MEDICAL EDUCATION RESOURCE

Structures in the Neck

Introduction

The neck contains several vital structures arranged in layers and compartments, including:

- **Visceral structures:** thyroid, parathyroid glands, trachea, and oesophagus
- **Vascular structures:** carotid arteries and jugular veins
- **Neural structures:** cervical sympathetic trunk and cranial nerves IX–XII
- **Muscular and fascial planes** that divide and protect these components.

Thyroid Gland

General Description

- The thyroid is an **endocrine gland** shaped like a **butterfly**, located in the **lower part of the anterior neck**.
- Function:
  - Regulates **basal metabolic rate (BMR)**
  - Promotes **growth and development**
  - Plays a key role in **calcium metabolism**

- It is the only gland in the body that **uses iodine** to synthesize hormones (**T? and T?**).

Parts

- **Right and left lobes** connected by a **thin isthmus**
- Occasionally a **pyramidal lobe** extends upwards from the isthmus
- A fibrous/muscular band called **levator glandulae thyroideae** may connect the isthmus or pyramidal lobe to the **hyoid bone**

Situation and Extent

- Lies anterior to **C5–T1 vertebrae**, embracing the **upper trachea**
- **Isthmus:**
  - Lies opposite **2nd–4th tracheal rings**
- **Lobes:**
  - Extend from **middle of thyroid cartilage** to **6th tracheal ring**

Capsules and Relations

- **True capsule:** condensation of gland’s connective tissue
- **False capsule:** derived from **pretracheal fascia**
- **Posterior surface** related to:

- **Carotid sheath** and its contents
- **Parathyroid glands**
- **Recurrent laryngeal nerve**

Blood Supply

- **Arteries:**
  - *Superior thyroid artery* – from external carotid
  - *Inferior thyroid artery* – from thyrocervical trunk
  - *Thyroid ima artery* (inconstant) – from brachiocephalic trunk
- **Veins:**
  - *Superior and middle thyroid veins* ? internal jugular vein
  - *Inferior thyroid vein* ? left brachiocephalic vein

Nerve Supply

- **Sympathetic:** from **middle and inferior cervical ganglia**
- **Parasympathetic:** via **vagus nerve**
- **Recurrent laryngeal nerve** lies in the **tracheoesophageal groove** near the gland — at surgical risk.

Dissection

- Reflect sternocleidomastoid laterally and cut sternothyroid muscle to expose thyroid.
- Identify:
  - **Isthmus** over 2nd–4th tracheal rings
  - **Lateral lobes** on either side
  - **Superior and inferior thyroid arteries**
  - **Recurrent laryngeal nerves** posteriorly
  - **Parathyroid glands** near posterior border

Clinical Anatomy

1. Goitre

- Non-inflammatory enlargement of thyroid gland.
- May compress:
  - **Trachea ? Dyspnoea**
  - **Oesophagus ? Dysphagia**
  - **Recurrent laryngeal nerve ? Hoarseness**

2. Thyroidectomy

- During surgical removal, care to:
    - **Ligate superior thyroid artery close to gland** (avoid external laryngeal nerve injury)
    - **Avoid ligation of inferior thyroid artery** (to preserve recurrent laryngeal nerve)
    - Preserve **parathyroid glands**

3. Pyramidal Lobe

- Present in about 50% of people; represents remnant of the **thyroglossal duct**.

4. Thyroglossal Cyst

- Midline cyst due to **persistence of thyroglossal duct**; moves with tongue protrusion.

5. Ectopic Thyroid Tissue

- May be found anywhere along thyroglossal duct pathway, even at the **base of tongue** (lingual thyroid).

Histology of Thyroid Gland

- The thyroid gland is composed of numerous **follicles**, separated by thin **connective tissue septa**.
- Each **follicle** is roughly **spherical** and filled with **colloid** material.
- **Follicular cells (principal cells):**

- Lined by **simple cuboidal epithelium**.
- Synthesize and secrete **thyroglobulin**, precursor of thyroid hormones (**T?, T?**).
- Epithelium becomes **columnar** when active and **squamous** when inactive.

- **Parafollicular cells (C cells):**
  - Found between follicles or in follicular basement membrane.
  - Secrete **calcitonin**, which lowers **blood calcium** by inhibiting osteoclastic activity.

- **Stroma:**
  - Rich in **capillaries**, elastic fibers, and connective tissue.
  - Highly vascular to facilitate hormone transport.

Development of Thyroid Gland

- **Origin:** Endodermal thickening in the floor of the **primitive pharynx** (between tuberculum impar and copula).
- It descends through the **thyroglossal duct** to its final position in the neck.
- The **foramen caecum** of the tongue marks the site of origin.
- The **pyramidal lobe** represents the **persistent upper part of thyroglossal duct**.
- Occasionally, **thyroid tissue** remains along the path (lingual, suprahyoid, or substernal thyroid).

Time of development: Begins in **4th week of intrauterine life**.

Parathyroid Glands

General Features

- Four small, oval, **yellowish-brown** glands on **posterior surface of the thyroid gland**.
- Arranged as:
  - **Two superior parathyroids**
  - **Two inferior parathyroids**
- **Shape:** Ovoid
- **Size:** About 6 × 3 × 2 mm
- **Weight:** 30–50 mg each

Relations

- Each lies within the **capsule of thyroid**, on its posterior aspect.
- The **recurrent laryngeal nerve** runs **near the inferior parathyroids**.

Blood Supply

- **Artery:** Inferior thyroid artery
- **Vein:** Parathyroid veins ? thyroid venous plexus

- **Nerve Supply:** Sympathetic from **middle and inferior cervical ganglia**

Histology of Parathyroid Gland

- **Cells:**
  - **Chief (principal) cells:** Small, pale-staining cells producing **parathormone (PTH)**.
  - **Oxyphil cells:** Larger, acidophilic cells; increase in number with **age**; function uncertain.
- **Stroma:** Delicate connective tissue with rich **vascular network**.
- **Function:** PTH increases **blood calcium** by stimulating **bone resorption** and **renal calcium reabsorption**.

Clinical Anatomy of Parathyroid Glands

- **Hypoparathyroidism:**
  - Occurs accidentally after **thyroidectomy** if parathyroids are removed.
  - Causes **hypocalcaemia**, leading to **tetany (muscle spasms)**.
- **Hyperparathyroidism:**
  - Caused by **adenoma** or hyperplasia.
  - Leads to **hypercalcaemia** and **bone resorption** (osteitis fibrosa cystica).

Thymus

General Description

- A **bilobed lymphoepithelial organ** in the **superior and anterior mediastinum**, extending into the **neck in children**.
- Functions in **T-lymphocyte (T-cell) maturation** and **immune development**.
- **Involution:** After puberty, it gradually shrinks and is replaced by **fatty tissue**.

Parts

- **Right and left lobes**, separated by connective tissue septa into **lobules**.
- Each lobule has:
    - **Cortex:** Densely packed with **lymphocytes**.
    - **Medulla:** Paler, with fewer lymphocytes and **Hassall's corpuscles** (epithelial reticular cells).

Histology of Thymus

- **Capsule:** Thin connective tissue layer enclosing each lobe.
- **Cortex:** Densely packed with small lymphocytes and epithelial reticular cells.
- **Medulla:** Contains fewer lymphocytes and numerous **Hassall's corpuscles**—concentric, eosinophilic, keratinized epithelial structures.

- **Function:**
    - Site of **T-lymphocyte differentiation and maturation**.
    - **Secretes thymosin and thymopoietin**, promoting immune cell development.

Development of Thymus and Parathyroid Glands

- **Thymus:**
    - Develops from **endoderm of the ventral wing** of the **third pharyngeal pouch** (during 6th week).
    - The two thymic primordia fuse in the midline to form the bilobed gland.
- **Parathyroid glands:**
    - **Superior parathyroids** – from **fourth pharyngeal pouch**.
    - **Inferior parathyroids** – from **third pharyngeal pouch** (descend with thymus).
    - Final positions: posterior surface of thyroid gland.
- **Migration:** Failure of descent leads to **ectopic parathyroids**, sometimes within **thymus or carotid sheath**.

Subclavian Artery

- **Origin:**
  - *Right side* ? from **brachiocephalic trunk**.
  - *Left side* ? directly from **arch of aorta**.
- **Extent:** From its origin to the outer border of the first rib where it continues as the **axillary artery**.
- **Parts (3 by scalenus anterior):**
  1. **First part** – from origin to medial border of scalenus anterior.
  2. **Second part** – posterior to scalenus anterior.
  3. **Third part** – from lateral border of scalenus to outer border of first rib.
- **Branches:**
  - *First part* ? **vertebral a.**, **internal thoracic a.**, **thyrocervical trunk**.
  - *Second part* ? **costocervical trunk**.
  - *Third part* ? no branch (occasionally *suprascapular or dorsal scapular a.*).

Relations (anterior–posterior–superior–inferior):

- Anteriorly ? internal jugular & subclavian veins, vagus nerve.
- Posteriorly ? pleura, apex of lung.

- Superiorly ? brachial plexus trunks.
- Inferiorly ? first rib and pleura.

Clinical Notes – *aneurysm* compresses brachial plexus ? pain & paresthesia in upper limb.

Common Carotid Artery

- **Origin:** Right from brachiocephalic trunk; left from arch of aorta.
- **Extent:** From sternoclavicular joint to upper border of thyroid cartilage (C4) ? divides into **internal and external carotid arteries**.
- **Relations:** Enclosed in **carotid sheath** with internal jugular vein (lateral) and vagus nerve (posterior between them).
- **Pulsation:** Felt between trachea and sternocleidomastoid at C6 level.

Clinical Notes – *carotid sinus* (baroreceptor) and *carotid body* (chemoreceptor) at bifurcation; sensitive to pressure ? bradycardia or syncope on massage.

Internal Carotid Artery

- **Course:** Ascends deep to posterior belly of digastric & stylohyoid, enters carotid canal ? cranial cavity.
- **No branches in neck.**
- **Supplies:** brain, eye (through ophthalmic a.).

Subclavian Vein

- Continuation of **axillary vein** at outer border of first rib.
- Passes in front of scalenus anterior to join **internal jugular vein** forming the **brachiocephalic vein**.
- Has a **valve near its termination**.

Clinical Note: Often used for central venous catheterization; injury can cause pneumothorax due to close pleural relation.

Internal Jugular Vein

- Continuation of **sigmoid sinus** in jugular foramen.
- Descends within carotid sheath ? joins subclavian vein behind sternoclavicular joint forming **brachiocephalic vein**.
- **Tributaries:** inferior petrosal sinus, common facial, lingual, pharyngeal, superior and middle thyroid veins.

Clinical Note: Used for central venous pressure (CVP) monitoring; pulsation visible in right heart failure.

Brachiocephalic Vein

- **Formed by:** union of subclavian and internal jugular veins behind sternoclavicular joint.

- **Right vein** – short & vertical; **Left** – long & oblique across superior mediastinum ? join to form **superior vena cava**.

Clinical Note: Enlarged thyroid or retrosternal goitre may compress left brachiocephalic vein ? neck vein distension.

Glossopharyngeal Nerve (IX Cranial Nerve)

Course in Neck

- Descends between **internal and external carotid arteries**.
- Lies **deep to the styloid process** and associated muscles (styloglossus, stylopharyngeus).
- Runs with **stylopharyngeus muscle**, giving branches to it.

Branches

- **Tympanic branch (Jacobson's nerve):** to middle ear.
- **Carotid branch:** to carotid sinus and carotid body (baroreceptor and chemoreceptor).
- **Pharyngeal branches:** form **pharyngeal plexus** with vagus and sympathetic fibers.
- **Tonsillar branches:** to palatine tonsil.
- **Lingual branches:** to posterior one-third of tongue (taste + general sensation).

Function

- **Sensory:** pharynx, tonsil, posterior tongue, middle ear.
- **Motor:** stylopharyngeus muscle.
- **Parasympathetic:** parotid gland (via otic ganglion).

Clinical Note:

- Lesion causes loss of **gag reflex (afferent limb)**, dysphagia, and loss of taste in posterior 1/3 of tongue.

Vagus Nerve (X Cranial Nerve)

Course in Neck

- Descends within **carotid sheath** between internal jugular vein (lateral) and carotid arteries (medial).
- Gives off **pharyngeal, superior laryngeal, and recurrent laryngeal branches**.

Branches

- **Pharyngeal branches:** motor to pharyngeal constrictors and soft palate (except tensor palati).
- **Superior laryngeal nerve:**
  - *External branch* ? cricothyroid muscle.
  - *Internal branch* ? mucosa above vocal cords.

- **Recurrent laryngeal nerve:** supplies all intrinsic laryngeal muscles except cricothyroid.
- **Cardiac branches:** to cardiac plexus.

Clinical Note:

- Injury to **recurrent laryngeal nerve** ? hoarseness or loss of voice.
- **Vagus lesion** ? dysphagia, loss of cough reflex (afferent limb), and deviation of uvula to opposite side.

Accessory Nerve (XI Cranial Nerve)

Parts

1. **Cranial part:** joins vagus ? supplies pharynx, palate, larynx.
2. **Spinal part:** main functional part.

Course

- Emerges from **spinal cord (C1–C5)** ? enters skull via foramen magnum ? exits through **jugular foramen**.
- Passes obliquely down and backward, entering **sternocleidomastoid** then **trapezius**.

Function: Motor to **sternocleidomastoid** and **trapezius**.

Clinical Note:

- Lesion ? drooping of shoulder, difficulty in turning head to opposite side.

Cervical Part of the Sympathetic Trunk

Formation

- Continuation of thoracic sympathetic chain.
- Lies **behind carotid sheath**, on prevertebral fascia.
- Has **three ganglia:**
    1. **Superior cervical ganglion** (C1–C4)
    2. **Middle cervical ganglion** (C5–C6)
    3. **Inferior cervical ganglion** (C7–C8) – often fuses with first thoracic ? *stellate ganglion*.

Branches

- **Gray rami communicantes:** to cervical spinal nerves.
- **Cardiac branches:** superior, middle, and inferior cardiac nerves ? cardiac plexus.
- **Pharyngeal branches:** to pharyngeal plexus.
- **Vascular branches:** form periarterial plexuses around carotid arteries.

Functions

- Vasomotor, pilomotor, and secretomotor (sweat glands of head and neck).
- Dilates pupil (via internal carotid plexus ? long ciliary nerves).

Clinical Anatomy

Horner’s Syndrome

- Due to lesion of **cervical sympathetic chain**.
- **Features:**
  - Ptosis (drooping eyelid)
  - Miosis (constricted pupil)
  - Anhidrosis (loss of sweating)
  - Enophthalmos (sunken eyeball)

Stellate Ganglion Block

- Done for **relief of pain** or **vascular spasm** in upper limb and head (e.g., Raynaud’s disease).

Dissection

During dissection, identify lymph nodes in:

- **Submental**, **submandibular**, **parotid**, **mastoid**, and **occipital** regions.
- Include **deep cervical nodes** and **jugular lymph trunk** at the root of the neck.

Superficial Group of Lymph Nodes

1. **Occipital Nodes** – at the apex of posterior triangle, drain posterior scalp.
   ? Efferents ? supraclavicular deep cervical nodes.

2. **Mastoid (Posterior Auricular) Nodes** – behind the ear, drain scalp above and behind auricle.
   ? Efferents ? upper deep cervical nodes.

3. **Parotid Nodes** – on and within parotid gland, drain eyelids, external ear, and scalp anterior to ear.
   ? Efferents ? upper deep cervical nodes.

4. **Submandibular Nodes** – beneath mandible, over submandibular gland.
   ? Drain:
   - Forehead (center)
   - Nose and paranasal sinuses (frontal, maxillary, ethmoidal)
   - Inner canthus of eye
   - Upper lip, anterior cheek, gums, and teeth
   - Outer part of lower lip and teeth
   - Anterior two-thirds of tongue (except tip)
   - Receive efferents from submental nodes
     ? Efferents ? jugulo-omohyoid and jugulodigastric nodes.

5. **Submental Nodes** – below chin; drain tip of tongue, central lower lip, and anterior floor of mouth.

? Efferents ? deep cervical nodes

6. **Anterior Cervical Nodes** – along anterior jugular vein; drain skin below hyoid.
7. **Lateral Superficial Cervical Nodes** – along external jugular vein, over sternocleidomastoid; drain lower parotid region and skin near jaw angle.

Deep Group of Lymph Nodes

Subdivided into Five Levels

1. **Upper Lateral (Jugulodigastric Node)**
    - Below posterior belly of digastric.
    - Main drainage: **palatine tonsil**, pharynx, and posterior tongue.
2. **Middle Lateral Nodes**
    - Around internal jugular vein.
    - Drain **thyroid and parathyroid glands** and **larynx** via prelaryngeal, pretracheal, and paratracheal nodes.
3. **Lower Lateral (Jugulo-omohyoid Node)**
    - Above omohyoid tendon; main node of **tongue drainage**.
4. **Posterior Triangle Nodes**
    - Around spinal accessory nerve.

- Drain **posterior scalp and neck**.

5. **Retropharyngeal Nodes**
   - Behind buccopharyngeal fascia, in front of prevertebral fascia.
   - Drain **pharynx, nasal cavity, palate, auditory tube**.
   - Efferents ? upper deep cervical nodes.

Deepest Group

1. **Prelaryngeal and Pretracheal Nodes**
   - Over cricothyroid membrane and in front of trachea.
   - Drain **larynx**, **trachea**, and **thyroid isthmus**.
2. **Paratracheal Nodes**
   - Along sides of trachea and oesophagus with recurrent laryngeal nerves.
   - Drain **trachea**, **larynx**, **thyroid**, and **oesophagus**.

Main Lymph Trunks at the Root of the Neck

- **Jugular Lymph Trunks (Right and Left):**
  - Formed by efferents of deep cervical nodes.

- **Right trunk:** opens into right lymphatic duct or directly into right venous angle.
- **Left trunk:** opens into **thoracic duct**.

- **Thoracic Duct:**
  - Largest lymphatic channel.
  - Terminates at **left jugulosubclavian angle** (junction of left internal jugular and subclavian veins).
  - Arch lies ~3–4 cm above clavicle, in front of **C7 transverse process**.
  - **Relations:**
    - *Anterior* – left common carotid artery, vagus, internal jugular vein.
    - *Posterior* – vertebral vessels, sympathetic trunk, thyrocervical trunk.

Clinical Anatomy

1. Jugulodigastric Node

- Enlarged in **tonsillitis** or **pharyngitis** ("tonsillar node").

2. Jugulo-omohyoid Node

- Enlarged in **carcinoma of the tongue** ("main node of tongue").

3. Submandibular Nodes

- Enlarged in infections of **face, lips, or oral cavity**.

4. Deep Cervical Nodes

- Metastatic spread in **laryngeal, thyroid, or tongue cancers**.

5. Left Supraclavicular (Virchow's) Node

- Enlargement indicates **abdominal malignancy**, often **gastric carcinoma**.

Styloid Apparatus

Components

The **styloid apparatus** is a set of four structures connected to the **styloid process** of the temporal bone:

1. **Styloglossus muscle**
2. **Stylohyoid muscle**
3. **Stylopharyngeus muscle**
4. **Stylohyoid ligament**

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1. Styloglossus

- **Origin:** Styloid process of temporal bone.
- **Insertion:** Side of tongue blending with intrinsic muscles.

- **Nerve supply:** Hypoglossal nerve (XII).
- **Action:** Retracts and elevates the tongue during swallowing.

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2. Stylohyoid

- **Origin:** Styloid process.
- **Insertion:** Hyoid bone; splits around the intermediate tendon of digastric.
- **Nerve supply:** Facial nerve (VII).
- **Action:** Elevates and retracts hyoid bone, elongating the floor of the mouth.

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3. Stylopharyngeus

- **Origin:** Styloid process.
- **Insertion:** Posterior border of thyroid cartilage and pharyngeal wall.
- **Nerve supply:** Glossopharyngeal nerve (IX).
- **Action:** Elevates pharynx during swallowing and speech.

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4. Stylohyoid Ligament

- Fibrous band extending from **styloid process to lesser cornu of hyoid bone**.
- Occasionally ossified ? called the **epihyal bone** (in some mammals).

Relations

- The three muscles diverge downward and forward, forming a **fan-shaped arrangement**.
- Between them lie key **neurovascular structures**:
  - **Glossopharyngeal nerve (IX)** between stylopharyngeus and styloglossus.
  - **External carotid artery** and **facial artery** pass near stylohyoid.

Functional Significance

- Coordinates **swallowing movements** — tongue elevation, pharyngeal elevation, and hyoid retraction occur sequentially.
- Collectively, the styloid apparatus acts as a **"suspensory framework"** between skull and hyoid.

Clinical Anatomy

- **Eagle's Syndrome:**
  - Elongated styloid process or calcified stylohyoid ligament causes **neck and facial pain**, **dysphagia**, or **earache** due to pressure on glossopharyngeal nerve.
  - Diagnosed by palpation in the tonsillar fossa or radiographs.

Development of the Arteries

General Concept

- Major arteries of the head and neck arise from **aortic arches** associated with the **pharyngeal arches** in the embryo.
- There are **six pairs** of arches, though not all persist.

Derivatives of Aortic Arches

ARCH	DERIVATIVE ARTERY/STRUCTURE
1st arch	Part of **maxillary artery**
2nd arch	**Stapedial artery** (mostly disappears)
3rd arch	**Common carotid artery** and proximal part of **internal carotid artery**
4th arch (right)	**Right subclavian artery** (proximal part)
4th arch (left)	**Arch of aorta**
5th arch	Rudimentary / disappears
6th arch	**Pulmonary arteries** and (on left side) **ductus arteriosus**

Additional Developmental Sources

- **External carotid artery:** sprouts from 3rd arch.
- **Subclavian artery:** distal parts from **7th intersegmental artery**.
- **Vertebral artery:** formed by longitudinal anastomosis of **1st–6th intersegmental arteries**.

Anomalies

- **Double aortic arch** – persistence of both 4th arches ? tracheal or oesophageal compression.
- **Right aortic arch** – left 4th arch regresses; associated with situs inversus.
- **Coarctation of aorta** – narrowing near ductus arteriosus.
- **Aberrant right subclavian artery** – arises distal to left subclavian, passes behind oesophagus ? dysphagia lusoria.

Mnemonics

Muscles of the Styloid Apparatus

Mnemonic: *“Stylo Gave High Praise”*

- **Stylo** ? Styloglossus
- **Gave** ? Glossopharyngeal nerve (nerve to stylopharyngeus)
- **High** ? Hypoglossal nerve (nerve to styloglossus)
- **Praise** ? Facial nerve (nerve to stylohyoid)

This helps recall **all three styloid muscles** and their **different cranial nerve supplies**:

- Styloglossus ? Hypoglossal (XII)
- Stylohyoid ? Facial (VII)

- Stylopharyngeus ? Glossopharyngeal (IX)

Derivatives of Aortic Arches

Mnemonic: *“Max Stays Calm, Often Silent, Patiently”*

- **Max** ? 1st arch ? **Maxillary artery**
- **Stays** ? 2nd arch ? **Stapedial artery**
- **Calm** ? 3rd arch ? **Common & Internal carotid arteries**
- **Often** ? 4th arch ? **Aortic arch (left)**, **Right subclavian (right)**
- **Silent** ? 5th arch ? **Disappears (no derivative)**
- **Patiently** ? 6th arch ? **Pulmonary arteries + Ductus arteriosus**

> **Facts to Remember**

- The **styloid process** develops from the **Reichert’s cartilage** of the **2nd pharyngeal arch**.
- **Eagle’s syndrome** results from **elongation of styloid process** or **ossification of stylohyoid ligament**, compressing cranial nerves IX or X.
- The **styloid apparatus** is closely related to the **parapharyngeal space**, which contains vital neurovascular structures.
- The **3rd aortic arch** is responsible for forming both the **common** and **proximal internal carotid arteries**.

- The **external carotid artery** arises as a **sprout from the 3rd aortic arch**.
- The **right subclavian artery** is derived from **4th arch (proximal)** + **right dorsal aorta (middle)** + **7th intersegmental artery (distal)**.
- The **left 4th arch** forms the **arch of aorta** between **left common carotid** and **left subclavian** origins.
- The **6th aortic arches** give rise to **pulmonary arteries**; the **left one** retains its distal connection as the **ductus arteriosus**.
- **Ductus arteriosus** becomes **ligamentum arteriosum** after birth.
- **Vertebral artery** develops from longitudinal anastomosis between **first six intersegmental arteries**.

Clinicoanatomical Problems

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1. A patient complains of pain in the throat, radiating to the ear, aggravated by swallowing and yawning. On examination, a bony projection is palpable in the tonsillar fossa. What is the diagnosis?

Answer:
Eagle's Syndrome (Elongated Styloid Process Syndrome)

Explanation:

- Caused by elongation or ossification of the **styloid process** or **stylohyoid ligament**.
- The elongated process irritates nearby structures such as:

    - **Glossopharyngeal nerve (IX)** ? throat and ear pain
    - **Internal carotid artery** ? headache or neck pain
- Pain increases during **swallowing, yawning, or tongue movement**.
- Diagnosis: palpation in the **tonsillar fossa** reproduces the pain.
- Treatment: surgical shortening of styloid process (styloidectomy).

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2. During thyroid surgery, a structure passing from skull to hyoid is found ossified. What is it likely to be, and what is its clinical significance?

Answer:
Ossified Stylohyoid Ligament

Explanation:

- The **stylohyoid ligament** connects the **styloid process to the lesser cornu of hyoid bone**.
- Ossification makes it rigid and may compress adjacent nerves (IX, X, XII).
- Can produce symptoms similar to Eagle's syndrome.

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3. A patient presents with dysphagia and neck pulsation. Imaging shows an aberrant right subclavian artery passing behind the oesophagus. Explain its embryological basis.

Answer:
Aberrant Right Subclavian Artery (Arteria Lusoria)

Explanation:

- Caused by **persistence of right 7th intersegmental artery** and **distal right dorsal aorta**, with regression of right 4th arch and proximal dorsal aorta.
- The artery arises distal to the left subclavian from the **descending aorta**, and passes **behind oesophagus**.
- Leads to **dysphagia lusoria** (difficulty in swallowing due to vascular compression).

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4. A newborn has cyanosis. Investigation shows a patent ductus arteriosus (PDA). What embryonic structure failed to regress?

Answer:
Left 6th Aortic Arch

Explanation:

- The **ductus arteriosus**, derived from the **distal part of the left 6th aortic arch**, connects the pulmonary artery to the aorta in the fetus.
- After birth, it normally closes to form the **ligamentum arteriosum**.
- Failure to close results in **PDA**, causing **left-to-right shunt** and **cyanosis**.

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5. A mass in the upper neck compresses the left brachiocephalic vein. What might be the cause?

Answer:
Retrosternal (Substernal) Goitre

Explanation:

- The **left brachiocephalic vein** lies behind the manubrium sterni and in front of large arteries.

- An enlarged **thyroid gland extending into the thorax** can compress it ? venous congestion and neck swelling.

Frequently Asked Questions

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1. What structures form the styloid apparatus?

The **styloid apparatus** consists of:

- Three muscles — **Styloglossus**, **Stylohyoid**, **Stylopharyngeus**
- One ligament — **Stylohyoid ligament**

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2. What is the nerve supply of each muscle of the styloid apparatus?

- **Styloglossus** ? Hypoglossal nerve (XII)
- **Stylohyoid** ? Facial nerve (VII)
- **Stylopharyngeus** ? Glossopharyngeal nerve (IX)

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3. What is the function of the styloid apparatus?

- Acts as a **coordinated functional unit** during **swallowing and speech**, elevating the tongue, pharynx, and hyoid bone in sequence.
- Helps **stabilize** the upper neck by suspending the hyoid from the skull.

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4. What is Eagle’s syndrome?

- A condition caused by **elongation of the styloid process** or **calcification of the stylohyoid ligament**.
- Produces **throat or ear pain**, **dysphagia**, and **facial discomfort**, especially during swallowing or tongue movement.
- Pain radiates along **glossopharyngeal or vagus nerve** distribution.

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5. What is the embryological origin of the styloid process?

- Develops from **Reichert's cartilage** of the **second pharyngeal (hyoid) arch**.

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6. What does the 3rd aortic arch form?

- Forms the **common carotid artery** and **proximal internal carotid artery**.
- External carotid develops as a **sprout** from it.

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7. What is the fate of the 6th aortic arches?

- **Right side:** proximal part ? right pulmonary artery; distal part disappears.
- **Left side:** proximal part ? left pulmonary artery; distal part ? **ductus arteriosus** (later ligamentum arteriosum).

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8. What is the embryological cause of an aberrant right subclavian artery?

- Regression of the **right 4th arch** and **proximal dorsal aorta**, with persistence of **right 7th intersegmental artery**.

- The artery arises from the aortic arch and passes **behind the oesophagus**.

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9. What are the derivatives of the first and second aortic arches?

- **1st arch** ? part of **maxillary artery**.
- **2nd arch** ? **stapedial** and **hyoid arteries** (mostly disappear).

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10. What does the ductus arteriosus become after birth?

- Becomes the **ligamentum arteriosum**, a fibrous band connecting the pulmonary artery to the aorta.

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11. What is the developmental basis of double aortic arch?

- Persistence of both **right and left 4th aortic arches**, forming a vascular ring that compresses **trachea and oesophagus**.

Multiple Choice Questions — Styloid Apparatus & Development of Arteries

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1. Which of the following structures does *not* form part of the styloid apparatus?
A. Styloglossus
B. Stylohyoid
C. Stylopharyngeus
D. Stylomastoid ligament
? **Answer:** D. Stylomastoid ligament
Explanation: Only the *stylohyoid ligament* is part of the apparatus; no stylomastoid ligament exists.

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2. The stylohyoid ligament connects which two structures?

A. Styloid process and body of hyoid bone

B. Styloid process and lesser cornu of hyoid bone

C. Styloid process and greater cornu of hyoid bone

D. Mastoid process and hyoid bone

? **Answer:** B. Styloid process and lesser cornu of hyoid bone

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3. The styloid process develops from which embryological structure?

A. Meckel's cartilage

B. Reichert's cartilage

C. Mandibular arch

D. Fourth pharyngeal arch cartilage

? **Answer:** B. Reichert's cartilage

Explanation: Reichert's cartilage belongs to the *second pharyngeal arch* and gives rise to the styloid process and part of the hyoid apparatus.

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4. The nerve supply of stylopharyngeus muscle is —

A. Hypoglossal nerve

B. Glossopharyngeal nerve

C. Facial nerve

D. Mandibular nerve

? **Answer:** B. Glossopharyngeal nerve

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5. Eagle's syndrome is due to —

A. Elongation of styloid process

B. Ossification of stylohyoid ligament

C. Compression of glossopharyngeal nerve

D. All of the above

? **Answer:** D. All of the above

Explanation: The elongated or ossified styloid process compresses nearby nerves (especially IX and X), causing pain during swallowing or head movement.

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6. The 3rd aortic arch gives rise to —

A. External carotid artery

B. Internal carotid artery (proximal part)

C. Common carotid artery

D. Both B and C

? **Answer:** D. Both B and C

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7. The 4th aortic arch on the right side forms —

A. Right subclavian artery (proximal part)

B. Arch of aorta

C. Pulmonary artery

D. Vertebral artery

? **Answer:** A. Right subclavian artery (proximal part)

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8. The 4th aortic arch on the left side forms —

A. Right subclavian artery

B. Arch of aorta

C. Pulmonary artery

D. Common carotid artery

? **Answer:** B. Arch of aorta

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9. The 6th aortic arch gives rise to —

A. Pulmonary arteries and ductus arteriosus

B. Vertebral artery

C. Subclavian artery

D. Maxillary artery

? **Answer:** A. Pulmonary arteries and ductus arteriosus

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10. The external carotid artery develops as a sprout from —

A. 1st aortic arch

B. 2nd aortic arch

C. 3rd aortic arch

D. 4th aortic arch

? **Answer:** C. 3rd aortic arch

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11. Persistence of both right and left 4th arches results in —

A. Double aortic arch

B. Coarctation of aorta

C. Patent ductus arteriosus

D. Aberrant subclavian artery

? **Answer:** A. Double aortic arch

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12. The ductus arteriosus connects —

A. Aorta to pulmonary veins

B. Aorta to left pulmonary artery

C. Pulmonary artery to aorta

D. Left atrium to pulmonary artery

? **Answer:** C. Pulmonary artery to aorta

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13. The ductus arteriosus becomes which adult structure after birth?

A. Ligamentum teres

B. Ligamentum venosum

C. Ligamentum arteriosum

D. Median umbilical ligament

? **Answer:** C. Ligamentum arteriosum

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14. Aberrant right subclavian artery passes behind oesophagus because of —

A. Persistence of right 4th arch

B. Regression of right 4th arch

C. Persistence of left 4th arch

D. Regression of left 6th arch

? **Answer:** B. Regression of right 4th arch

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15. The first aortic arch forms —

A. Maxillary artery

B. Stapedial artery

C. Common carotid artery

D. Internal thoracic artery

? **Answer:** A. Maxillary artery

Viva Voce – Styloid Apparatus & Development of Arteries

Q1. What is the styloid apparatus?
It is a group of structures derived from the **second pharyngeal arch**, consisting of:

- **Three muscles:** Styloglossus, Stylohyoid, Stylopharyngeus
- **One ligament:** Stylohyoid ligament
  All are connected to the **styloid process** of the temporal bone.

Q2. Name the nerves supplying the muscles of the styloid apparatus.

- **Styloglossus** ? Hypoglossal nerve (XII)
- **Stylohyoid** ? Facial nerve (VII)
- **Stylopharyngeus** ? Glossopharyngeal nerve (IX)

Q3. From which pharyngeal arch does the styloid process develop?
From the **second pharyngeal (hyoid) arch**, specifically from **Reichert's cartilage**.

Q4. What is the function of the styloid apparatus?
To coordinate movements of the **tongue, pharynx, and hyoid bone** during **swallowing and speech**.

Q5. What is Eagle's syndrome?
A condition caused by **elongation of the styloid process** or **ossification of the stylohyoid ligament**, producing **throat and ear pain**, especially during swallowing or tongue movement.

Q6. What embryological anomaly causes an aberrant right subclavian artery?
Due to **regression of the right 4th aortic arch** and persistence of the **right dorsal aorta**, which makes the artery arise from the aortic arch and pass **behind the oesophagus**.

Q7. What does the 3rd aortic arch form?
The **common carotid artery** and **proximal part of the internal carotid artery**.

Q8. What are the derivatives of the 4th aortic arch?

- **Right side:** proximal part of **right subclavian artery**
- **Left side:** part of the **arch of aorta**

Q9. What does the 6th aortic arch form?
The **pulmonary arteries**, and on the left side, its distal part becomes the **ductus arteriosus**.

Q10. What is the fate of the ductus arteriosus after birth?
It closes to form the **ligamentum arteriosum**.

Q11. What does the external carotid artery develop from?
It develops as a **sprout from the 3rd aortic arch**.

Q12. What are the derivatives of the 1st and 2nd aortic arches?

- **1st arch:** part of **maxillary artery**
- **2nd arch: stapedial** and **hyoid arteries** (which mostly disappear)

Q13. What is the developmental basis of double aortic arch?
Persistence of **both right and left 4th aortic arches**, forming a vascular ring around the **trachea and oesophagus**.

Q14. Which aortic arch contributes to the ductus arteriosus?

The **left 6th aortic arch**.

Q15. Which nerve is at risk in Eagle’s syndrome?

The **glossopharyngeal nerve (IX)**, due to proximity to the styloid process.