

HEAD AND NECK ASSIGNMENT

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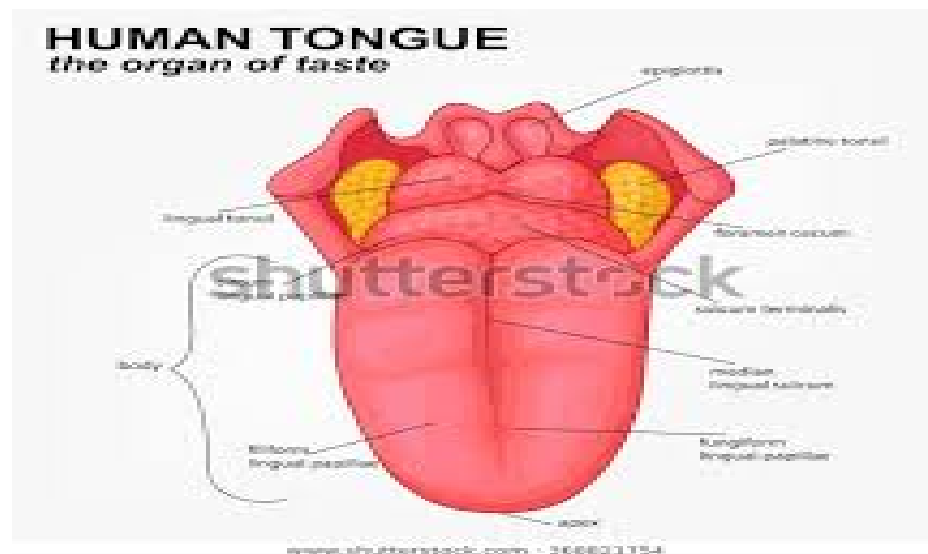
QUESTION 1

Discuss the anatomy of the tongue and commend on its applied anatomy

Introduction

The tongue is a mobile muscular organ covered with mucous membrane and is found in the mouth of most vertebrates.

It is partly in the oral cavity and partly in the oropharynx.



Parts of the tongue

The tongue has a root, body, and apex.

The root of the tongue is the attached posterior portion, extending between the mandible, hyoid, and the nearly vertical posterior surface of the tongue.

The body of the tongue is the anterior, approximately two thirds of the tongue between root and apex.

The apex (tip) of the tongue is the anterior end of the body, which rests against the incisor teeth. The body and apex of the tongue are extremely mobile

Surfaces of the tongue

The tongue features two surfaces.

The more extensive, superior and posterior surface is the dorsum of the tongue (commonly referred to as the “top” of the tongue).

The inferior surface of the tongue (commonly referred to as its “underside”) usually rests against the floor of the mouth.

The margin of the tongue separating the two surfaces is related on each side to the lingual gingivae and lateral teeth.

The tongue is attached via muscles to the hyoid bone, mandible, styloid process, palate, and pharynx, and it is divided into two (2) parts by the V-shaped sulcus terminalis.

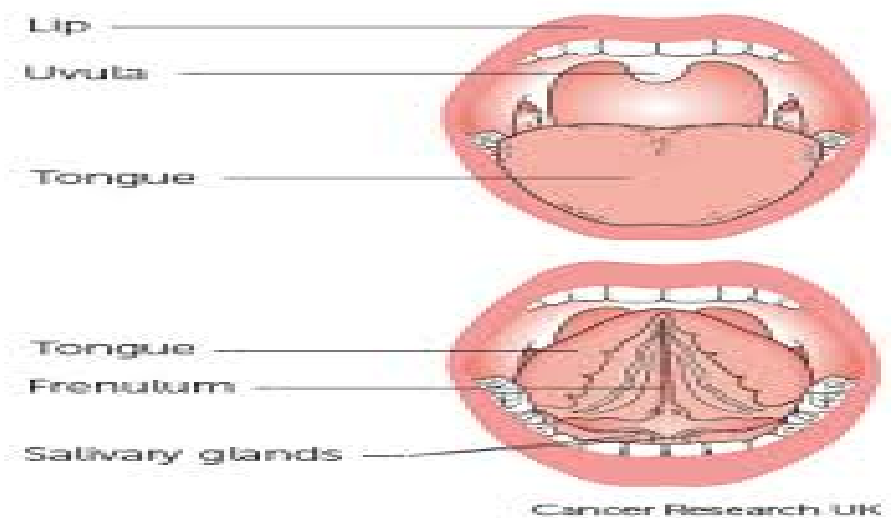
The two parts which are the anterior two-thirds (presulcal) and the posterior one-third (postsulcal), are structurally and developmentally distinct.

The foramen cecum at the apex of the sulcus terminalis indicates the site of embryonic origin of the thyroglossal duct (Mill et al., 2019; Alaoui et al., 2018; Hamad et al., 2018).

The following papillae cover the tongue and are used for taste perception:

- i. **Vallate papillae** which are arranged in a V-shape anterior to the sulcus terminalis and studded with numerous taste buds. It is innervated by the glossopharyngeal nerve (CN IX).
- ii. **Fungiform papillae** which are mushroom-shaped papillae with erythematous domes, located on the lateral aspects and at the apex of the tongue.
- iii. **Filiform papillae** which are slim, cone-shaped projections organized in rows parallel to the sulcus terminalis
- iv. **Foliate papillae** which are rarely found in humans (vestigial).

Another important part of the tongue is the **lingual tonsil**, a collection of nodular lymphatic tissue towards the posterior one-third of the dorsum of the tongue.



The inferior surface of the tongue is covered with a thin, transparent mucous membrane.

This surface is connected to the floor of the mouth by a midline fold called the frenulum of the tongue. The frenulum allows the anterior part of the tongue to move freely. On each side of the frenulum, a deep lingual vein is visible through the thin mucous membrane.

A sublingual caruncle (papilla) is present on each side of the base of the lingual frenulum that includes the opening of the submandibular duct from the submandibular salivary gland.

Muscles

The tongue is essentially a mass of muscles that is mostly covered by mucosa (mucous membrane).

The tongue has both intrinsic and extrinsic muscles. Generally, extrinsic muscles alter the position of the tongue, and intrinsic muscles alter its shape. The four intrinsic and four extrinsic muscles in each half of the tongue are separated by a median fibrous lingual septum, which merges posteriorly with the lingual aponeurosis.

Intrinsic muscles: are confined to the tongue. They have their attachments entirely within the tongue and are not attached to bone.

- i. The **superior longitudinal lingual** muscle. It shortens the tongue and curls it upward.
- ii. The **inferior longitudinal lingual** muscle. It shortens the tongue and curls it downward.
- iii. The **transverse lingual** muscle. It elongates and narrows the tongue.
- iv. The **vertical lingual** muscle. It flattens the tongue.

Extrinsic muscles: originate outside the tongue and attach to it. They mainly move the tongue but they can alter its shape as well.

- i. The **genioglossus** muscle. It protrudes the tongue and it is innervated by the hypoglossal nerve (CN XII).
- ii. The **styloglossus** muscle. It draws up the sides of the tongue to create a trough for swallowing. It is a pair which works together on each side to retract the tongue. It is also innervated by the hypoglossal nerve (CN XII).
- iii. The **hyoglossus** muscle. It depresses and retracts the tongue and it is also innervated by the hypoglossal nerve (CN XII).
- iv. The **palatoglossus** muscle. It elevates the posterior tongue, closes the oropharyngeal isthmus, aids in the initiation of swallowing, and prevents the spill of saliva from the vestibule into the oropharynx by maintaining the palatoglossal arch. It is the only extrinsic muscle of the tongue that is not innervated by the hypoglossal nerve. It is innervated by the vagus nerve (CN X).

Innervation of the tongue

The hypoglossal nerve (CN XII) provides motor innervations 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).

Lesions of the hypoglossal nerve cause deviation of the tongue to the ipsilateral side.

For general sensation (touch and temperature), the mucosa of the anterior two thirds of the tongue is supplied by the lingual nerve, a branch of CN V3.

For special sensation (taste), this part of the tongue, except for the vallate papillae, is supplied by the chorda tympani nerve, a branch of CN VII.

The chorda tympani joins the lingual nerve in the infratemporal fossa and runs anteriorly in its sheath.

The mucosa of the posterior third of the tongue and the vallate papillae are supplied by the lingual branch of the glossopharyngeal nerve (CN IX) for both general and special sensation.

Twigs of the internal laryngeal nerve, a branch of the vagus nerve (CN X), supply mostly general but some special sensation to a small area of the tongue just anterior to the epiglottis.

These mostly sensory nerves also carry parasympathetic secretomotor fibers to serous glands in the tongue.

There are four basic taste sensations: sweet, salty, sour, and bitter. Sweetness is detected at the apex, saltiness at the lateral margins, and sourness and bitterness at the posterior part of the tongue. All other “tastes” expressed by gourmets are olfactory (smell and aroma).

Blood supply to the tongue

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, and it departs at the level of the greater horn of the hyoid bone within the carotid triangle.

Branching from the external carotid artery, the lingual artery passes deep to

the hyoglossus muscle and superficial to the middle pharyngeal constrictor muscle. Thereafter, it gives rise to the following four (4) arteries:

- i. The **suprahyoid artery**. It supplies the omohyoid, sternothyroid and thyrohyoid muscles. They anastomose with the corresponding vessels from the opposite side.
- ii. The **dorsal lingual arteries**. It arises 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 also anastomose with their corresponding vessels on the opposite side.
- iii. The **sublingual artery**. It branches at the anterior border of the hyoglossus muscle. It supplies the sublingual gland before giving branches to the mylohyoid muscle.
- iv. The **deep lingual artery**. It is the termination of the lingual artery.

The deep lingual arteries communicate with each other near the apex of the tongue. The dorsal lingual arteries are prevented from communicating by the lingual septum.

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.

The sublingual veins in elderly people are often varicose (enlarged and tortuous). Some or all of them may drain into the internal jugular vein (IJV), or they may do so indirectly, joining first to form a lingual vein that accompanies the initial part of the lingual artery.

Lymphatic drainage of the tongue

The lymphatic drainage of the tongue is exceptional. Most of the lymphatic drainage converges toward and follows the venous drainage; however, lymph from the tip of the tongue, frenulum, and central lower lip runs an independent course. Lymph from the tongue takes four routes:

1. Lymph from the root drains bilaterally into the superior deep cervical lymph nodes.
2. Lymph from the medial part of the body drains bilaterally and directly to the inferior deep cervical lymph nodes.
3. Lymph from the right and left lateral parts of body drains to the submandibular lymph nodes on the ipsilateral side.
4. The apex and frenulum drain to the submental lymph nodes, the medial portion draining bilaterally.

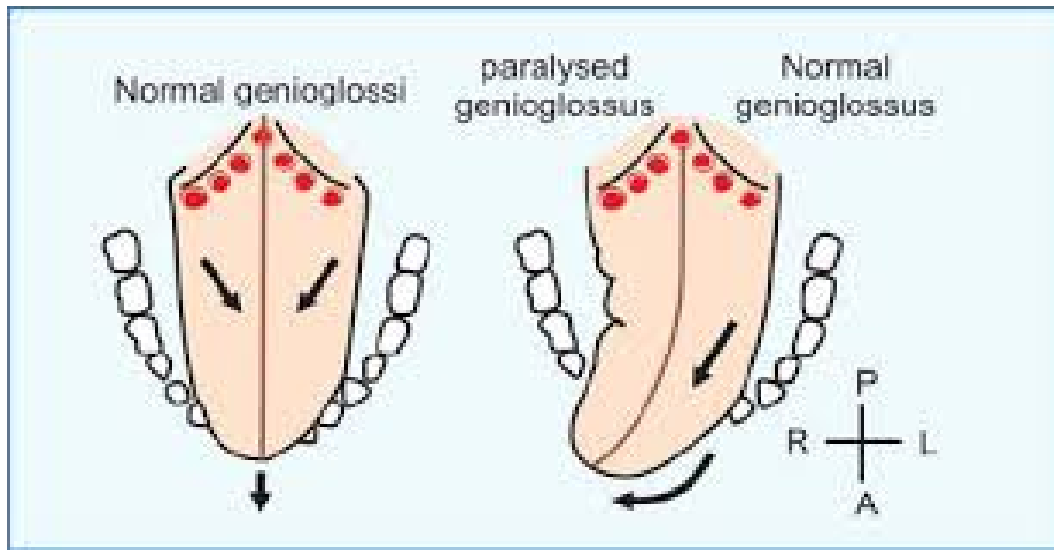
All lymph from the tongue ultimately drains to the deep cervical nodes, and passes via the jugular venous trunks into the venous system at the right and left venous angles.

Applied anatomy

Paralysis of genioglossus

This occurs when the genioglossus muscle is paralyzed. This increases the tendency of the tongue to fall posteriorly, obstructing the airway and presenting the risk of suffocation.

Total relaxation of the genioglossus muscles occurs during general anesthesia; therefore, an airway is inserted in an anesthetized person to prevent the tongue from relapsing.



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Injury to Hypoglossal Nerve

Trauma, such as a fractured mandible, may injure the hypoglossal nerve (CN XII), resulting in paralysis and eventual atrophy of one side of the tongue.

The tongue deviates to the paralyzed side during protrusion because of the action of the unaffected genioglossus muscle on the other side.

Ankyloglossia (tongue-tie)

This occurs due to an abnormal length of the frenulum linguae which causes limited manipulation of the tongue during speech and results in a speech impediment

In the most common form of ankyloglossia, the frenulum extends to the tip of the tongue.

Geographic tongue (migratory glossitis)

It is a benign, asymptomatic condition characterized by the presence of large red patches with a grayish-white border covering the dorsum of an

otherwise normal tongue.

It is caused by the inflammation of the mucous membrane of the tongue, which results in loss of lingual papillae.

The lesions are known to migrate over time. The name arises from the map-like appearance of the tongue in this condition (Bett et al., 2019; Kurtipek et al., 2019).

Fissured tongue (scrotal tongue/plicated tongue)

It occurs when several small furrows present on the dorsal surface of the tongue.

It can be an oral manifestation of psoriasis.

It is generally painless and benign and is often associated with other syndromes (e.g. Down syndrome) (Pei et al., 2019).

Question 2

Write an essay on the air sinuses

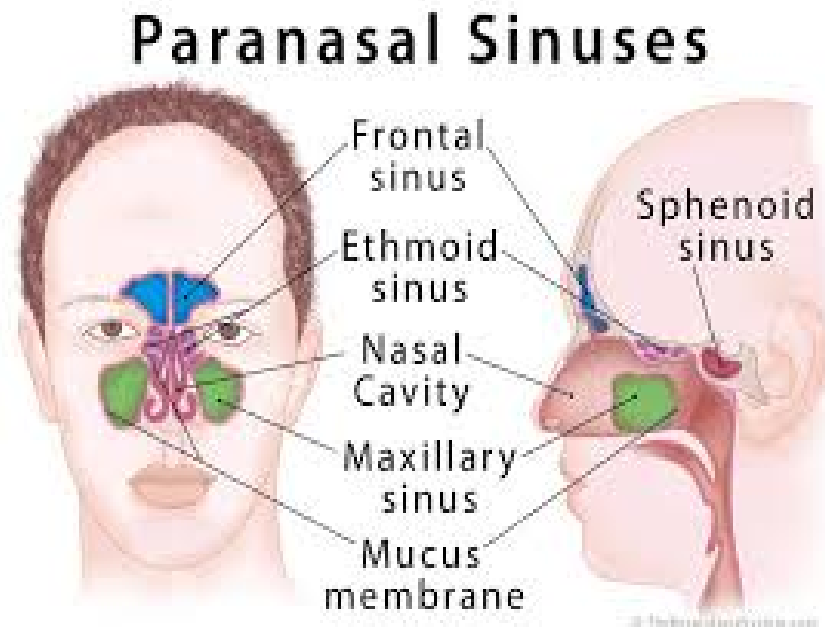
Introduction

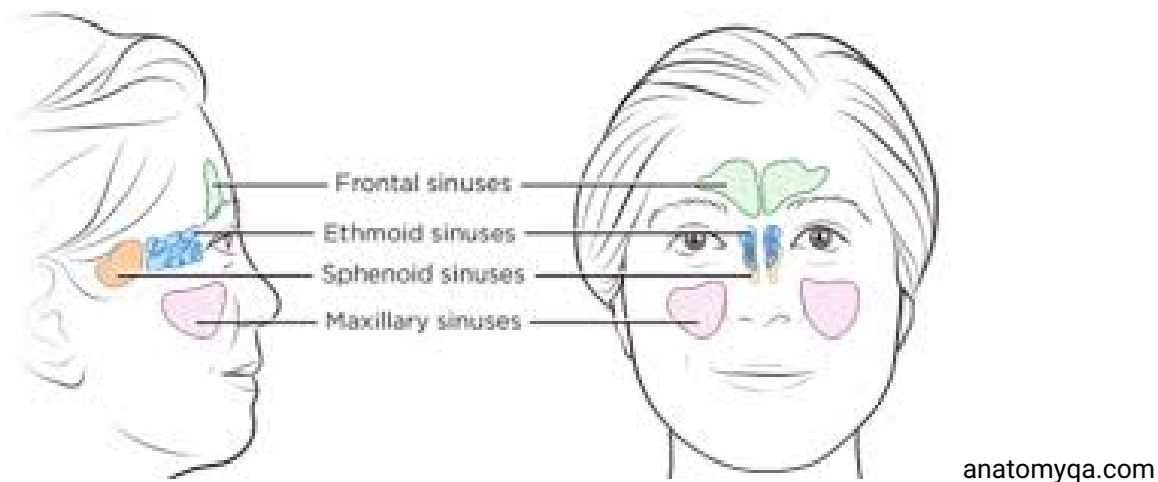
The nasal cavity is a roughly cylindrical, midline, airway passage that extends from the nasal ala anteriorly to the choana posteriorly.

It is divided in the midline by the nasal septum.

On each side, it is flanked by the maxillary sinuses, and roofed by the frontal, ethmoid and sphenoid sinuses, in anterior to posterior manner.

It is composed of intricate and subdivided air passages and drainage pathways that connect the sinuses.





Structure and function

There are four (4) sinuses in humans. They are all lined by the pseudostratified columnar epithelium. They are outlined as follows:

1. The **maxillary sinus**

It is the largest of the paranasal sinuses, located under the eyes in the maxillary bone.

Adjacent structures include the lateral nasal wall, the orbital floor, and the posterior maxillary wall which contains the pterygopalatine fossa.

The maxillary sinus is innervated by the infraorbital nerve (CN V2).

The maxillary and facial arteries supply the sinus, and the maxillary vein supplies venous drainage.

The maxillary sinus drains into the ethmoid infundibulum.

There is typically only one ostium per maxillary sinus.

The size of the maxillary sinus at adult stage is approximately 15 mL, making it the largest paranasal sinus.

2. The **frontal sinus**

It is located superior to the orbit and within the frontal bone.

The typical volume at the adult stage is 4 to 7 mL.

The frontal sinus drains into the frontal recess via the middle meatus and this drainage can be variable, either medial or lateral to the uncinate, depending on its attachment.

The frontal sinus vasculature consists of the supraorbital and supratrochlear arteries and ophthalmic and supraorbital veins.

Similarly, its innervation is provided by the supraorbital and supratrochlear nerves (CN VI).

Several anatomical spaces/structures are important to frontal sinus anatomy:

- Frontal recess: Drainage space between the frontal sinus and semilunar hiatus that is bounded by the posterior wall of the agger nasi cell, lamina papyracea, and the middle turbinate.
- Frontal sinus infundibulum: Space that drains into the frontal recess that is located superior to the agger nasi cells
- Frontal cells: anterior ethmoid cells that pneumatize the frontal recess. These cells may cause obstruction or persistent sinus disease. They are located posterior and superior to the agger nasi cell, and there are 4 types as classified by Bent and Kuhn:
 - i. Type I: Single cell above the agger nasi cell but below the floor of the frontal sinus
 - ii. Type II: Multiple cells above the agger nasi, may extend into the frontal sinus
 - iii. Type III: Single large cell that extends supraorbitally through the floor of the frontal sinus, attaches to the anterior table
 - iv. Type IV: Single isolated cell that is contained within the frontal sinus

3. The **ethmoid sinuses**

It is formed from several discrete air cells within the ethmoid bone between the nose and eyes.

There are 3 to 4 cells at birth and develop into 10 to 15 by adulthood for a total volume of 2 to 3 mL.

The anterior ethmoids drain into the ethmoid infundibulum, in the middle meatus.

The posterior ethmoid sinuses drain into the sphenoethmoidal recess located in the superior meatus.

The ethmoid sinuses are supplied by the anterior and posterior ethmoid arteries, respectively. These arteries are branches of the ophthalmic artery, which is a branch off of the internal carotid artery.

Ethmoid sinus venous drainage is by the maxillary and ethmoid veins. The anterior and posterior ethmoid veins provide innervation.

- The complex ethmoidal labyrinth can be reduced into a series of lamellae based on embryologic precursors. These lamellae are obliquely oriented and lie parallel to each other.
- The first lamella is the uncinate process.
- The second lamella corresponds to the ethmoid bulla.
- The third lamella is also known as the basal or ground lamella of the middle turbinate. This lamella serves as the division of the anterior and posterior ethmoids. The anterior part inserts vertically into the crista ethmoidalis. The middle portion attaches obliquely into the lamina papyracea. The posterior third attaches to the lamina papyracea as well but in a horizontal fashion.
- The fourth lamella is the superior turbinate.
- The agger nasi cell is the most anterior of the anterior ethmoid cells. It is found anterior and superior to the middle turbinate attachment to the lateral wall. The posterior wall of the agger nasi cell forms the anterior wall of the frontal recess.
- The ethmoid bulla is the largest of the anterior ethmoid cells that lies above the infundibulum. This structure is important because the anterior ethmoid artery courses over the roof of this cell.

4. The **sphenoid sinus**

The sphenoid sinuses are located centrally and posteriorly within the sphenoid bone.

They drain into the sphenoethmoidal recess located within the superior meatus.

The sphenopalatine artery supplies the sinus, and venous drainage is via the maxillary vein.

Innervation is provided by the sphenopalatine nerve, which is comprised of parasympathetic fibers and CN V2.

The typical adult size is 0.5 to 8 mL.

Several important structures have a close anatomical relationship to the sphenoid sinus.

The carotid artery is located adjacent to the lateral wall of the sinus, and in 25% of patients, it is dehiscence in this area.

The optic nerve is also located adjacent to the lateral wall of the sinus and can be dehiscence in up to 5% of individuals.

Blood supply to the sinuses

The major artery of the maxillary sinus is the internal maxillary artery, a branch of the external carotid artery.

The ethmoid and frontal sinuses have a variety of blood supplies, including meningeal vessels for the cribriform plate above the ethmoid sinuses, as well as the posterior wall of the frontal air cells.

The sphenoid sinuses may derive blood supply from small branches of the cavernous internal carotid arteries.

Nerve supply to the sinuses

The major nerve running below the frontal sinus is the first division of the fifth cranial nerve.

The major nerve of the inferior aspect of the maxillary sinus is the second division of the fifth cranial nerve.

This nerve has sensory but no specific motor functions, as opposed to the third division of cranial nerve five, the latter of which has both sensory (primarily skill of the jaw and the teeth) and motor functions (primarily muscles of mastication).