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DEPARTMENT: MEDICINE AND SURGERY

COURSE: GROSS ANATOMY OF THE HEAD AND NECK

LEVEL: 300

ASSIGNMENT

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

TONGUE

The tongue is a mobile muscular organ that can assume a variety of shapes and positions. The tongue is involved in mastication, taste deglutination (swallowing), articulation, and oral cleansing. However, its main functions are forming words during speaking and squeezing food into the oropharynx when swallowing. 

**Parts and surfaces of the tongue**

The tongue has a root, a body, an apex, a curved dorsum, and an inferior surface. The root of the tongue is the part of the tongue that rests on the floor of the mouth. It is usually defined as the posterior third of the tongue. The body of the tongue is the anterior two-thirds of the tongue. 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 dorsum (dorsal surface) of the tongue is the posterosuperior surface, which is located partly in the oral cavity and partly in the oropharynx. It is characterized by a V‐shaped groove, the terminal sulcus or groove, 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 into the anterior (oral) part in the oral cavity proper and the posterior (pharyngeal) part in the oropharynx. The margin of the tongue is related on each side to the lingual gingivae and lateral teeth.

The mucous membrane on the anterior part of the tongue is rough because of the presence of numerous small lingual papillae:

Vallate papillae: Large and flat topped, they lie directly anterior to the terminal sulcus and are arranged in a V‐shaped row. They are surrounded by deep moat‐like trenches, the walls of which are studded with taste buds. The ducts of the serous glands of the tongue open into the trenches.

Foliate papillae: Small lateral folds of the lingual mucosa. They are poorly developed in humans.

Filiform papillae: Long and numerous, they 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.

Fungiform papillae: Mushroom shaped pink or red spots, they are scattered among the filiform papillae but are 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 mucous membrane over the anterior part of the dorsum of the tongue is thin and closely attached to the underlying muscle. A shallow midline groove of the tongue divides the tongue into right and left halves. The groove also indicates the site of fusion of the embryonic distal tongue buds.

The mucous membrane 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 and can be inspected only with a mirror or downward pressure on the tongue with a tongue depressor.

The inferior surface of the tongue is covered with a thin, transparent mucous membrane through which one can see the underlying veins. 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 submandibularductfrom the submandibular salivary gland.

**Muscles of the Tongue**

The tongue is essentially a mass of muscles that is mostly covered by mucous membrane. Although it is traditional to do so, providing descriptions of the actions of tongue muscles ascribing (1) a single action to a specific muscle, or (2) implying that a particular movement is the consequence of a single muscle acting, greatly oversimplifies the actions of the tongue and is misleading. The muscles of the tongue do not act in isolation and some muscles perform multiple actions; parts of a single muscle are capable of acting independently, producing different, even antagonistic actions. In, general, however, extrinsic muscles alter the position of the tonguewhile intrinsicmuscles 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 the Tongue***

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

***Intrinsic Muscles of the 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. They are illustrated and their shape, position, attachments, and main actions. 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).



**Innervation of the Tongue**

All muscles of the tongue, except the *palatoglossus* (actually a palatine muscle supplied by the *pharyngeal plexus*), receive motor innervation from CN XII, the **hypoglossal nerve**. 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 through the *chorda tympani nerve*, a branch of CN VII. The chorda tympani joins the lingual nerve and runs anteriorly in its sheath. The mucous membrane 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. Parasympathetic fibers from the chorda tympani nerve travel with the lingual nerve to the submandibular and sublingual salivary glands. These nerve fibers synapse in the *submandibular ganglion*, which hangs from the lingual nerve. 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).



**Vasculature of the Tongue**

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 posterior part (root); the **deep lingual arteries** supply the anterior part. 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). All these lingual veins terminate, directly or indirectly, in the internal jugular vein.



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:

Lymph from the *posterior third* drains into the *superior deep cervical lymph nodes.*

Lymph from the *medial part* of the anterior two thirds drains directly to the *inferior deep cervical lymph nodes.* Lymph from the lateral parts of the anterior two thirds drains to the *submandibular lymph nodes.* The apex and frenulum drain to the *submental lymph nodes.* The posterior third and the medial part of the anterior two thirds drain bilaterally.



**APPLIED ANATOMY**

**Gag Reflex**

It is possible to touch the anterior part of the tongue without feeling discomfort; however, when the posterior part is touched, the individual gags. CN IX and CN X are responsible for the muscular contraction of each side of the pharynx. Glossopharyngeal branches provide the afferent limb of the gag reflex.

**Paralysis of the Genioglossus**

When the genioglossus muscle is paralyzed, the tongue has a tendency 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.

**Injury to the 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.

**Sublingual Absorption of Drugs**

For quick absorption of a drug, for instance, when nitroglycerin is used as a vasodilator in *angina pectoris*, the pill or spray is put under the tongue where it dissolves and enters the deep lingual veins in <1 min.

**Lingual Carcinoma**

A *lingual carcinoma* in the posterior part of the tongue metastasizes to the superior deep cervical lymph nodes on both sides, whereas a tumor 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 the IJV, metastases from the tongue may be widely distributed through the submental and submandibular regions and along the IJVs in the neck.

**Frenectomy**

An overly large lingual frenulum (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 movement and speech.

**Thyroglossal Duct Cyst**

A cystic remnant of the thyroglossal duct, associated with development of the thyroid gland, may be found in the root of the tongue and be connected to a sinus that opens at the foramen cecum. Surgical excision of the cyst may be necessary. Most *thyroglossal duct cysts* are in the neck, close or just inferior to the body of the hyoid bone.

**Aberrant Thyroid Gland**

Aberrant thyroid glandular tissue may be found anywhere along the path of the embryonic thyroglossal duct. Although uncommon, the thyroglossal duct carrying thyroid‐forming tissue at its distal end may fail to descend to its definitive position in the neck. Aberrant thyroid tissue may be in the root of the tongue, just posterior to the foramen cecum, or in the neck. Cystic remnants of the thyroglossal duct may be differentiated from an undescended thyroid by radioisotope scanning. An aberrant thyroid gland may be the only thyroid tissue the person has; if so, removal will require the person be continually medicated with thyroid hormone.

1. Write an essay on the air sinuses

***Paranasal Sinuses***

The **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. The sinuses continue to invade the surrounding bone, and marked extensions are common in the crania of older individuals.



**Frontal Sinuses**

The **frontal sinuses** are between the outer and the inner tables of the frontal bone, posterior to the superciliary arches and the root of the nose. Frontal sinuses are usually detectable in children by 7 years of age. Each sinus drains through a **frontonasal duct** into the *ethmoidal infundibulum*, which opens into the *semilunar hiatus* of the middle nasal meatus. The frontal sinuses are innervated by branches of the *supraorbital nerves* (CN V1).

**Sphenoidal Sinuses**

The **sphenoidal sinuses** are located in the body of the sphenoid and may extend into the wings of this bone. They are unevenly divided and separated by a bony septum. Because of this extensive pneumatization (formation of air cells or sinuses), the body of the sphenoid is fragile. Only thin plates of bone separate the sinuses from several important structures: the optic nerves and optic

chiasm, the pituitary gland, the internal carotid arteries, and the cavernous sinuses. The sphenoidal sinuses are derived from a posterior ethmoidal cell that begins to invade the sphenoid at approximately 2 years of age. In some people, several posterior ethmoidal cells invade the sphenoid, giving rise to multiple sphenoidal sinuses that open separately into the *sphenoethmoidal recess.* The posterior ethmoidal arteries and posterior ethmoidal nerve supply the sphenoidal sinuses.

**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.

**Ethmoidal Cells**

The **ethmoidal cells** (**sinuses**) are small invaginations of the mucous membrane of the middle and superior nasal meatus into the ethmoid bone between the nasal cavity and the orbit. The ethmoidal cells usually are not visible in plain radiographs before 2 years of age but are recognizable in CT scans. The **anterior** **ethmoidal cells** drain directly or indirectly into the middle nasal meatus through the ethmoidal infundibulum. 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 (Fig. 7.65*B*). The **posterior ethmoidal cells** open directly into the superior meatus. The ethmoidal cells are supplied by the anterior and posterior ethmoidal branches of the *nasociliary* *nerves* (CN V1 ).