Nerves of the thorax
• **Right vagus nerve**
  - First lying posterolateral to the brachiocephalic artery
  - Passes *behind* the root of the *right* lung — *(pulmonary plexus)*
  - Passes onto the *posterior* surface of the esophagus — *(esophageal plexus)*
  - Passes through the esophageal opening of diaphragm

• **Left vagus nerve**
  - First lying between left common carotid & left subclavian artery
  - Passes *behind* the root of the *left* lung *(pulmonary plexus)*
  - On leaving the plexus, the vagus passes onto *anterior* surface of the esophagus *(esophageal plexus)*
  - Passes through the esophageal opening of diaphragm
• **branches**
  - Both supply lungs and esophagus
  - Right vagus gives off cardiac branches
  - Left vagus gives origin to left recurrent laryngeal nerve
  - LRL nerve supplies all the muscles acting on the left vocal cord except cricothyroid muscle (tensor of the cord)
Phrenic nerves

- Arise from the neck from anterior rami of the C3, C4, C5.
- The efferent fibers are the sole nerve supply to the muscle.
- The afferent fibers carry sensation to CNS from peritoneum covering the central region, pleura, and pericardium.
• Right phrenic nerve
  - Descends along the right side of the right brachiocephalic vein
  - Passes *in front* of the root of the right lung
  - Runs along the right side of pericardium (separated from RA)
  - Terminal branches pass through the *caval opening of diaphragm*

• Left phrenic nerve
  - Descends along the left side of the left subclavian artery
  - Passes *in front* of the root of the left lung
  - Runs along the left side of pericardium (separated from LV)
  - Terminal branches *pierce the muscle of diaphragm*
Clinical notes
Paralysis of the diaphragm

- May be paralyzed because of the pressure from malignant tumors in the mediastinum
- Results in immobile dome of the diaphragm
• Thoracic part of the sympathetic trunk

- Most laterally placed structure in the mediastinum
- Runs downward on the heads of the ribs
- Leaves the thorax on the side of T12
- Has 12 segmentally arranged ganglia, each with white and gray ramus communicans
- 1\textsuperscript{st} ganglion + inferior cervical ganglion = stellate ganglion
Stellate ganglion:
Inferior cervical ganglion
1st thoracic ganglion

Anterior View

Sympathetic trunk
Vagus nerve (CN X)
Cervical cardiac branch
2nd rib
Right recurrent laryngeal nerve
• Thoracic part of the sympathetic trunk

- **Branches:**
  - Gray rami communicantes
  - First 5 ganglia give fibers to the heart, aorta, lungs, esophagus
  - Lower 8 ganglia form the splanchnic fibers:
    - ganglia 5-9 -- Greater splanchnic nerve.
    - ganglia 10-11 -- Lesser splanchnic nerve.
    - ganglion 12 -- Lowest splanchnic nerve.
Sympathetic trunk in the treatment of Raynaud's disease

- Vasoconstriction of arterioles in fingers
Sympathetic trunk in treatment of Raynaud disease

- Preganglionic sympathectomy of the 2\textsuperscript{nd} and 3\textsuperscript{rd} thoracic ganglia can be performed to increase blood flow to the fingers.
Spinal anesthesia and the sympathetic nervous system

- High spinal anesthesia may block the preganglionic sympathetic fibers passing out from the lower thoracic segments of spinal cord.

- This produce temporary vasodilatation below this level.
Esophagus
Esophagus

- Tubular structure; 25 cm long
- Continuous above with the laryngeal part of pharynx (C6)
- Passes through the diaphragm at level of (T10)

In the neck:
- Lies in front of the vertebral column
- Laterally; related to the lobes of the thyroid gland
- Anteriorly; related to trachea and recurrent laryngeal nerves
In the thorax:
- Passes downward and to the left through superior and then posterior mediastinum
- At level of sternal angle: the aortic arch pushes the esophagus over the midline
- Anteriorly: it is related to trachea, left recurrent laryngeal nerve, left principal bronchus & pericardium
Posteriorly: it is related to thoracic vertebrae, thoracic duct, azygos veins, right posterior intercostal arteries, descending aorta.
**Esophagus**

- **Right side:** mediastinal pleura, terminal part of the azygos vein

Diagram showing:
- Right subclavian vein
- Rami communicantes
- Sympathetic trunk
- Azygos vein
- Right bronchi
- Pulmonary arteries
- Pulmonary veins
- Greater splanchnic nerve
- Lesser splanchnic nerve
- Inferior vena cava
- Trachea
- Right vagus
- Right internal jugular vein
- Right brachiocephalic vein
- Right phrenic nerve
- Superior vena cava
- Ascending aorta
- Right atrium covered by pericardium
- Pericardium
- Diaphragm
**Esophagus**

- **Left side:** left subclavian artery, aortic arch, thoracic duct, pleura

Diagram showing:
- left brachiocephalic vein
- left ventricle covered by pericardium
- pericardium
- thoracic duct
- sympathetic trunk
- left phrenic nerve
- left vagus nerve
- arch of aorta
- left recurrent laryngeal nerve
- ligamentum arteriosum
- left pulmonary artery
- left bronchi
- left pulmonary veins
- descending aorta
- greater splanchnic nerve
- diaphragm
- esophagus
Vagus nerves + sympathetic nerves = esophageal plexus
- Left vagus nerve lies anterior to the esophagus
- Right vagus nerve lies posterior to the esophagus

In the abdomen:
- Descends for about 1.3 cm and then enters the stomach
- Anteriorly related to the left lobe of the liver
- Posteriorly related to the left crus of the diaphragm
Blood supply of the esophagus

**Arteries**
- Upper third - Inferior thyroid artery
- Middle third - Branches from descending thoracic aorta
- Lower third - Branches from the left gastric artery

**Veins**
- Upper third - Inferior thyroid veins
- Middle third - Azygous vein
- Lower third - Left gastric vein (portal vein)
• **Lymph drainage of the esophagus**
  - Upper third - Deep cervical nodes
  - Middle third - Superior and posterior mediastinal nodes
  - Lower third - Along the left gastric blood vessels and celiac nodes

• **Nerve supply of the esophagus**
  - Supplied by parasympathetic and sympathetic fibers via vagi and sympathetic trunks
Clinical notes
Esophageal constrictions

- Esophagus has 3 anatomic & physiologic constrictions:
  - Where pharynx joins the upper end
  - Where aortic arch and left bronchus cross its anterior surface
  - Where esophagus passes through the diaphragm into stomach

- They are sites where swallowed foreign bodies can lodge or through which it may be difficult to pass an esophagoscope

- Strictures develop here after the drinking of caustic delay

- Common sites of carcinoma of esophagus
At the lower third of the esophagus:
- Tributaries of the azygos veins (systemic veins)
- Tributaries of the left gastric vein (drains into portal vein)

When portal vein become obstructed (cirrhosis, portal HTN):
- Dilatation of the portal-systemic anastomoses
- Varicose esophageal veins may rupture during the passage of food, causing **hematemesis** (vomiting of blood)
Carcinoma of the lower third of the esophagus

- The lymph drainage of the lower third of the esophagus descends through the esophageal opening in the diaphragm and ends in the celiac nodes.

- Surgical removal of lesion would include celiac lymph nodes too.

- Restoration of the continuity of the gut: esophago-jejunostomy.
Thymus

- Site for development of T-lymphocyte
- Laying between the sternum and the pericardium in the anterior mediastinum
  - In newborn, reaches its largest size
  - Continues to grow until puberty
  - Thereafter undergoes involution

**Blood supply**

- Inferior thyroid
- Internal thoracic arteries
Clinical notes
Chest pain

- Common problem in clinical practice.

- May be caused by disease in the thoracic and abdominal walls, or to many different thoracic and abdominal viscera.

- The severity of the pain is often unrelated to the seriousness of the cause.

- Myocardial pain may mimic esophagitis, musculoskeletal chest wall pain, and other non-life-threatening causes.

- It is not good enough to have a correct diagnosis only 99% of the time with chest pain.
Chest pain

- **Causes**
  - **Cardiovascular**
    - Angina
    - Myocardial infarction
    - Acute aortic dissection
    - Pericarditis
  - **Gastrointestinal**
    - Reflux esophagitis
    - Esophageal spasm
    - Peptic ulcer disease
  - **Pulmonary**
    - Pneumonia
    - Pulmonary embolism
    - Pneumothorax
  - **Musculoskeletal**
    - Chest wall injuries
    - Costochondritis
    - Rib secondaries
    - Herpes zoster
• History

% Character
- crushing
- tearing
- pleuritic
- burning

% Location
- Retrosternal
- radiation

% Precipitating factors
- Effort
- emotion
- food
- cold
- posture
- movement

% Relieving factors
- Nitrates
- antacids
- sitting forward

% Hx. Of Trauma

% Emotion
Chest pain

• Examination
  - Temperature
  - Pulse
  - JVP
  - Palpation of the chest
  - Auscultation of the chest
  - Lower limbs

• Investigations
  - CBC
  - Cardiac enzymes
  - ECG & CXR
• Somatic chest pain
  ❑ Pain arising from the chest or abdominal walls is intense and directly localized
  ❑ Somatic pain arises in sensory nerve endings in these structures and is conducted to CNS

• Visceral chest pain
  ❑ Pain is diffuse and poorly localized
  ❑ It is conducted to the CNS along afferent autonomic nerves
    ❑ Mostly with sympathetic nerves
    ❑ Sometimes with parasympathetic nerves (e.g., pharynx, upper part of esophagus and trachea)
• Referred chest pain
  - Feeling of pain at location other than the site of origin of the stimulus, but in an area supplied by the same adjacent segments of the spinal cord
  - Both somatic and visceral structures can produce referred pain
END OF THORAX