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GROSS ANATOMY OF HEAD AND NECK

ANA 301

NOSE AND ORAL CAVITY

QUESTION

1. Discuss the anatomy of the tongue and comment on its applied anatomy.
2. Write an essay on the air sinuses.

ANSWERS

1. ANATOMY OF THE TONGUE

Introduction

The tongue is a pink, muscular organ in the oral cavity. It facilitates perception of gustatory stimuli. It also plays important roles in speech, mastication and deglutition. It has an average length of about 8.5cm in adult males. It forms part of the floor of the oral cavity and part of the anterior wall of the oropharynx.

Parts of the Tongue

The anterior part of the tongue is in the oral cavity and is somewhat triangular in shape with a blunt apex of tongue. The apex is directed anteriorly and sits immediately behind the incisor teeth. The apex is followed by the body of the tongue. It has a rough superior surface that abuts the palate and is populated with taste buds and lingual papillae, and a smooth inferior surface that is attached to the floor of the cavity by the **lingual frenulum**. The root of tongue is the most posterior part of the tongue. It is populated by numerous lymphoid aggregates known as the lingual tonsil. It is attached to the mandible and the hyoid bone.

Surface of the Tongue

- a. The Superior Surface of the Tongue: The oral or anterior two-thirds of the tongue is oriented in the horizontal plane. It includes the **apex** and **body** of the tongue. It terminates at the **sulcus terminalis**; which can be seen extending literally in an oblique direction from the foramen cecum towards the palatoglossal arch. The mucosa of the dorsal surface of the oral tongue is made up of papillae. There is also a longitudinal midline

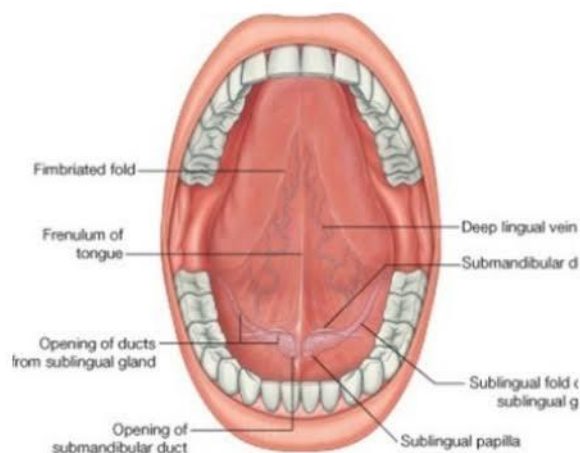
groove running in an anteroposterior direction from the tip of the tongue to the **foramen cecum**. This marks the embryological point of fusion of the lateral lingual swellings that formed the oral tongue. It also represents the location of the **median lingual septum** of the tongue that inserts in the body of the hyoid bone.

The pharyngeal surface or posterior one-third of the tongue curves inferiorly and becomes oriented more in the vertical plane. It is made up of the **base** of the tongue. The oral and pharyngeal surfaces are separated by a V-shaped terminal sulcus of tongue. Unlike the oral tongue, the pharyngeal tongue does not have any lingual papillae. Instead, its mucosa is also continuous with the mucosa of the laterally located palatine tonsils, the lateral oropharyngeal walls, and the posterior epiglottis and glossoepiglottic folds.

- b. **Inferior Surface of the Tongue:** The undersurface of the oral part lacks papillae, but does have a number of linear mucosal folds. A single median fold (the frenulum of tongue) is continuous with the mucosa covering the floor of the oral cavity, and overlies the midline sagittal septum. On each side of the frenulum is a lingual vein, and lateral to each vein is a rough fimbriated fold called **plica fimbriata**.

On the pharyngeal surface, the mucosa covering the tongue is irregular in contour because of the many small nodules of lymphoid tissue in the submucosa. These nodules are collectively the **lingual tonsil**. There are no papillae on the pharyngeal surface.

INFERIOR SURFACE



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Fig 1. Diagram showing the Inferior Surface of the Tongue

Papillae and Taste Buds

The superior surface of the oral part of the tongue is covered by hundreds of papillae. The papillae in general increase the surface area between the surface of the tongue and the contents of the oral cavity. These papillae are of four types:

- a. Filiform Papillae: They are small cone-shaped projections of the mucosa that end in one or more points. They are the most abundant papillae. They do not possess taste buds.
- b. Fungiform Papillae: They are mushroom-shaped and contain a few taste buds on the apical aspect. It is less abundant than the filiform papillae. They are highly vascular. They are concentrated along the margins of the tongue.
- c. Circumvallate Papillae: They are blunt-ended cylindrical papillae invaginations in the tongue's surface. They are only about 8 to 12 vallate papillae in a single V-shaped line immediately anterior to the terminal sulcus of tongue. They possess taste buds.
- d. Foliate Papillae: they appear as bilaterally paired, parallel, longitudinal slits on the posterolateral margin of the tongue, near the sulcus terminalis. It is populated with numerous taste buds.

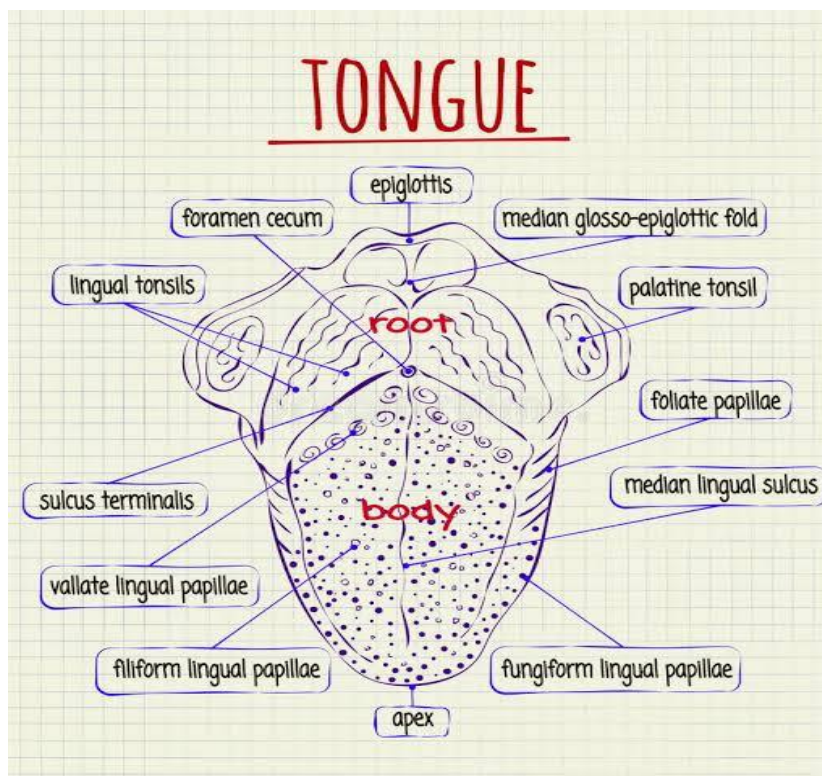


Fig 2. Diagram showing the Superior Surface of the Tongue

Muscles of the Tongue

The tongue is chiefly a muscular organ with some amount of fatty and fibrous tissue distributed throughout its substance. The tongue is completely divided into left and right half by a median sagittal septum composed of connective tissue. Due to this, all muscles of the tongue are paired structures. The muscles of the tongue are divided into two groups: intrinsic and extrinsic lingual muscles. The intrinsic and extrinsic muscles make the tongue have that characteristic flexibility. Except for the palatoglossus, which is innervated by the vagus nerve (CN X), all muscles of the tongue are innervated by the hypoglossal nerve (CN XII).

a. Intrinsic Muscles

The intrinsic muscles of the tongue originate and insert within the substance of the tongue. These muscles can alter the shape of the tongue. It is made up of four paired muscles. In dorsoventral manner, the muscles are superior longitudinal, inferior longitudinal, transverse and vertical muscles.

b. Extrinsic Muscles

These are muscles that extend outside of the organ to anchor it to surrounding bony structures. These muscles dictate the movement of the tongue in and out of the oral cavity. There are four pairs of extrinsic muscles, the genioglossus, hyoglossus, styloglossus and palatoglossus. These muscles protrude, retract, depress, and elevate the tongue. These movements facilitate closing of the oropharyngeal isthmus and as a result separate the oral cavity from the oropharynx.

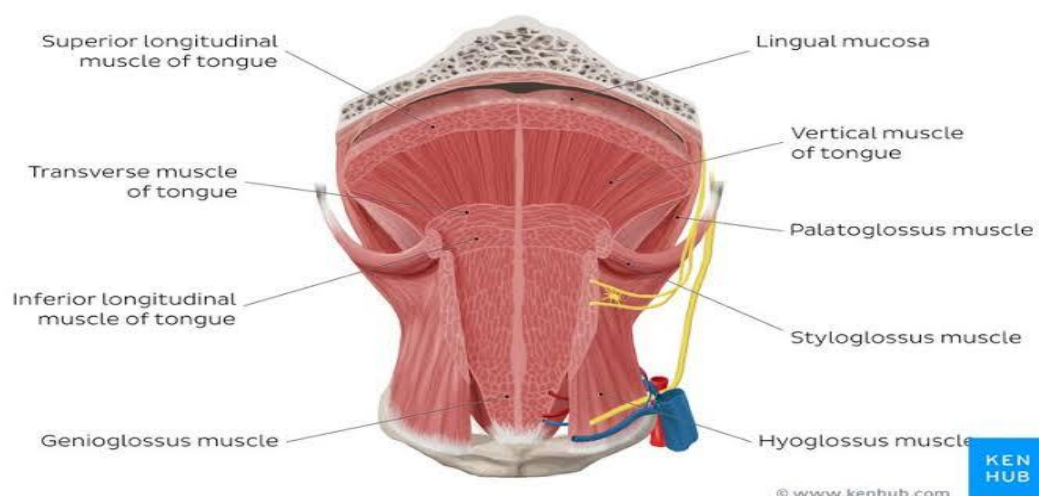


Fig 3. Diagram showing the Musculature of the Tongue

Blood Supply of the Tongue

Arterial Supply

The major artery of the tongue is the lingual artery. The lingual artery originates from the external carotid artery in the neck adjacent to the tip of the greater horn of the hyoid bone in the carotid triangle. It passes deep to the hyoglossus and lies on the middle pharyngeal constrictor muscle. It gives rise to the suprahyoid, dorsal lingual and sublingual arteries and terminates as the deep lingual artery, which ascends between the genioglossus and inferior longitudinal muscles. In addition to the tongue, lingual artery supplies the sublingual gland, gingiva, and oral mucosa in the floor of oral cavity.

Venous Drainage

The tongue is drained by dorsal lingual and deep lingual veins. The veins are accompanied by their corresponding arteries. The deep lingual veins, which begin at the apex of the tongue, run posteriorly beside the lingual frenulum to join the sublingual vein. The lingual veins drain into the internal jugular vein in the neck.

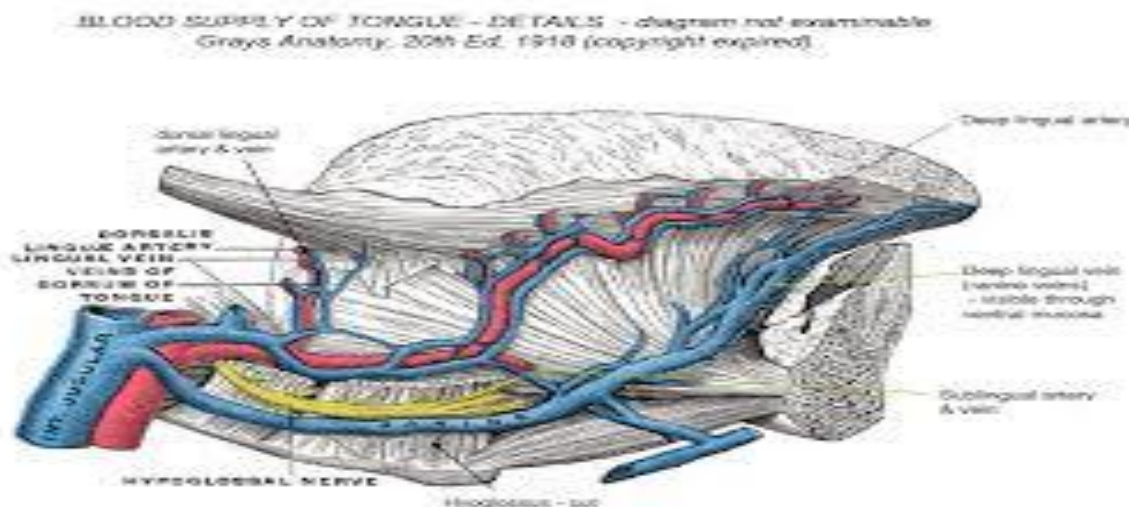


Fig 4. Diagram showing the Blood Supply of the Tongue

Lymphatic Drainage

All lymphatic vessels from the tongue ultimately drain into the deep cervical chain of nodes along the internal jugular vein. Lymph from the posterior one-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 one-third and the medial part of the anterior two-thirds drain bilaterally.

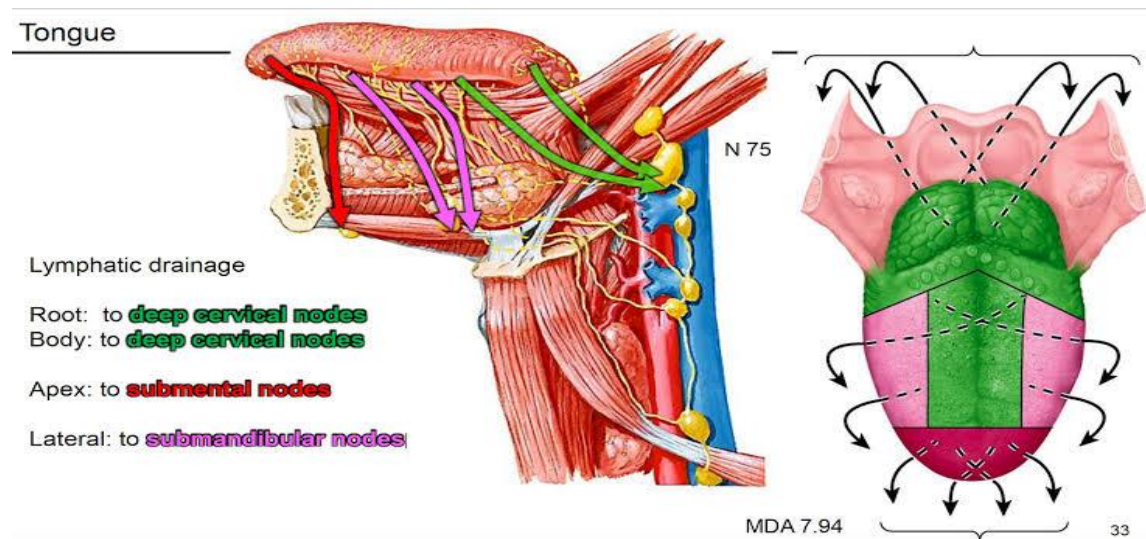


Fig 5. Diagram showing the Lymphatic Drainage of the Tongue

Innervation

Innervation of the tongue is complex and involves a number of nerves.

➤ Motor Innervation

All the muscles of the tongue are innervated by the hypoglossal nerve (CN XII), except for the palatoglossal muscle which is innervated by the vagus nerve (CN X).

➤ Sensory Innervation

The anterior two-third of the tongue are supplied by the lingual nerve for general sensation. It is also supplied by the chorda tympani, a branch of the facial nerve (CN VII) transferring nerve fibres to the lingual nerve, for taste. The posterior one-third of the tongue and the circumvallate papillae are supplied by the lingual branch of the glossopharyngeal nerve (CN IX) for both general sensation and taste. Another contribution is made by the internal laryngeal branch of the vagus nerve (CN X) for general sensation and taste. Hence, the facial nerve (CN VII) glossopharyngeal nerve (CN IX), and the vagus nerve (CN X) provide nerve fibres for taste; those from facial nerve (CN VII) are ultimately conveyed by lingual nerve (CN V₃).

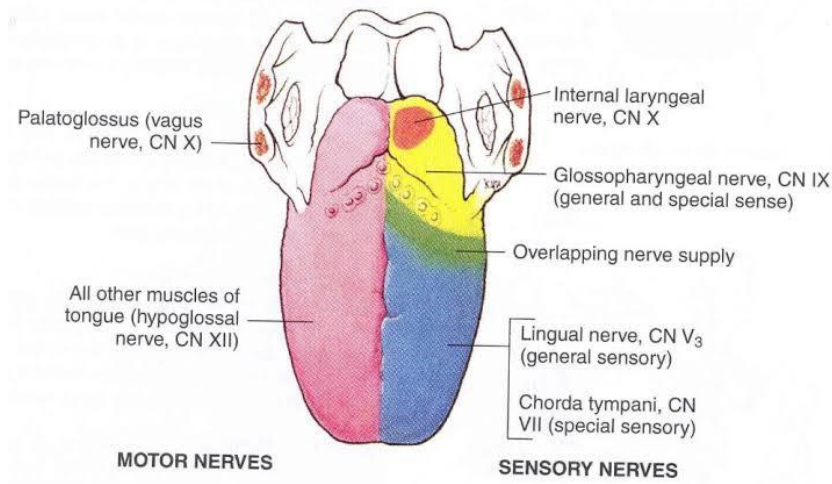


Fig 6. Diagram showing the Innervation of the Tongue

Clinical Anatomy

- Injury to the Hypoglossal Nerve:** This occurs when there is trauma like fractured mandible injure hypoglossal nerve. This causes paralysis or atrophy of one side of tongue. Tongue deviates to paralyzed side during protrusion due to action of unaffected genioglossus muscles.
- 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 tumour in the anterior part usually does not metastasize to the inferior deep cervical lymph nodes until late in disease. Metastases from the tongue may be widely distributed through the submental, and submandibular regions and along the internal jugular veins in the neck.
- Sublingual Absorption of Drugs:** for quick absorption, pill or spray is put under the tongue where it dissolves and enter the lingual veins (nitroglycerin in angina pectoris).
- In grand mal epilepsy, the tongue is commonly bitten by the front incisors during the attack.
- The undersurface of the tongue is a good site observation of jaundice.

2. AIR SINUSES

Introduction

The large facial bones that surround the nasal cavity; the frontal bone, the maxilla, the sphenoid, and ethmoid bones are hollow to a greater extent. In a healthy human, these hollow spaces are air-filled. They are called air sinuses or

paranasal sinuses. The paranasal sinuses all communicate with the nasal cavity. They function in 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.

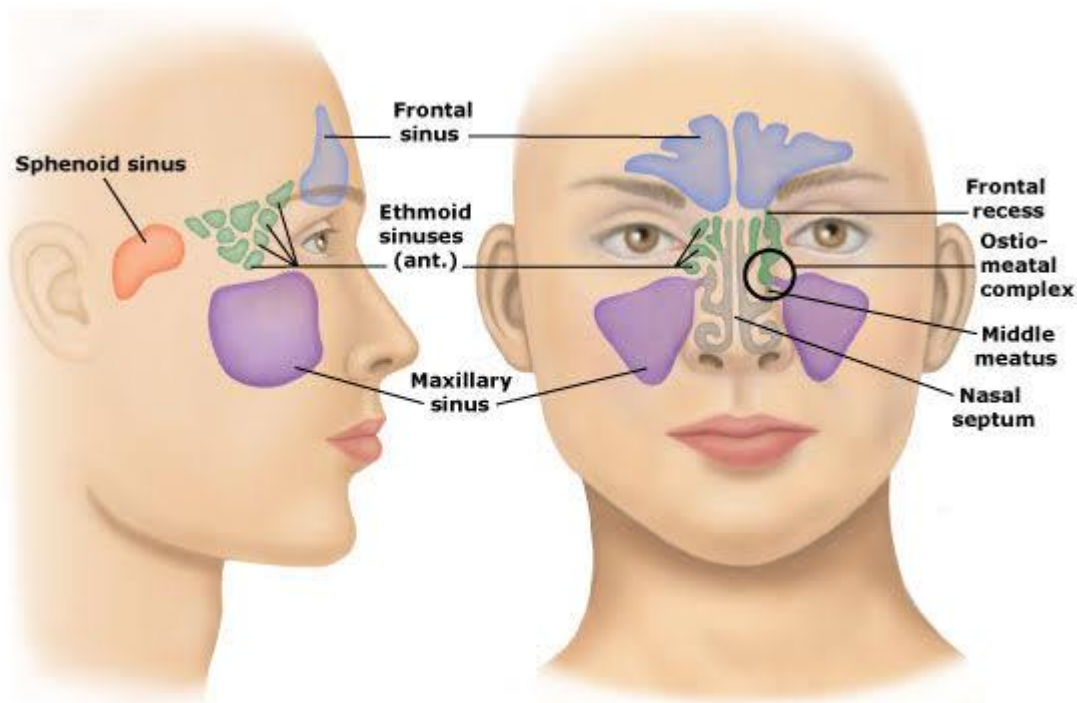


Fig 7. Diagram Showing the Paranasal Sinuses

Structure of the Air Sinuses

- **The Maxillary Sinuses:** They are the largest of the paranasal sinuses, are under the eyes, in the maxillary bones (open in the back of the semilunar hiatus of the nose). They have thin walls which are 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 limited by the cheekbones. The submandibular lymph nodes are the main destination during lymphatic drainage. It receives arterial supply from anterior superior alveolar artery, middle superior artery, posterior superior alveolar artery. They are innervated by the trigeminal nerve (CN Vb).
- **The Frontal Sinuses:** They are located superior to the eyes, in the frontal bone. The pair of sinuses are irregular in shape. The frontal sinuses are contained 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.

They drain primarily into the ethmoidal infundibulum and the corresponding lymph drainage occurs via the submandibular lymph nodes. They are also innervated by the trigeminal nerve (CN Va).

- The Ethmoid sinuses: 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. Superior to the ethmoid sinus is the anterior cranial fossa and the frontal bone, laterally the orbit can be found, while the nasal cavity is situated medially. 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 blood supply for this region. They are innervated by the ethmoidal nerves, which branch from the nasociliary nerve of the trigeminal nerve (CN Va)
- The sphenoidal sinuses: It is in the sphenoid bone. It is the most posterior of the sinuses. The anterior wall separates this pair of sinuses from the nasal cavity, as does the hypophyseal fossa, pituitary gland and the optic chiasm superiorly and the nasopharynx and pterygoid canal inferiorly. It receives arterial supply from the posterior ethmoidal artery and the posterior lateral nasal branches. The anterior and middle ethmoid sinuses send their lymphatic drainage to the submandibular lymph nodes They are innervated by the trigeminal nerve (CN Va and Vb). They are located behind the eyes.

The paranasal air sinuses are lined with respiratory epithelium (ciliated pseudostratified columnar epithelium).

Clinical Significance

- Inflammation

The paranasal sinuses are joined to the nasal cavity via small orifices called ostia. These become blocked easily by allergic inflammation, or by swelling in the nasal lining that occurs with a cold. If this happens, normal drainage of mucus within the sinuses is disrupted, and **sinusitis** may occur. Other clinical problems can include secondary sinusitis, the inflammation of the sinuses from another source such as an infection of the adjacent teeth. These conditions may be treated with drugs such as decongestants, which cause

vasoconstriction in the sinuses; reducing inflammation; by traditional techniques of nasal irrigation; or by corticosteroid.

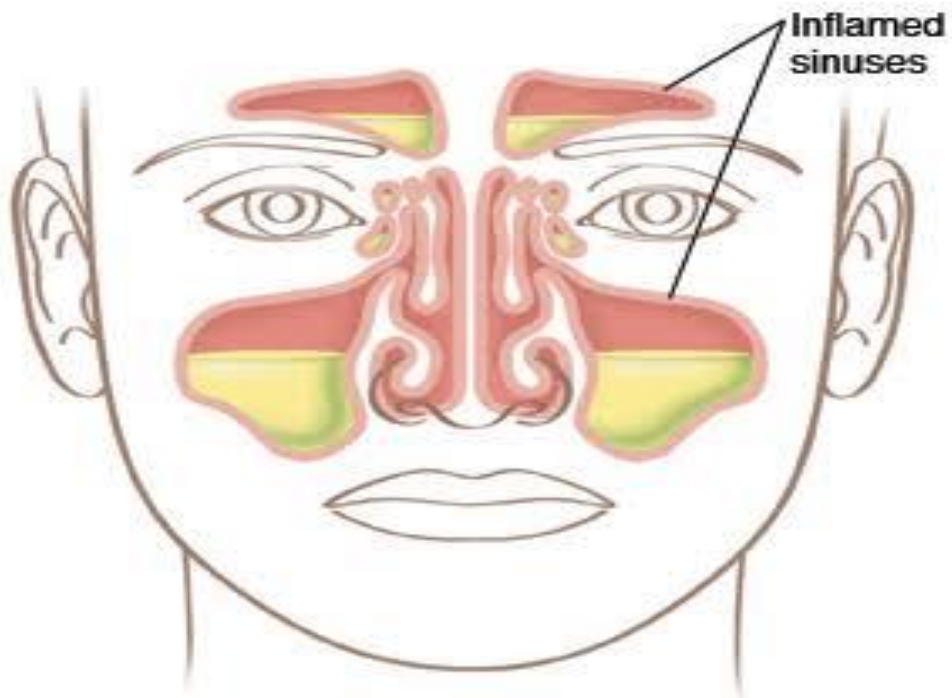


Fig 7. Diagram Showing Inflamed Sinuses