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COURSE: GROSS ANATOMY OF THE HEAD AND NECK

DEPARTMENT: MEDICINE AND SURGERY

ASSIGNMENT

- 1) Discuss the Anatomy of the tongue and comment on its applied anatomy.
- 2) Write an essay on the air sinuses.

ANSWER

1) ANATOMY OF THE TONGUE AND ITS APPLIED ANATOMY

The tongue is a mobile muscular organ covered with moist, pink tissue called mucosa. It is partly in the oral cavity (oral part) and partly in the oropharynx (pharyngeal part). The tongue is involved with mastication, taste, deglutition, articulation, and oral cleaning. But its main function is forming words during speaking and squeezing food into the oropharynx when swallowing.

Parts of the Tongue

The tongue has a root, an apex(tip) and a body.

- a) **ROOT:** The root of the tongue is the part that rests on the floor of the mouth. It is usually defined as the posterior part of the tongue. The root is attached to the styloid process and soft palate above and to the mandible and hyoid bone below. Because of these attachments, humans are not able to swallow the tongue. It is close in proximity to two muscles: the geniohyoid and mylohyoid muscles.
- b) **APEX(TIP):** The apex (tip) of the tongue is the anterior end of the body, which rests against the incisor teeth. It is extremely mobile.
- c) **BODY:** The body is the remaining part between the root and the apex. It has:
 - A curved upper surface or dorsum.
 - An inferior surface.

DORSUM

The dorsum of the tongue is the convex part which is located partly in the oral cavity and partly in the oropharynx. It is characterized by a 'V' shaped groove called the terminal sulcus, the angle of which points posteriorly to the foramen caecum. The terminal sulcus divides the dorsum of the tongue in to:

- An oral part or anterior two-thirds.

- A pharyngeal part or anterior one-third.
- Small posteriormost part.

Oral(anterior) part:

This part is also called the presulcal anterior part and it is found in the oral cavity proper. It has a longitudinal midline groove running in an anteroposterior direction from the tip of the tongue to the foramen cecum and it divides the anterior part into right and left parts. The median lingual (fibrous) septum of the tongue that inserts in the body of the hyoid bone is found here. The mucosa of the anterior part of the tongue is relatively thin and closely attached to the underlying muscle. It has a rough texture because of numerous small lingual papillae.

Types of Papillae

- Vallate papillae:** These large, flat-topped bumps lie just in front of the terminal sulcus, located about two-thirds back on the surface of the tongue. They are surrounded by deep trenches—into which ducts open from fluid-producing glands—and their walls are covered in taste buds.
- Foliate papillae:** Though poorly developed in humans, these small folds of the mucosa surface of the tongue are found to the sides. They also have taste receptors located in taste buds.
- Filiform papillae:** Lying in V-shape rows parallel to the terminal sulcus, these bumps are elongated and numerous. They contain nerve endings that are sensitive to touch. Appearing scaly, threadlike, and pinkish grey in colour, they can make the tongues of some animals (such as cats) especially rough. At the tongue's tip, these papillae sit more crosswise (arranged transversely).
- Fungiform papillae:** Scattered among the filiform papillae are these oddly mushroom-shaped spots that may be pink or red in coloration. They are most found along the tip or sides of the tongue. Many contain receptors for taste within taste buds.

Pharyngeal(lymphoid) part:

It lies behind the palatoglossal folds and functions as the anterior wall of the oropharynx. Unlike the oral part, the pharyngeal part does not have any lingual papillae. Instead, its mucosa is populated by aggregates of lymphatic tissue known as the lingual tonsils. The mucosa is also continuous with the mucosa of the laterally located palatine tonsils, the lateral oropharyngeal walls, and the posterior epiglottis and glossoepiglottic folds. The mucosa of the posterior part of the tongue is thick and freely movable.

Posteriormost part:

It is connected to the epiglottis by three folds of mucous membrane. These are the median glossoepiglottic fold and the right and left lateral glossoepiglottic fold. On either side of the

median fold, there is a depression called the vallecula. The lateral folds separate the vallecula from the piriform fossa.

INFERIOR SURFACE

The inferior surface of the tongue is covered with a thin transparent mucous membrane through which veins are seen. This surface is connected to the floor of the mouth by a midline fold called frenulum of the tongue. It allows the anterior part of the tongue to move freely. A sublingual caruncle is present on each side of the base of lingual frenulum.

Muscles of the Tongue

The muscles of the tongue is divided in to two types, namely extrinsic and intrinsic. There are four extrinsic muscles and four intrinsic muscles in each half. The tongue is divided into two halves by a median fibrous lingual septum, which merges posteriorly with the lingual aponeurosis.

Intrinsic muscles of the tongue:

The intrinsic muscles are confined to the tongue and not attached to bone. There are four paired intrinsic muscles of the tongue and they are named by the direction in which they travel: **the superior longitudinal, inferior longitudinal, transverse and vertical muscles of the tongue.** These muscles affect the shape and size of the tongue.

Superior longitudinal	<p>Origin - submucosa of posterior tongue, lingual septum</p> <p>Insertion - apex/anterolateral margins of tongue</p> <p>Innervation - hypoglossal nerve (CN XII)</p> <p>Blood supply - lingual branch of external carotid artery</p> <p>Action - retracts and broadens tongue, elevates apex of tongue</p>
Inferior longitudinal	<p>Origin - root of tongue, body of hyoid bone</p> <p>Insertion - apex of tongue</p> <p>Innervation - hypoglossal nerve (CN XII)</p> <p>Blood supply - lingual branch of external carotid artery</p> <p>Action - retracts and broadens tongue, lowers apex of tongue</p>
Transverse muscle	<p>Origin - lingual septum</p> <p>Insertion - lateral margin of tongue</p> <p>Innervation - hypoglossal nerve (CN XII)</p> <p>Blood supply - lingual branch of external carotid artery</p> <p>Action - narrows and elongates tongue</p>
Vertical muscle	<p>Origin - root of tongue, genioglossus muscle</p> <p>Insertion - lingual aponeurosis</p> <p>Innervation - hypoglossal nerve (CN XII)</p> <p>Blood supply - lingual branch of external carotid artery</p> <p>Action - broadens and elongates tongue</p>

Extrinsic muscle of the tongue

The extrinsic muscles are that originate outside the tongue and attach to it. The muscles include **genioglossus, hyoglossus, styloglossus, and palatoglossus**. They mainly move the tongue, but they can alter its shape as well.

Genioglossus	Origin - Superior mental spine of mandible Insertion - entire length of dorsum of tongue, lingual aponeurosis, body of hyoid bone Innervation - hypoglossal nerve (CN XII) Blood supply - sublingual branch of lingual artery, submental branch of facial artery Action - depresses and protrudes tongue (bilateral contraction); deviates tongue contralaterally (unilateral contraction)
Hyoglossus	Origin - body and greater horn of hyoid bone Insertion - inferior/ventral parts of lateral tongue Innervation - hypoglossal nerve (CN XII) Blood supply - sublingual branch of lingual artery, submental branch of facial artery Action - depresses and retracts tongue
Styloglossus	Origin - anterolateral aspect of styloid process (of temporal bone), stylomandibular ligament Insertion - blends with inferior longitudinal muscle (longitudinal part); blends with hyoglossus muscle (oblique part) Innervation - hypoglossal nerve (CN XII) Blood supply - sublingual branch of lingual artery Action - retracts and elevates lateral aspects of tongue
Palatoglossus	Origin - palatine aponeurosis of soft palate Insertion - lateral margins of tongue, blends with intrinsic muscles of tongue Innervation - vagus nerve (CN X) (via branches of pharyngeal plexus) Blood supply - ascending palatine branch of facial artery, ascending pharyngeal artery Action - elevates root of tongue, constricts isthmus of fauces

Innervation of the Tongue

- The hypoglossal nerve (CN XII) provides motor innervation to all of the intrinsic and extrinsic muscles of the tongue except for the palatoglossus muscle, which is innervated by the vagus nerve (CN X). It runs superficial to the hyoglossus muscle.
- In the anterior 2/3, general sensation is supplied by the trigeminal nerve (CNV). Specifically, the lingual nerve, a branch of the mandibular nerve (CN V3).

On the other hand, taste in the anterior 2/3 is supplied from the facial nerve (CNVII). In the petrous part of the temporal bone, the facial nerve gives off three branches, one of which is chorda tympani. This travels through the middle ear and continues on to the tongue.

- Taste to the posterior one-third of the tongue is accomplished through innervation from the glossopharyngeal nerve (CN IX), which also provides general sensation to the posterior one-third of the tongue.

Arterial Supply and Venous Drainage

Blood supply to the tongue is predominantly from the lingual artery, a branch of the external carotid artery between the superior thyroid artery and the facial artery, which departs at the level of the greater horn of the hyoid bone within the carotid triangle. After branching from the external carotid artery, the lingual artery passes deep to the hyoglossus muscle and superficial to the middle pharyngeal constrictor muscle. It then gives rise to the following four arteries:

- The suprahyoid artery supplies the omohyoid, sternothyroid, and thyrohyoid muscles. They anastomose with the corresponding vessels from the opposite side.
- The dorsal lingual arteries arise beneath the hyoglossus muscle and pass to the posterior part of the dorsum of the tongue. They supply the mucous membrane of this region as well as the glossopalatine arch, lingual tonsils, soft palate, and epiglottis. They anastomose with their corresponding vessels on the opposite side.
- The sublingual artery branches at the anterior border of the hyoglossus muscle before passing between the genioglossus muscle and mylohyoid muscle to the sublingual gland. It supplies the sublingual gland before giving branches to the mylohyoid muscle. One branch from the sublingual artery passes posterior to the alveolar process of the mandible and anastomoses with the corresponding artery from the other side. A second branch of the sublingual artery pierces the mylohyoid muscle and anastomoses with the submental branch of the facial artery.
- The deep lingual artery, which is the termination of the lingual artery, passes between the genioglossus muscle and inferior longitudinal muscle.

The veins of the tongue are the dorsal lingual veins, which accompany the lingual artery ; the deep lingual veins , which begin at the apex of the tongue, run posteriorly beside the lingual frenulum to join the sublingual vein. All these lingual veins terminate in the internal jugular vein.

Lymphatic Drainage

Lymph from the tongue takes four routes.

- (1) Lymph from the posterior third drains into the superior deep cervical lymph nodes.
- (2) Lymph from the medial part of the anterior two third drains directly to the inferior deep cervical lymph nodes.

(3) Lymph from the lateral parts of the anterior two third drains to the sub mandibular lymph nodes.

(4) The apex and frenulum drain to the submental lymph nodes.

APPLIED ANATOMY

- A. Ankyloglossia: The lingual frenulum (from the Latin word meaning “bridle”) is a small fold of mucous membrane that connects the middle of the lower surface of the tongue to the floor of the mouth. If it is too short, often from birth, the tongue may be abnormally retracted into the lower jaw. This lower position leads to a condition that is colloquially known as being “tongue tied.” This may be rarely checked (or simply ignored), especially if it is at the back of the tongue, and often goes untreated. It may be recognized with early infancy swallowing problems and speech impairment at school age as the short frenulum may interfere with tongue movements and function. Clipping the frenulum is a simple surgery and this frenulectomy may be necessary for infants to free the tongue for normal speech development.
- B. Gag reflex: It is possible to touch the anterior part of the tongue without feeling discomfort. When the posterior part is touched, the individual gags. CN IX, CN X, are responsible for the muscular contractions of each side of the pharynx.
- C. Paralysis of genioglossus: When this muscle is paralysed the tongue tends to fall posteriorly, obstructing the airway and preventing the risk of suffocation. Total relaxation of the genioglossus muscles occurring during general anaesthesia therefore an airway is inserted in an anesthetized person to prevent the tongue from relapsing.
- D. Injury to the hypoglossal nerve: Trauma, such as fractured mandible , may injure the hypoglossal nerve, resulting in paralysis and eventual atrophy of one side of the tongue.
- E. A lingual carcinoma in the posterior part of the tongue metastases to the superior deep cervical lymph nodes on both sides, where as a tumour in the anterior part usually does not metastasize to the inferior deep cervical lymph nodes until late in the disease. Because these nodes are closely related to I J V, metastases from the tongue may be widely distributed.
- F. Frenectomy: A large lingual frenulum (tongue tie) interfere with the tongue movements and may affect speech. In unusual cases a frenectomy in infants may be required.
- G. Ulcers of the tongue: Various types of ulcers are follows (i) Aphthous ulcers is a small painful ulcer seen on tip, under surface of the tongue in its anterior part. (ii) Dental ulcer: is caused by mechanical irritation either by a jagged tooth or denture. (iii) Syphilitic ulcer: mainly snail track ulcers in second stage of syphilis. (iii) Carcinomatous ulcers: It usually occurs in elderly individuals above the age of 50 years. Common site is at the margins particularly in anterior two third of the tongue.

- H. Hairy tongue syndrome: The tongue may appear white or black due to overgrowth of the papillae on the surface of the tongue. A thorough scraping may clear off the debris and resolve the unpleasant appearance and associated smell.

2) AIR SINUSES:

The air sinuses are also known as the paranasal sinuses. The paranasal sinuses are air-filled cavities in the interior of the maxilla and the frontal, sphenoid, and ethmoid bones. Sinuses are formed in childhood by the nasal cavity eroding into surrounding bone. As they are outgrowths of the nasal cavity, they all drain back into it – openings to the paranasal sinuses are found on the roof and lateral walls of the nasal cavity. The inner surface is lined by a respiratory mucosa. There are four paired sinuses, named according to the bone in which they are located: **maxillary, frontal, sphenoid and ethmoid.**

Their function is obscure, but they provide resonance to the voice, shape to the face and some degree of warmth and humidification to inspired air. The paranasal sinuses are supplied by branches of the ophthalmic and maxillary nerves.

Maxillary sinus

The maxillary sinuses are the largest of all the paranasal sinuses. It is shaped like a pyramid; its base is usually medial, with its apex in the zygomatic process of the maxilla. Its roof is the floor of the orbit, and its floor is the alveolar process of the maxilla. Each maxillary sinus drains by one or more openings, the maxillary ostium (ostia), into the middle nasal meatus of the nasal cavity by way of the semilunar hiatus. They have thin walls which are often penetrated by the long roots of the posterior maxillary teeth. The superior border of this sinus is the bony orbit, the inferior is the maxillary alveolar bone and corresponding tooth roots, the medial border is made up of the nasal cavity and the lateral and anterior border are limited by the cheekbones. Posteriorly, two anatomical spaces known as the pterygopalatine fossa and the infratemporal fossa exist.

The arterial supply of the maxillary sinus is mainly from superior alveolar branches of the maxillary artery however, branches of the descending and greater palatine arteries supply the floor of the sinus.

Venous drainage is into the facial vein and the pterygoid plexus of veins.

Innervation of the maxillary sinus is from the anterior, middle, and posterior superior alveolar nerves, which are branches of the maxillary nerve.

Frontal Sinus

These are the most superior in location, found under the forehead. The frontal sinuses are variable in size, but always triangular-shaped. The frontal sinus may be regarded as an anterior ethmoidal cell that has invaded the frontal bone postnatally. The right and left frontal sinuses, frequently of different sizes, are separated by a bony septum that is usually deviated to one side. The frontal sinus drains into the middle meatus in a variable manner directly or by a frontonasal duct, which opens into the frontal recess or the ethmoidal infundibulum. Often a frontal sinus has two parts: a vertical part in the

squamous part of the frontal bone, and a horizontal part in the orbital part of the frontal bone. One or both parts may be large or small. When the supra-orbital part is large, its roof forms the floor of the anterior cranial fossa and its floor forms the roof of the orbit.

They drain primarily into the ethmoidal infundibulum and the corresponding lymph drainage occurs via the submandibular lymph nodes. It is innervated by the ophthalmic nerve, including the supraorbital and supratrochlear branches.

The frontal sinuses are supplied by the: anterior ethmoidal artery, supraorbital artery, supratrochlear artery.

Sphenoidal Sinuses

The sphenoidal sinus is in the body of the sphenoid bone, and it varies greatly in size. The sphenoid sinuses lie relatively superiorly, at the level of the sphenoid-ethmoidal recess. They are found more posteriorly and are related superiorly and laterally to the cranial cavity. The sphenoid sinuses drain out onto the roof of the nasal cavity. Its superior aspect is related to the hypophysis (pituitary) and the optic nerves and chiasma and laterally to the cavernous sinus and internal carotid artery.

The lymphatic drainage occurs in the same way as the posterior ethmoid sinus. The posterior ethmoidal artery and the posterior lateral nasal branches supply the sphenoidal sinuses. The posterior ethmoidal nerve and the orbital branch of the pterygopalatine ganglion innervate them.

Ethmoidal Sinuses

The ethmoidal sinus comprises numerous small cavities (ethmoidal cells) in the ethmoidal labyrinth. There are three ethmoidal sinuses: anterior, middle and posterior. They empty into the nasal cavity at different places:

- Anterior – The anterior ethmoidal cells drain directly or indirectly into the middle nasal meatus through the ethmoidal infundibulum.
- Middle – The middle ethmoidal cells open directly into the middle meatus and are sometimes called “bullar cells” because they form the ethmoidal bulla, a swelling on the superior border of the semilunar hiatus
- Posterior – The posterior ethmoidal cells open directly into the superior meatus.

The anterior and middle ethmoid sinuses send their lymphatic drainage to the submandibular lymph nodes while the posterior ethmoid sinus sends its own to the retropharyngeal lymph nodes.

The anterior and posterior ethmoidal arteries, as well as the posterior lateral nasal branches provide an ample blood supply to this region. Meanwhile the anterior and posterior ethmoidal nerves and the posterior lateral superior and inferior nasal nerves help innervate it.