, C7, C8 and T1.
3. The plexus emerges as five roots lying anterior to scalenus medius and posterior to scalenus anterior. The trunks lie at the base of the posterior triangle of the neck, where they are palpable, and pass over the first rib, posterior to the third part of the subclavian artery, to descend behind the clavicle. The divisions form behind the middle third of the clavicle.
4. Branches of the lateral cord:
   - Lateral pectoral nerve to pectoralis major
   - Musculocutaneous nerve to corachobrachialis, biceps, brachialis and the elbow joint. It continues as the lateral cutaneous nerve of the forearm, supplying the radial surface of the forearm
   - Lateral part of the medial nerve
5. Branches of the medial cord:
   - Medial pectoral nerve
   - Medial cutaneous nerves of the arm and forearm
   - Ulnar nerve
   - Medial part of median nerve
6. Perform a PDEQ check:
   - *Patient*: procedure explained, full consent obtained, intravenous access, supine with a pillow under the head, arm abducted with elbow flexed and shoulder rotated so that the hand lies next to the head on the pillow
   - *Drugs*: local anaesthetic (skin and injectate); full resuscitation drugs should be available
   - *Equipment*: nerve stimulator and 50-mm insulated nerve stimulator needle. Full monitoring as per AAGBI guidelines

     Note: ultrasound-guided regional blocks are becoming more popular due to improved efficacy and safety profiles; opt for ultrasound if you have been trained to use it.
   - Position the patient appropriately and identify the axillary artery. Draw a line down from the anterior axillary fold (insertion of pectoralis major) crossing the artery
   - After cleaning and draping the skin, infiltrate local anaesthetic subcutaneously
   - Fix the artery between your index and middle finger and insert a needle to pass above or below the artery
   - Pass the needle 45 degrees to the skin, angled proximally to a depth of 10–15 mm, aiming either above the artery (median, musculocutaneous nerves), below the artery (ulnar nerve) or below and behind the artery (radial nerve)

- If using a nerve stimulator, adequate proximity to each nerve is indicated by motor responses produced at 0.2–0.4 mA
- If using ultrasound, the proximity of the needle to the correct nerve can be clearly visualised. Most anaesthetists would use an in-plane approach for this purpose
- After negative aspiration, inject 30–40 mL of levobupivicaine, ropivicaine or lignocaine depending on your desired onset and duration of the block
- Do not inject if blood is aspirated or resistance is felt on injection

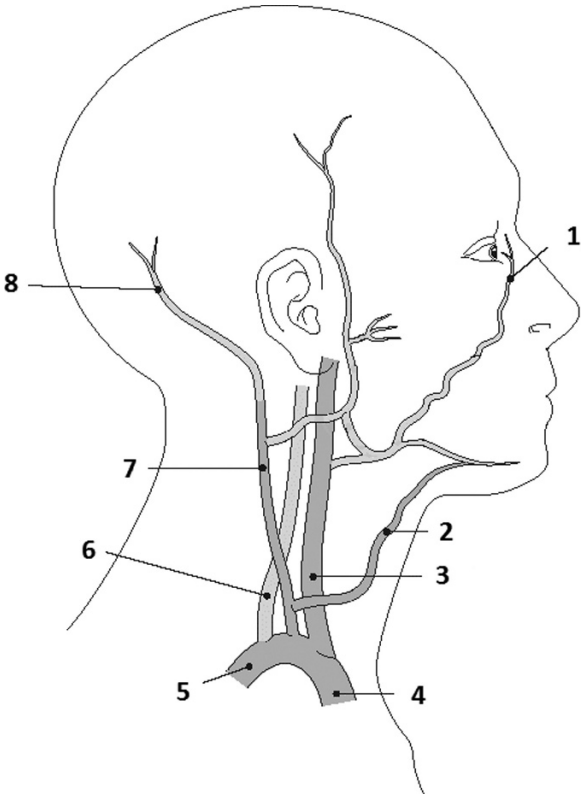
7. The axillary approach may miss the intercostobrachial nerve supplying the superomedial surface of the arm and the musculocutaneous nerve. The intercostobrachial nerve can be blocked by subcutaneous infiltration.
8. Complications include:
   - Intravascular injection of local anaesthetic
   - Temporary and permanent nerve damage
   - Bleeding
   - Failure
   - Phrenic nerve palsy
   - Recurrent laryngeal nerve palsy
   - Pneumothorax

Brachial plexus anatomy may be tested by asking how you would perform a brachial plexus block on a human subject or manikin. Being able to draw a schematic diagram of the plexus in 10 seconds will not help if the question asks about the anatomical relationships of the plexus in the neck. Detailed knowledge of the neck and upper limb anatomy is vital for safe anaesthetic practice and this will be expected by the examiner.

3. Great veins of the neck

Candidate's instructions

Look at the given diagram and answer the following questions.



Erdmann A. *Concise Anatomy for Anaesthesia*. Cambridge. 2007. Reproduced with permission.

Questions

1. Label the structures 1–8.
2. Which sinuses combine to form the internal jugular vein?
3. What is the relationship between the internal jugular vein and the carotid artery?
4. Where does the internal jugular vein terminate?
5. Which veins combine to form the external jugular vein?
6. Where do the anterior and external jugular veins join?

Answers

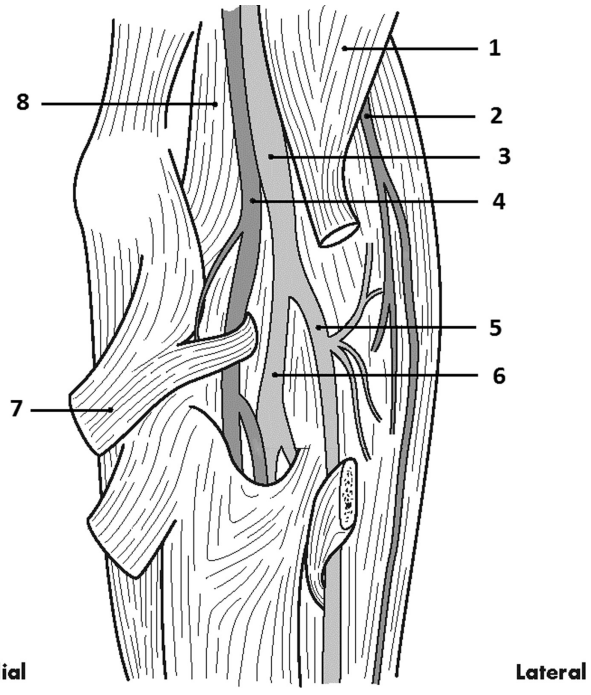
1. 1. Facial vein
   2. Anterior jugular vein
   3. Right internal jugular vein
   4. Right brachiocephalic vein
   5. Right subclavian vein
   6. Right vertebral vein
   7. External jugular vein
   8. Posterior auricular vein
2. The sigmoid sinuses and inferior petrosal sinuses combine to form the internal jugular vein, which then passes through the jugular foramen at the base of the skull.
3. The internal jugular vein lies posterior to the carotid artery at the level of C2, posterolateral at C3, and then lateral to the artery at C4. The vein and artery are contained within the carotid sheath along with the vagus nerve.
4. The internal jugular vein terminates behind the sternoclavicular joint as it unites with the subclavian vein to form the brachiocephalic vein.
5. The external jugular vein arises from the junction of the posterior auricular vein and the posterior division of the retromandibular vein. It lies within the superficial tissues of the neck.
6. The external and anterior jugular veins pierce the deep fascia of the neck, usually posterior to the clavicular head of sternocleidomastoid, and unite before draining into the subclavian vein behind the midpoint of the clavicle.

This station is unlikely to involve demonstrating the anatomy on a human subject. It may touch on central venous cannulation but this is commonly asked in a separate station.

4. Antecubital fossa

Candidate's instructions

Look at the given model and answer the questions that follow.



Erdmann A. *Concise Anatomy for Anaesthesia*. Cambridge. 2007. Reproduced with permission.

Questions

1. Label the structures 1–8.
2. What are the borders of the antecubital fossa?
3. What are the contents of the antecubital fossa?
4. What is the path of the radial nerve through the antecubital fossa?
5. Where does the ulnar nerve traverse the elbow joint?
6. How would you block the median nerve at the elbow?

Answers

1. 1. Biceps
   2. Radial nerve
   3. Brachial artery
   4. Median nerve
   5. Radial artery
   6. Ulnar artery
   7. Pronator teres
   8. Brachialis
2. The borders are as follows:

Proximally	– a line between the humeral epicondyles
Laterally	– brachioradialis
Medially	– pronator teres
The floor	– supinator and brachialis
The roof	– deep fascia with median cubital vein and median cutaneous nerve on top

3. The antecubital fossa contains the median, radial and posterior interosseous nerves, the brachial artery (dividing into radial and ulnar arteries) and the biceps tendon.
4. The radial nerve descends in the upper arm, lying between the medial and long heads of the triceps, and enters the antecubital fossa between the lateral epicondyle of the humerus and the musculospiral groove. It runs just lateral to the biceps tendon and under brachioradialis before dividing into its superficial and deep branches.
5. The ulnar nerve arises medial to the axillary artery and continues medial to the brachial artery, lying on corachobrachialis, to the midpoint of the humerus. Here it leaves the anterior compartment by passing posteriorly through the medial intermuscular septum with the superior ulnar collateral artery. It lies between the intermuscular septum and the medial head of triceps, passing posterior to the medial humeral epicondyle, and enters the forearm between the two heads of flexor carpi ulnaris.
6. Once you have explained the procedure to the patient and have prepared your drugs and equipment:
   - Flex the elbow and mark the elbow crease
   - Identify the brachial artery on this line and mark a point just medial to the artery
   - Clean and drape the area and use a fully aseptic technique
   - Direct your insulated stimulator needle 45 degrees to the skin, aiming proximally
   - At 10–15 mm, a pop or click will be felt (bicipital aponeurosis)
   - Electrical stimulation with 0.2–0.4 mA should elicit finger flexion (pronation alone is inadequate)
   - Slowly inject 5 mL of your chosen local anaesthetic solution to block the nerve

Again note that modern anaesthetic practice may well employ the use of ultrasound for a median nerve block. If you have been trained in its use and are happy with the technique, then use that approach.