Facts to remember, Clinicoanatomical Problem

Facts to Remember — Trachea, Oesophagus, and Thoracic Duct

Trachea

- The trachea extends from the **lower border of the cricoid cartilage (C6)** to the level of the **sternal angle (T4/T5)**, where it divides into right and left bronchi.
- It is about **10–12 cm long** and **2 cm wide** in adults.
- It consists of **16–20 C-shaped hyaline cartilaginous rings**, open posteriorly.
- The **trachealis muscle** connects the open ends of the cartilage rings posteriorly.
- **Right bronchus** is **wider, shorter, and more vertical**, hence foreign bodies commonly enter it.
- The **carina** marks the bifurcation of the trachea; it is the most **sensitive part for cough reflex**.
- The trachea is lined by **pseudostratified ciliated columnar epithelium with goblet cells**.
- **Blood supply** – Inferior thyroid and bronchial arteries.
- **Nerve supply** – Vagus (parasympathetic) and sympathetic trunks.
- **Tracheostomy** is done between the **2nd and 4th tracheal rings**.

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Oesophagus

- The oesophagus is about **25 cm long** and extends from the **lower border of the cricoid cartilage (C6)** to the **cardiac orifice of the stomach (T11)**.
- It passes through the **diaphragm at the level of T10**.
- There are **three natural constrictions** at:
    1. **C6** – at the cricoid cartilage,
    2. **T4** – where it is crossed by the aortic arch,
    3. **T10** – where it pierces the diaphragm.
- The **upper third** contains **striated muscle**, the **middle third** has **mixed**, and the **lower third** contains **smooth muscle**.
- The lining epithelium is **stratified squamous non-keratinized**.
- **Venous drainage** forms **porto-systemic anastomosis** between the **azygos** and **left gastric veins**.
- **Lymphatic drainage** – Deep cervical, posterior mediastinal, and left gastric nodes.
- **Blood supply** – Inferior thyroid, oesophageal branches of aorta, and left gastric arteries.
- **Nerve supply** – Vagus (parasympathetic) and sympathetic trunks.
- **Clinical importance:**
    - **Achalasia cardia:** failure of the lower oesophageal sphincter to relax.
    - **Oesophageal varices:** due to portal hypertension.

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- **Tracheoesophageal fistula:** abnormal communication between oesophagus and trachea.

- **Barium swallow study** shows constrictions and pathological compressions.

Thoracic Duct

- The **largest lymphatic vessel**, about **45 cm long**, beginning at the **cisterna chyli (T12)**.
- Enters the thorax through the **aortic opening of the diaphragm**.
- Ascends in the **posterior mediastinum**, between the **aorta (left)** and **azygos vein (right)**.
- Crosses to the **left side at T5**, ascends in the **superior mediastinum**, and arches in the **neck at C7** to open into the **left venous angle** (junction of left internal jugular and subclavian veins).
- Drains lymph from the **entire body below the diaphragm** and the **left half above it**.
- Major tributaries:
    - Left jugular trunk
    - Left subclavian trunk
    - Left bronchomediastinal trunk
    - Posterior intercostal and mediastinal lymph vessels
- **Clinical points:**

- **Chylothorax:** rupture of thoracic duct ? chyle in pleural cavity.
- **Obstruction:** due to tumors or fibrosis ? lymphedema.
- **Injury during neck or thoracic surgery** causes chyle leak.
- **Duplication** of the thoracic duct may occur congenitally.

Clinicoanatomical Problem — Trachea, Oesophagus, and Thoracic Duct

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Clinical Case

A **young woman** in her **mid-pregnancy** presented with **rapid breathing** and **difficulty in swallowing**.
She also gave a past history of **sore throat** accompanied by **pain in her joints** during childhood.

Questions

1. What is the likely diagnosis?
The most probable diagnosis is **rheumatic heart disease**, specifically **mitral stenosis**.

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2. What is the cause of these symptoms?

- Rheumatic fever, a **post-streptococcal infection**, damages the **mitral valve**, leading to **mitral stenosis**.
- This results in **obstruction to blood flow** from the **left atrium to the left ventricle**, causing **left atrial enlargement**.
- The enlarged **left atrium** lies **anterior to the oesophagus** and compresses it, producing **dysphagia** (difficulty in swallowing).

- A **barium swallow** X-ray shows a characteristic **indentation on the oesophagus** due to the enlarged atrium.
- The **reduced cardiac output** and **pulmonary congestion** from mitral stenosis lead to **breathlessness and fatigue**.
- The **rapid breathing** (tachypnea) occurs because less oxygenated blood reaches the lungs and systemic circulation.

Summary of Clinical Correlation

SYMPTOM	ANATOMICAL CAUSE
Dysphagia	Compression of oesophagus by enlarged left atrium
Breathlessness	Pulmonary congestion due to mitral stenosis
Fatigue	Decreased oxygen delivery to tissues
Systolic murmur	Turbulent flow through stenosed mitral valve

Key Diagnostic Point

A **barium swallow** study demonstrates the **indentation on the posterior wall of oesophagus**, confirming **left atrial enlargement** secondary to **mitral stenosis**.

This case highlights the close anatomical relationship between the **oesophagus and heart**, showing how **cardiac enlargement** can produce **gastro-oesophageal symptoms**.

Clinicoanatomical Problem — Trachea, Oesophagus, and Thoracic Duct

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Case 1 — Mitral Stenosis and Dysphagia

A **young woman** in her **mid-pregnancy** presented with **rapid breathing** and **difficulty in swallowing**, with a history of **sore throat and joint pains** in childhood.

Diagnosis:
Rheumatic heart disease (Mitral stenosis).

Anatomical Explanation:

- Rheumatic fever damages the **mitral valve**, causing **mitral stenosis** and **left atrial enlargement**.
- The **oesophagus**, lying immediately **posterior to the left atrium**, becomes compressed by the enlarged chamber, leading to **dysphagia** (difficulty swallowing).
- A **barium swallow** test shows a **posterior indentation** of the oesophagus due to the enlarged atrium.
- Impaired left ventricular filling and pulmonary venous congestion cause **breathlessness and fatigue** due to reduced oxygenation.
- Thus, the clinical features are a direct consequence of the **close anatomical relationship between the heart and the oesophagus**

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Case 2 — Tracheoesophageal Fistula

A **newborn** presents with **frothing at the mouth, choking during feeding**, and **cyanosis**.

Diagnosis:
Tracheoesophageal fistula (TEF) — abnormal communication between trachea and oesophagus.

Anatomical Explanation:

- During embryonic development, **incomplete separation of the trachea and oesophagus** leads to a persistent connection.
- Air passes into the stomach, and milk regurgitates into the lungs, causing **aspiration pneumonia**.
- **Surgical correction** is required immediately to prevent respiratory complications

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Case 3 — Achalasia Cardia

A **middle-aged patient** complains of **difficulty swallowing solids and liquids**, **regurgitation**, and **chest discomfort**.

Diagnosis:
Achalasia cardia — failure of the lower oesophageal sphincter to relax.

Anatomical Explanation:

- Caused by **degeneration or absence of ganglion cells** in the **myenteric plexus (Auerbach's plexus)** of the oesophageal wall.
- The **lower end of the oesophagus remains closed**, and food accumulates, causing **dilatation of the upper segment**.
- **Barium swallow** shows a **bird's beak appearance** due to tapering of the distal oesophagus

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Case 4 — Oesophageal Varices

A **patient with liver cirrhosis** presents with **vomiting of blood (haematemesis)**.

Diagnosis:
Oesophageal varices due to **portal hypertension**.

Anatomical Explanation:

- The **lower end of the oesophagus** contains a **porto-systemic anastomosis** between the **left gastric vein (portal)** and **azygos vein (systemic)**.
- In **portal hypertension**, these veins dilate to form **varices** that can rupture, causing **massive upper GI bleeding**.
- Seen radiologically as **worm-like shadows** on barium swallow

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Case 5 — Chylothorax

A **patient after neck dissection or thoracic surgery** develops **milky fluid collection in the pleural cavity**.

Diagnosis:
Chylothorax — leakage of lymph due to **thoracic duct injury**.

Anatomical Explanation:

- The **thoracic duct**, ascending behind the oesophagus and arching in the neck to open at the **left venous angle**, may be **injured during surgery or trauma**.
- Lymph (chyle) containing fat droplets accumulates in the pleural space.
- It causes **respiratory distress** and must be treated by **ligation of the duct or drainage**