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ANA 301

The tongue is a mass of muscle that is almost completely covered by a mucous membrane. It is also considered as a sensory/motor organ because of the roles it plays. It occupies most of the oral cavity and oropharynx. It is known for its role in taste, but it also assists with mastication (chewing). While there is significant variability in the length of the tongue among individuals, on average, the organ is roughly 10 cm long.

 The tongue is one of those structures derived from the pharyngeal apparatus. Towards the end of the fourth gestational week, the body of the tongue forms from derivatives of the first branchial arch. . Initially, two lateral lingual swellings and one medial swelling, called the tuberculum impar, form from the first pharyngeal arch. A second median swelling, known as the copula or hypobranchial eminence, develops from the mesoderm of the second, third, and fourth pharyngeal arches. A final third median swelling forms from the posterior portion of the fourth arch and develops into the epiglottis. Directly posterior to this swelling is the laryngeal orifice, which is accompanied on either side by the arytenoid swellings.

The lateral lingual swellings increase in size, eventually merging and overlapping the tuberculum impar. The merger of these two swellings forms the anterior two-thirds of the tongue. The mucosa overlying this part of the tongue originates from the first arch; thus, the sensory innervation to this area is from the mandibular branch of the trigeminal nerve (CN V3). Meanwhile, the second, third, and fourth portions of the pharyngeal arch, which make up the copula, develop into the posterior one-third of the tongue.

The tongue has 3 main parts

The tip or apex of the tongue is the most anterior and most mobile aspect of the organ.

The tip is followed by the body of the tongue. It has a rough superior surface that touches the palate and is populated with taste buds and lingual papillae, and a smooth inferior surface that is attached to the floor of the oral cavity by the lingual frenulum.

The base of the tongue is the most posterior part of the organ. It is populated by numerous lymphoid aggregates known as the lingual tonsils along with foliate papillae along the posterolateral surface.

The median sulcus of the tongue separates the body into left and right halves. The terminal sulcus, or groove, is a V-shaped furrow that separates the body from the base of the tongue. At the tip of this sulcus is the foramen cecum, a remnant of the proximal thyroglossal duct. The base of tongue contains the lingual tonsils, the inferiormost portion of Waldeyer’s ring.

The surface of the body of the tongue derives its characteristic appearance from the presence of lingual papillae, which are projections of lamina propria covered with epithelium. The 4 types of lingual papillae are as follows: vallate (circumvallate), foliate, filiform, and fungiform.

Vallate papillae are arranged in a V-shape anterior to the sulcus terminalis and studded with numerous taste buds. Innervation is by the glossopharyngeal nerve (CN IX). The vallate papillae are flat, prominent papillae that are surrounded by troughs. In humans, there are 8-12 vallate papillae, located directly anterior to the terminal sulcus. The ducts of the lingual glands of von Ebner secrete lingual lipase into the surrounding troughs to begin the process of lipolysis.

Fungiform papillae are mushroom-shaped papillae with erythematous domes, located on the lateral aspects and at the apex of the tongue. They are dispersed most densely along the tip and lateral surfaces of the tongue; humans have approximately 200-300 fungiform papillae.

Filiform papillae are slim, cone-shaped projections organized in rows parallel to the sulcus terminalis. They are the most numerous papillae and are located along the entire dorsum of the tongue, but they are not involved in taste sensation.

Foliate papillae are rarely found in humans (vestigial). They are small folds of mucosa located along the lateral surface of the tongue. Each vallate, foliate, and fungiform papilla contains taste buds (250, 1000, and 1600 taste buds, respectively). Each taste bud is innervated by several nerve fibers. In humans, all taste buds can perceive the 5 different taste qualities: salt, sweet, bitter, acid, and savoury. Each taste bud consists of taste receptor, basal, and edge cells.

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 tongue is made up majorly of 4 intrinsic and 4 extrinsic muscles. The muscles on each side of the tongue are separated by a fibrous lingual septum.

**Muscles of the Tongue**

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| --- | --- | --- | --- | --- |
| MUSCLES | TYPE | ORIGIN | INSERTION | ACTION |
| Superior longitudinal | Intrinsic | Lingual septum and submucous fibrous layer | Margins of tongue | Elevates tip and sides of tongue; shortens tongue |
| Inferior longitudinal | Intrinsic | Body of hyoid and base of tongue | apex | Curls tip inferiorly; shortens tongue |
| Transverse  | Intrinsic | Lingual septum | Submucous fibrous layer | Narrows and lengthens tongue |
| Vertical | Intrinsic | Superior surface of tongue | Inferior surface of tongue | Flattens and broadens tongue |
| genioglossus | extrinsic | Mental spine of mandible | Lateral and inferior tongue | Depresses and protrudes tongue |
| hyoglossus | extrinsic | Body and greater horn of hyoid | Lateral and inferior tongue | Depresses and retracts tongue |
| styloglossus | extrinsic | Styloid and stylohoid ligment | Lateral and inferior tongue | Retracts tongue |
| palatoglossus | extrinsic | Palantine aponeurosis | Lateral tongue | Elevates posterior tongue |

ARTERIAL SUPPLY OF THE TONGUE

The lingual artery is a branch of the external carotid artery that supplies the major part of the tongue. The root of the tongue is also supplied by the tonsilar and ascending pharyngeal arteries.

LYMPHATIC DRAINAGE

The tip of the tongue drains into the submental lymph nodes. The right and left halves of the anterior two-third of the tongue drains into the submandibular lymph nodes on either side. The posterior one-third of the tongue drains into the jugulo-omohyoid group of cervical lymph nodes.

VENOUS DRAINAGE

Deep lingual vein is the largest and the main vein which supplies the tongue.

The vein is visible on the inferior surface of the tongue. It runs backwards and crosses the genioglossus and hyoglossus muscle.

DISEASES OF THE TONGUE

ANKYLOGLOSSIA: Also called tongue tie. It is characterised by short or tight lingual frenum.

It is genetic in most cases and occurs occasionally due to factors like cocaine addicted mothers.

It occurs inabout 1.7% of world population.

Clinical features: frenum is short

 Speech defects

 Difficulty in cleansing food away from teeth and vestibule.

It can be managed by undergoing surgery.

MACROGLOSSIA: it is a congenital disease. Can be seen in people who have down syndrome, lymphangioma, haemangioma etc.

It occurs mostly in children, mild to severe in infants.

Clinical features: enlarged, smooth and drooling tongue

 difficulty in eating and speech

 noisy breathing and open bite

Management: in mild cases, speech therapy can be done. In severe cases, glossectomy, a surgical removal of excess tongue can be done.

MICROGLOSSIA AND AGLOSSIA

Aglossia- complete absence of tongue at birth

Microglossia – presence of small, rudimentary tongue.

Both are usually associated with syndromes such as Pierre Robin Syndrome etc. also associated with cleft lip and palate.

Clinical features: difficulty in eating and speaking.

 high arched palate

 narrow constricted mandible

 There may be air obstruction, due to negative pressure generated by deglutition and inspiration.

Management: non-surgical techniques such as nasogastric intubation may be carried out to prevent airway obstruction.

APPLIED ANATOMY:

Injury to the hypoglossal nerve (cranial nerve XII) results in deviation of the tongue toward the paralyzed side during protrusion. The tongue also atrophies over time on the paralyzed side

**AIR SINUSES**

The paranasal sinuses are air-filled spaces located within the bones of the skull and facial bones. They are centred on the nasal cavity and have various functions, including lightening the weight of the head, humidifying and heating inhaled air, increasing the resonance of speech, and serving as a crumple zone to protect vital structures in the event of facial trauma. Four sets of paired sinuses are recognized: maxillary, frontal, sphenoid, and ethmoid .

Maxillary Sinus: There are two large maxillary sinuses, one in each of the maxillary bones, which are in the cheek area next to the nose. The maxillary sinuses are lined with cells that make mucus to keep the nose from drying out. 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. 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 by the cheekbones. Posteriorly, two anatomical spaces known as the pterygopalatine fossa and the infratemporal fossa exist. The maxillary sinus drains into the nose through a hole called the ostia. When the ostia become clogged, sinusitis can occur. The ostia of the maxillary sinus often clog because the ostia are located near the top of the maxillary sinus, thus making proper drainage difficult.

Vascularisation, 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.

Maxillary sinusitis or an infection of the maxillary sinus can have the following symptoms: fever, pain or pressure in face near the cheekbones, toothache, and runny nose. Sinusitis is the most common of maxillary sinus illnesses and is usually treated with prescription antibiotics

Frontal Sinus: 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.These 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. 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

Sphenoid sinus: The sphenoid sinus originates in the sphenoid bone at the center of the head. It arises not from an out pouching of the nasal cavity but from the nasal embryonic lining. The sinus reaches its full size by the late teenage years. The sphenoid sinus is variably pneumatised and may extend as far as the foramen magnum in some patients.

The thickness of the walls of the sphenoid sinus is variable, with the anterosuperior wall and the roof of the sphenoid sinus being the thinnest bones. The sphenoid sinus ostium is located on the anterosuperior surface of the sphenoid face, usually medial to the superior turbinate.

The sphenoid sinus is supplied by the sphenopalatine artery, except for the planum sphenoidale, which is supplied by the posterior ethmoidal artery. Innervation of the sphenoid sinus comes from branches of the first and second divisions of the trigeminal nerve.

The ethmoid sinuses: These 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 cells may 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 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.