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1. **THE TONGUE**

**SURFACE OF THE TONGUE**

The tongue has two surfaces:

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

 • Vallate papillae: large and ﬂ at 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.

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

• Filiform papillae: 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.

• Fungiform papillae: 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 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.

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.



**THE MUSCLES OF THE TONGUE**

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, 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 (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 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.

lateral view of the tongue, with extrinsic muscles highlighted

**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.

 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. 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 ﬁ bers 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).

**VASCULATURE OF 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 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. 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.

Diagram showing blood suppply

**LYMPHATIC DRAINAGE**

The drainage zones of the mucosa of the tongue can be grouped into three:

 1. The tip drains to the submental nodes

 2. The anterior two-thirds drains to the submental and submandibular nodes and thence to the lower nodes of the deep cervical chain along the carotid sheath

 3. The posterior one-third drains to the upper nodes of the deep cervical chain.

There is a rich anastomosis across the midline between the lymphatics of the posterior one-third of the tongue so that a tumour on one side readily metastasizes to contralateral nodes. In contrast, there is little crosscommunication in the anterior two-thirds, where growths more than 0.5in (12mm) from the midline do not metastasize to the opposite side of the neck till late in the disease.

 **CLINCAL ANATOMY**

* Damage to the hypoglossal nerve is readily detected clinically by hemiatrophy of the tongue and deviation of the projected organ towards the paralysed side
* 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 the nodes are closely related to the IJV, metastases from the tongue may be distributed through the submental and submandibular regions and along the IJVs in the neck.
* 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.
* A [congenital disorder](https://en.wikipedia.org/wiki/Congenital_disorder) of the tongue is that of [ankyloglossia](https://en.wikipedia.org/wiki/Ankyloglossia%22%20%5Co%20%22Ankyloglossia) also known as tongue-tie. The tongue is tied to the floor of the mouth by a very short and thickened [frenulum](https://en.wikipedia.org/wiki/Frenulum_of_tongue%22%20%5Co%20%22Frenulum%20of%20tongue) and this affects speech, eating, and swallowing.

**2.) AIR SINUSES**

The **paranasal sinuses** are **air cavities** that help circulate the air that is breathed in and out of the [respiratory system](https://www.kenhub.com/en/library/anatomy/the-respiratory-system). They are situated around the [nasal cavity](https://www.kenhub.com/en/library/anatomy/nasal-cavity) and they are all paired and sometimes symmetrical, while always being bilateral. There are four different pairs of sinuses and they are called the:

* maxillary sinuses
* frontal sinuses
* sphenoidal sinuses
* ethmoidal sinuses

**The maxillary sinuses:** The maxillary sinuses are the largest of the all the paranasal sinuses. They have thin walls which are often penetrated by the long roots of the posterior maxillary[teeth](https://www.kenhub.com/en/library/anatomy/the-teeth). The superior border of this sinus is the [bony orbit](https://www.kenhub.com/en/library/anatomy/bones-of-the-orbit), the inferior is the maxillary alveolar bone and corresponding tooth roots, the medial border is made up of the [nasal cavity](https://www.kenhub.com/en/library/anatomy/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](https://www.kenhub.com/en/library/anatomy/infratemporal-fossa) exist.

**Vascularization, innervation and lymphatics**

The submandibular lymph nodes are the main destination during lymphatic drainage. The blood supply includes a contribution from the:

* anterior superior alveolar artery
* middle superior artery
* posterior superior alveolar artery

Innervation occurs through nerves of the same names as the arteries.

**The frontal sinuses:** Anteriorly, the frontal sinuses are contained by the forehead and the superciliary arches, superiorly and posteriorly by the anterior cranial fossa and inferiorly by the bony orbit, the anterior ethmoidal sinuses and the nasal cavity. Medially the sinuses face one another, separated by the midline. This pair of sinuses are irregular in shape when compared to one another and is underdeveloped at birth. They reach their full size and shape around seven to eight years of age.

**Vascularization, innervation and lymphatics**

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

The frontal sinuses are supplied by the:

* anterior ethmoidal artery
* supraorbital artery
* [supratrochlear artery](https://www.kenhub.com/en/library/anatomy/supratrochlear-artery)

**The sphenoidal sinuses:** The most posterior of all the sinuses in the head, the sphenoidal sinuses are large and irregular, just like their septum, which is made by the [sphenoid bone](https://www.kenhub.com/en/library/anatomy/the-sphenoid-bone).Laterally, a cavernous sinus exists which is part of the middle cranial fossa and also the carotid artery and cranial nerves [III](https://www.kenhub.com/en/library/anatomy/the-oculomotor-nerve), [IV](https://www.kenhub.com/en/library/anatomy/the-trochlear-nerve-and-the-abducent-nerve), V/I, [V/II](https://www.kenhub.com/en/library/anatomy/the-maxillary-branch-of-the-trigeminal-nerve)and [VI](https://www.kenhub.com/en/library/anatomy/the-trochlear-nerve-and-the-abducent-nerve) can be found.

The anterior wall separates this pair of sinuses from the nasal cavity, as does the hypophyseal fossa, the [pituitary gland](https://www.kenhub.com/en/library/anatomy/pituitary-gland) and the [optic chiasm](https://www.kenhub.com/en/library/anatomy/the-optic-nerve) superiorly and the[nasopharynx](https://www.kenhub.com/en/library/anatomy/the-pharynx) and pterygoid canal inferiorly.

**Vascularization, innervation and lymphatics**

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.

**The ethmoidal sinuses:** Superior to the ethmoidal sinus is the anterior cranial fossa and the [frontal bone](https://www.kenhub.com/en/library/anatomy/the-frontal-bone),laterally the orbit can be found, while the nasal cavity is situated medially. The ethmoid sinuses are unique because they are the only paranasal sinuses that are more complex than just a single cavity.

On each side of the midline, anywhere from three to eighteen ethmoidal air cellsmay be grouped together. These air cells are smaller individual sinuses grouped together to form one large one which encompass the anterior, middle and posterior nasal meatuses.

**Vascularization, innervation and lymphatics**

The anterior and middle ethmoid sinuses send their lymphatic drainage to thesubmandibular 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 theanterior and posterior ethmoidal nerves and the posterior lateral superior andinferior nasal nerves help innervate it.

**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 inﬂ ammation and swelling of the mucosa of the sinuses (sinusitis) and local pain. Sometimes several sinuses are inﬂ amed (pansinusitis), and the swelling of the mucosa may block one or more openings of the sinuses into the nasal cavities.
* Infection of Maxillary Sinuses: The maxillary sinuses are the most commonly infected, probably because their ostia (openings) are commonly small and are located high on their superomedial wall.When the mucous membrane of the sinus is congested, the maxillary ostia are often obstructed. Because of the high location of the ostia, when the head is erect it is impossible for the sinuses to drain until they are full. Because the ostia of the right and left sinuses lie on the medial sides (i.e., are directed toward each other), when lying on one’s side only the upper sinus (e.g., the right sinus if lying on the left side) drains. A cold or allergy involving both sinuses can result in nights of rolling from side to side in an attempt to keep the sinuses drained. A maxillary sinus can be cannulated and drained by passing a cannula from the naris through the maxillary ostium into the sinus.