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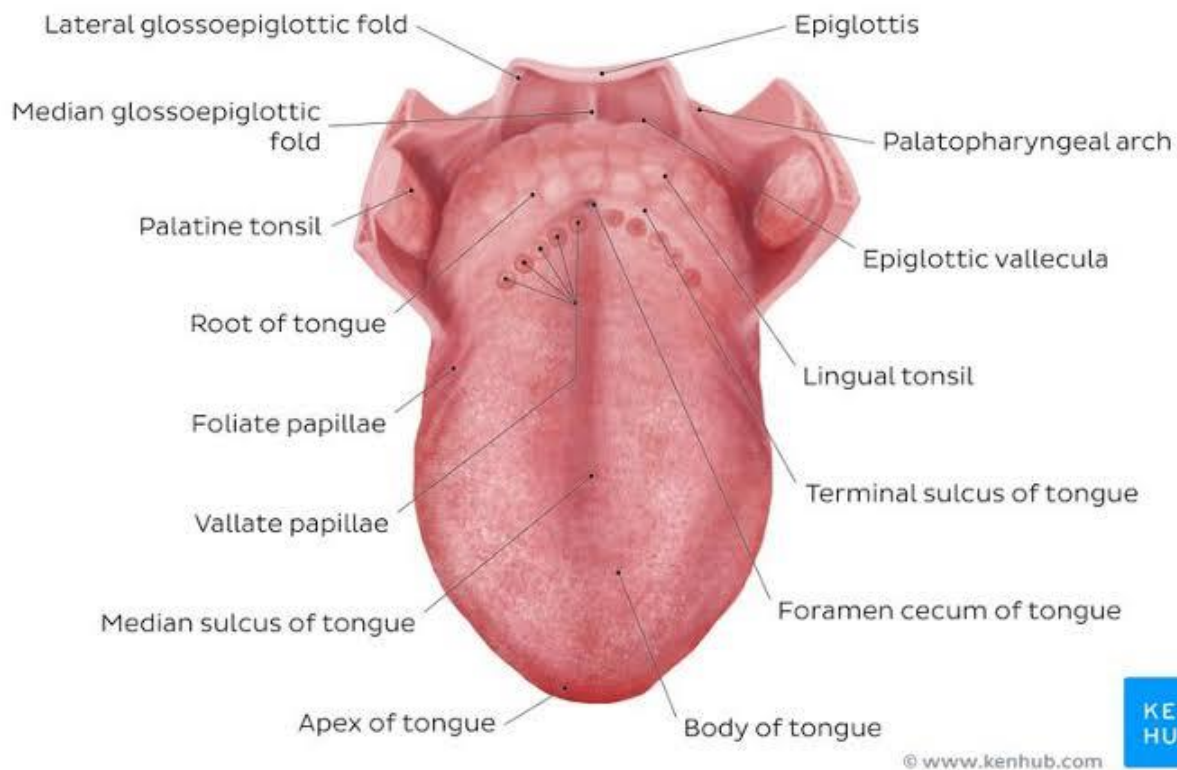
DEPARTMENT: MEDICINE AND SURGERY

LEVEL: 300L

COURSE: GROSS ANATOMY OF HEAD AND NECK

1. Discuss the anatomy of the tongue and comment on its applied anatomy.

The tongue is a mobile muscular organ covered with mucous membrane. It can assume a variety of shapes and positions. It is partly in the oral cavity and partly in the oropharynx. The tongue's main functions are articulation and squeezing food into the oropharynx as part of deglutition (swallowing). The tongue is also involved with mastication, taste, and oral cleansing.



PARTS AND SURFACES OF THE TONGUE

The tongue has 3 parts; 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.

The tongue has 2 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.

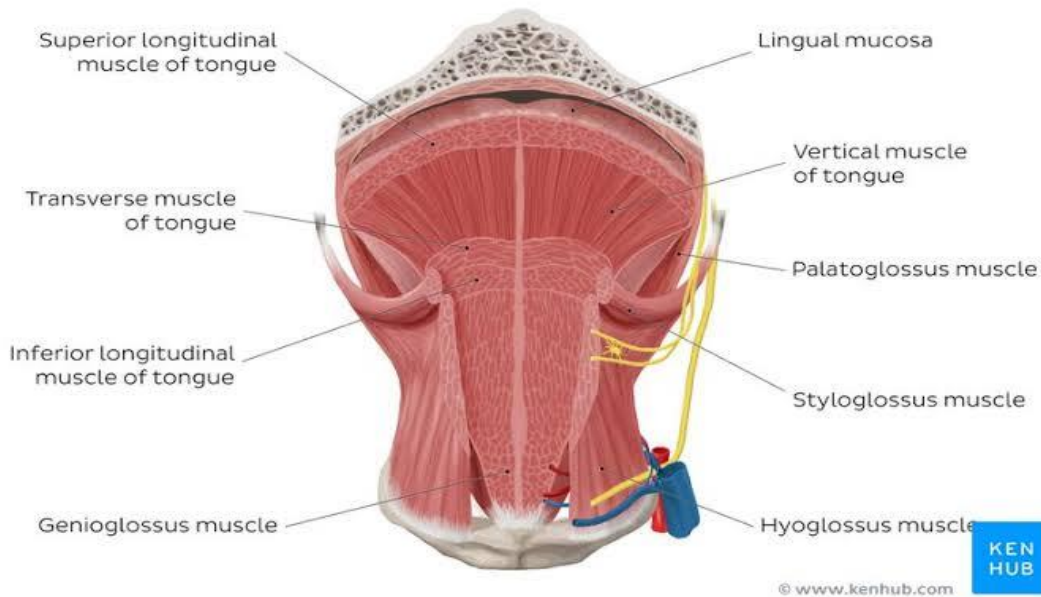
The margin of the tongue separating the two surfaces is related on each side to the lingual gingivae and lateral teeth. The dorsum of the tongue is characterized by a V-shaped groove, the terminal sulcus of the tongue, the angle of which points posteriorly to the foramen cecum. This small pit, frequently absent, is the non-functional remnant of the proximal part of the embryonic thyroglossal duct from which the thyroid gland developed. The terminal sulcus divides the dorsum of the tongue transversely into a presulcal anterior part in the oral cavity proper and a postsulcal posterior part in the oropharynx. A midline groove divides the anterior part of the tongue into right and left parts. 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:

- i. **Vallate papillae:** These are large and flat topped, lie directly anterior to the terminal sulcus and are arranged in a V-shaped row. They are surrounded by deep circular trenches, the walls of which are studded with taste buds. The ducts of the serous glands of the tongue open into the trenches.
- ii. **Foliate papillae:** These are small lateral folds of the lingual mucosa. They are poorly developed in humans.
- iii. **Filiform papillae:** These are long and numerous, contain afferent nerve endings that are sensitive to touch. These scaly, conical projections are pinkish gray and are arranged in V-shaped rows that are parallel to the terminal sulcus, except at the apex, where they tend to be arranged transversely.
- iv. **Fungiform papillae:** These are mushroom shaped pink or red spots scattered among the filiform papillae but most numerous at the apex and margins of the tongue.

The vallate, foliate, and most of the fungiform papillae contain taste receptors in the taste buds. The mucosa of the posterior part of the tongue is thick and freely movable. It has no lingual papillae, but the underlying lymphoid nodules give this part of the tongue an irregular, cobblestone appearance. The lymphoid nodules are known collectively as the **lingual tonsil**. The pharyngeal part of the tongue constitutes the anterior wall of the oropharynx. 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 OF THE TONGUE

The tongue is essentially a mass of muscles that is mostly covered by mucosa (mucous membrane). The muscles of the tongue do not act in isolation, and some muscles perform multiple actions. In general, **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.



EXTRINSIC MUSCLES OF TONGUE

The extrinsic muscles of the tongue are:

- a. Genioglossus
- b. Hyoglossus
- c. Styloglossus
- d. Palatoglossus

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

Muscle	Shape and Position	Main Action(s)
Genioglossus	Fan-shaped muscle; constitutes bulk of tongue	Bilateral activity depresses tongue, especially central part, creating a longitudinal furrow; posterior part pulls tongue anteriorly for protrusion; a most anterior part retracts apex of protruded tongue; unilateral contraction deviates ("wags") tongue to contralateral side

Hypoglossus	Thin, quadrilateral muscle	Depresses tongue, especially pulling its sides inferiorly; helps shorten (retrude) tongue
Styloglossus	Small, short triangular muscle	Retrudes tongue and curls (elevates) its sides, working with genioglossus to form a central trough during swallowing
Palatoglossus	Narrow crescent-shaped palatine muscle; forms posterior column of isthmus of fauces	Capable of elevating posterior tongue or depressing soft palate; most commonly acts to constrict isthmus of fauces

INTRINSIC MUSCLES OF TONGUE

The superior and inferior longitudinal, transverse, and vertical muscles are confined to the tongue. They have their attachments entirely within the tongue and are not attached to bone. The superior and inferior longitudinal muscles act together to make the tongue short and thick and to retract the protruded tongue. The transverse and vertical muscles act simultaneously to make the tongue long and narrow, which may push the tongue against the incisor teeth or protrude the tongue from the open mouth (especially when acting with the posterior inferior part of the genioglossus).

Muscle	Shape and Position	Main Action(s)
Superior longitudinal	Thin layer deep to mucous membrane of dorsum	Curled tongue longitudinally upward, elevating apex and sides of tongue; shortens (retrudes) tongue
Inferior longitudinal	Narrow band close to inferior surface	Curled tongue longitudinally downward, depressing apex; shortens (retrudes) tongue
Transverse	Deep to superior longitudinal muscle	Narrows and elongates (protrudes) tongue
Vertical	Fibers intersect transverse muscle	Flattens and broadens tongue

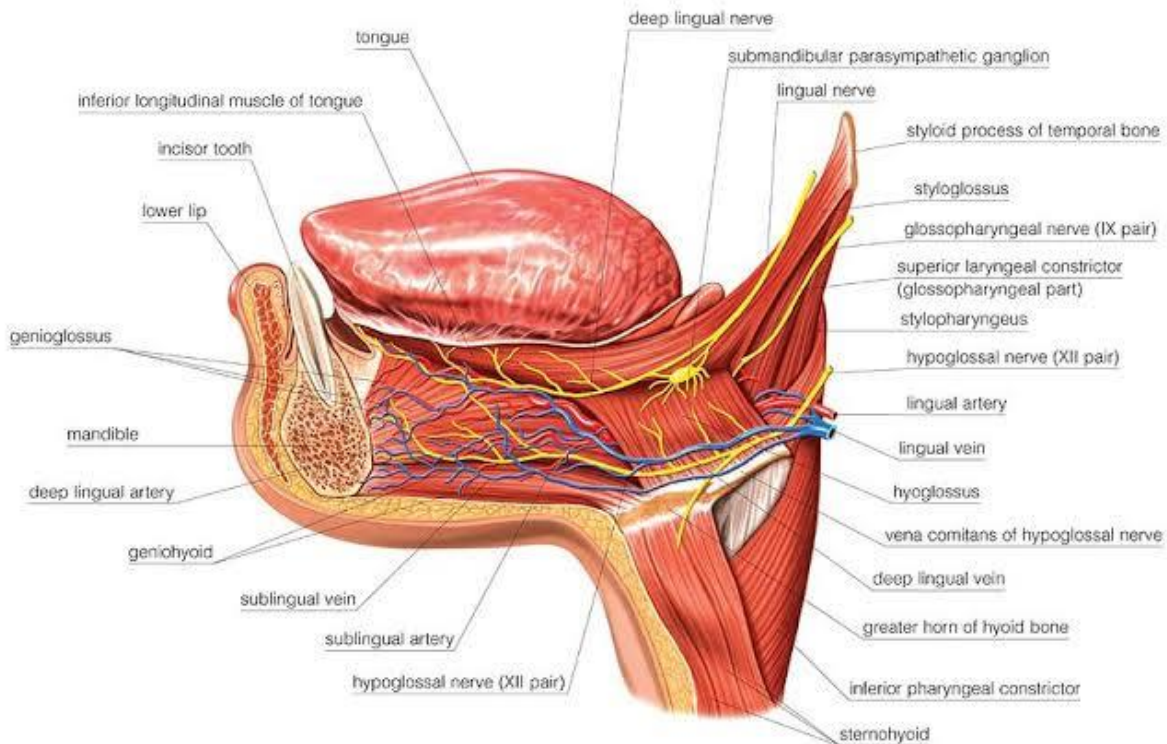
INNERVATION OF THE TONGUE

- All muscles of the tongue, except the palatoglossus, receive motor innervation from CN XII, **the hypoglossal nerve**. Palatoglossus is a palatine muscle supplied by the **pharyngeal plexus**.
- 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 (mandibular division of trigeminal nerve)**.
- For special sensation (taste), this part of the tongue, except for the vallate papillae, is supplied **the chorda tympani nerve, a branch of CN VII (facial nerve)**. 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.

VASCULATURE OF THE TONGUE



Arterial supply

The arteries of the tongue are derived from the **lingual artery**, which arises from the external carotid artery. On entering the tongue, the lingual artery passes deep to the hyoglossus muscle. The **dorsal lingual arteries** supply the root of the tongue; **the deep lingual arteries** supply the lingual body. 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.

Venous drainage

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. Some or all of them may drain into the internal jugular vein, or they may do so indirectly, joining first to form a lingual vein that accompanies the initial part of the lingual artery.

Lymphatic drainage

- 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.

CLINICAL ANATOMY

- **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.

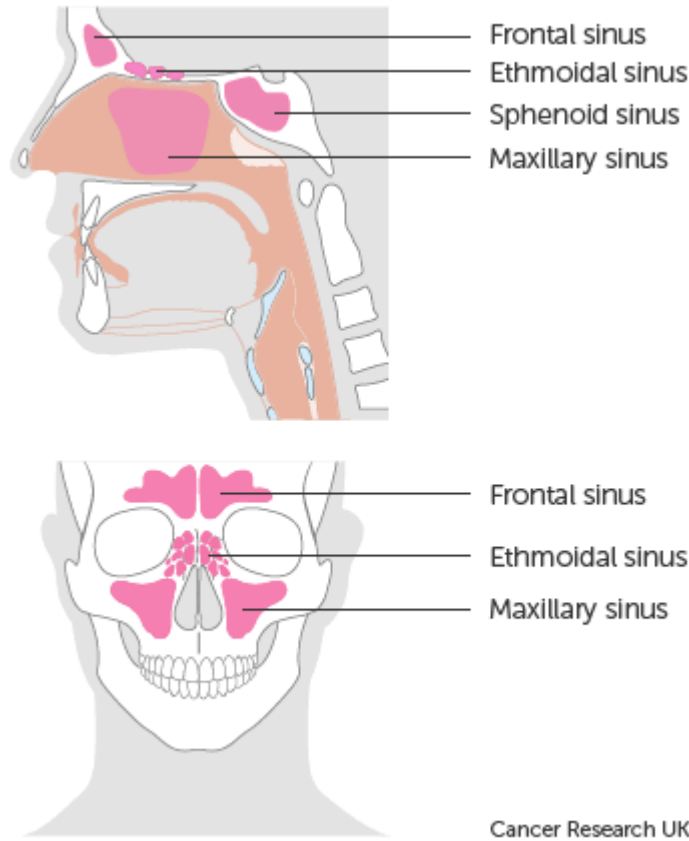
- **Frenectomy:**

An overly large frenulum of the tongue (tongue-tie) interferes with tongue movements and may affect speech. In unusual cases, a frenectomy (cutting the frenulum) in infants may be necessary to free the tongue for normal movements and speech.

2. Write an essay on the air sinuses.

Air sinuses, otherwise known as, paranasal sinuses are air-filled extensions of the respiratory part of the nasal cavity into the following cranial bones: frontal, ethmoid, sphenoid, and maxilla. They are named according to the bones in which they are located. . All:

- are lined by respiratory mucosa, which is ciliated and mucus secreting
- open into the nasal cavities
- are innervated by branches of the trigeminal nerve [V].



FRONTAL SINUSES

The frontal sinuses, one on each side, are variable in size and are the most superior of the sinuses. Each is triangular in shape and is in the part of the frontal bone under the forehead. The base of each triangular sinus is oriented vertically in the bone at the midline above the bridge of the nose and the apex is laterally approximately one-third of the way along the upper margin of the orbit. Each frontal sinus drains onto the lateral wall of the middle meatus via the frontonasal duct, which penetrates the ethmoidal labyrinth and continues as the ethmoidal infundibulum at the front end of the semilunar hiatus. The frontal sinuses are innervated by branches of the supra-orbital nerve from the ophthalmic nerve [V1]. Their blood supply is from branches of the anterior ethmoidal arteries.

ETHMOIDAL CELLS

The ethmoidal cells (sinuses) on each side fill the ethmoidal labyrinth. Each cluster of cells is separated from the orbit by the thin orbital plate of the ethmoidal labyrinth, and from the nasal cavity by the medial wall of the ethmoidal labyrinth. The ethmoidal cells are formed by a variable number of individual air chambers, which are divided into anterior, middle, and posterior ethmoidal cells based on the location of their apertures on the lateral wall of the nasal cavity:

- the anterior ethmoidal cells open into the ethmoidal infundibulum or the frontonasal duct

- the middle ethmoidal cells open onto the ethmoidal bulla, or onto the lateral wall just above this structure
- the posterior ethmoidal cells open onto the lateral wall of the superior nasal meatus.

Because the ethmoidal cells often erode into bones beyond the boundaries of the ethmoidal labyrinth, their walls may be completed by the frontal, maxillary, lacrimal, sphenoid, and palatine bones. The ethmoidal cells are innervated by:

- the anterior and posterior ethmoidal branches of the nasociliary nerve from the ophthalmic nerve [V1]
- the maxillary nerve [V2] via orbital branches from the pterygopalatine ganglion.

The ethmoidal cells receive their blood supply through branches of the anterior and posterior ethmoidal arteries.

MAXILLARY SINUSES

The maxillary sinuses are the largest of the paranasal sinuses. They occupy the bodies of the maxillae and communicate with the middle nasal meatus

- The apex of the maxillary sinus extends toward and often into the zygomatic bone.
- The base of the maxillary sinus forms the inferior part of the lateral wall of the nasal cavity.
- The roof of the maxillary sinus is formed by the floor of the orbit.
- The floor of the maxillary sinus is formed by the alveolar part of the maxilla.

The roots of the maxillary teeth, particularly the first two molars, often produce conical elevations in the floor of the sinus. 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. 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. Innervation of the maxillary sinus is from the anterior, middle, and posterior superior alveolar nerves, which are branches of the maxillary nerve.

SPHENOIDAL SINUSES

The sphenoidal sinuses, one on either side within the body of the sphenoid, open into the roof of the nasal cavity via apertures on the posterior wall of the sphenoid-ethmoidal recess. The apertures are high on the anterior walls of the sphenoid sinuses. The sphenoidal sinuses are related:

- above to the cranial cavity, particularly to the pituitary gland and to the optic chiasm
- laterally, to the cranial cavity, particularly to the cavernous sinuses
- below and in front, to the nasal cavities.

Because only thin shelves of bone separate the sphenoidal sinuses from the nasal cavities below and hypophyseal fossa above, the pituitary gland can be surgically approached through the roof of the nasal cavities by passing first through the anteroinferior aspect of the sphenoid bone and into the sphenoidal sinuses and then through the top of the sphenoid bone into the hypophyseal fossa. Innervation of the sphenoidal sinuses is provided by:

- the posterior ethmoidal branch of the ophthalmic nerve [V1]
- the maxillary nerve [V2] via orbital branches from the pterygopalatine ganglion.

The sphenoidal sinuses are supplied by branches of the pharyngeal arteries from the maxillary arteries.

CLINICAL ANATOMY

Sinusitis

Because the paranasal sinuses are continuous with the nasal cavities through apertures that open into them, infection may spread from the nasal cavities, producing inflammation and swelling of the mucosa of the sinuses (sinusitis) and local pain. Sometimes several sinuses are inflamed (pansinusitis), and the swelling of the mucosa may block one or more openings of the sinuses into the nasal cavities.

Infection of Ethmoidal Cells

If nasal drainage is blocked, infections of the ethmoidal cells may break through the fragile medial wall of the orbit. Severe infections from this source may cause blindness because some posterior ethmoidal cells lie close to the optic canal, which gives passage to the optic nerve and ophthalmic artery. Spread of infection from these cells could also affect the dural sheath of the optic nerve, causing optic neuritis.