

Anatomy

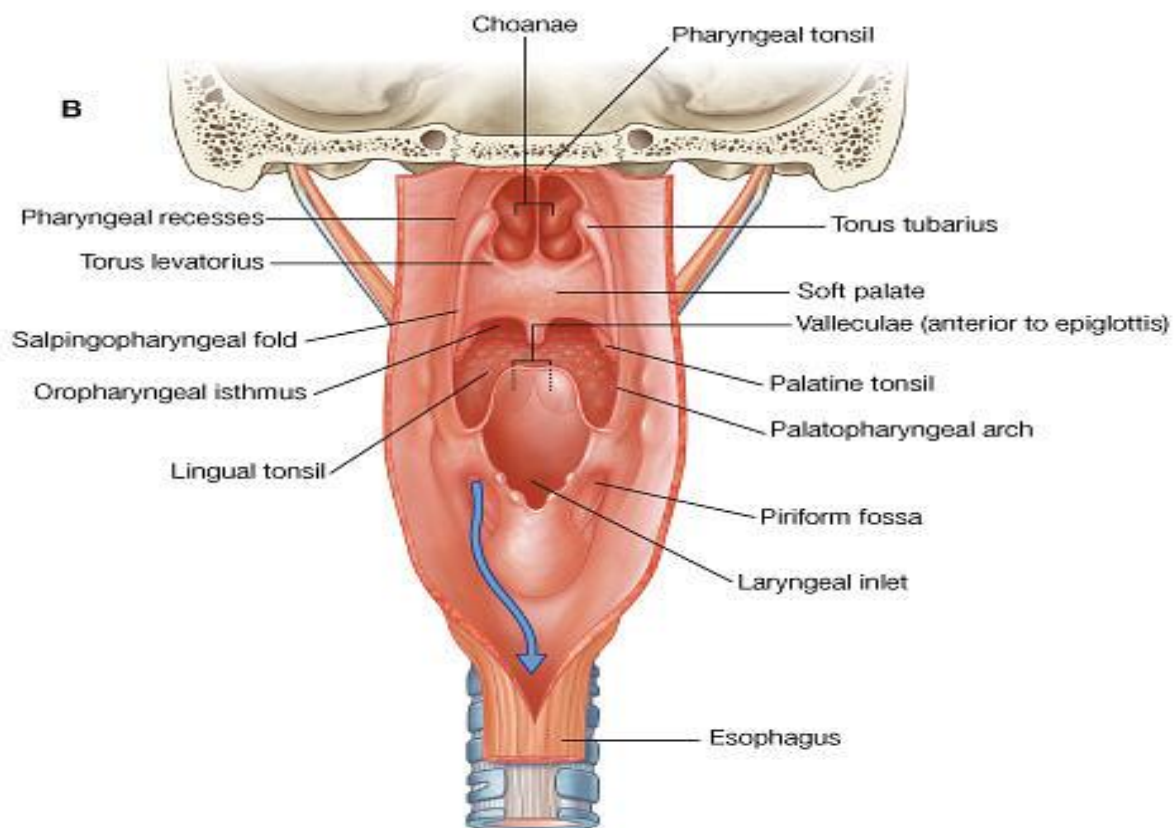
Pharynx

It is wide muscular tube [12 cm long], extends from the base of the skull to the level of the body of sixth cervical vertebra where it continuous with esophagus.

It divides into three parts according to its position:

1. Nasal part [posterior to the nasal cavity]
2. Oral part [posterior to the oral cavity]
3. Laryngeal part [posterior to the larynx]

It conducts the air to and from larynx and foods to the esophagus. It is widest at base of skull, and then it narrows rapidly at level of palate [pharyngeal isthmus] but widens again in the oral and laryngeal parts and then rapidly narrows to the esophagus.



Position and the relation

Posteriorly: pharyngeal venous plexus and layer of loose areolar tissue separates it from the prevertebral fascia.

Laterally: neurovascular bundles of the neck.

Anteriorly: it deficient anteriorly and is replaced by the posterior nasal apertures, the oropharyngeal isthmus [opening into the mouth] and the laryngeal inlet.

Superiorly: the base of the skull, including the body of the sphenoid, basilar part of the occipital bone.

Inferiorly: it is continuous with the esophagus

The pharyngeal wall

It consists of five layers

1. Mucous membrane
2. Submucosa
3. Pharyngobasilar fascia: it lines the internal surfaces of the pharyngeal muscles and fills the gap in the pharyngeal wall above the superior margin of superior constrictor muscle. It attaches the pharynx to the:
 - base of the skull
 - the auditory tube
 - lateral margins of posterior nasal openings
4. Pharyngeal muscles
5. Buccopharyngeal fascia: it covers the external surfaces of the buccinator and the pharyngeal muscles.

Pharyngeal muscles: they consist of

1. Outer muscles [its fibers run in circular direction]: include the superior constrictor, middle constrictor and inferior constrictor.
2. Inner muscles [its fibers run in longitudinal direction]: include the stylopharyngeus muscle, salpingopharyngeus muscle and the palatopharyngeus muscle.

The constrictor muscles

They are three muscles that form curved sheets, lie in the posterior wall and sides of the pharynx and overlap each other. They are inserted into median fibrous raphe which extends from the base of the skull to the esophagus. It supplied by the pharyngeal plexus with additional supply to the inferior constrictor from the external and recurrent laryngeal nerves. The action of these muscles is propelling the bolus of food downward. In addition, the superior constrictor narrows the pharyngeal isthmus.

1. the superior constrictor:

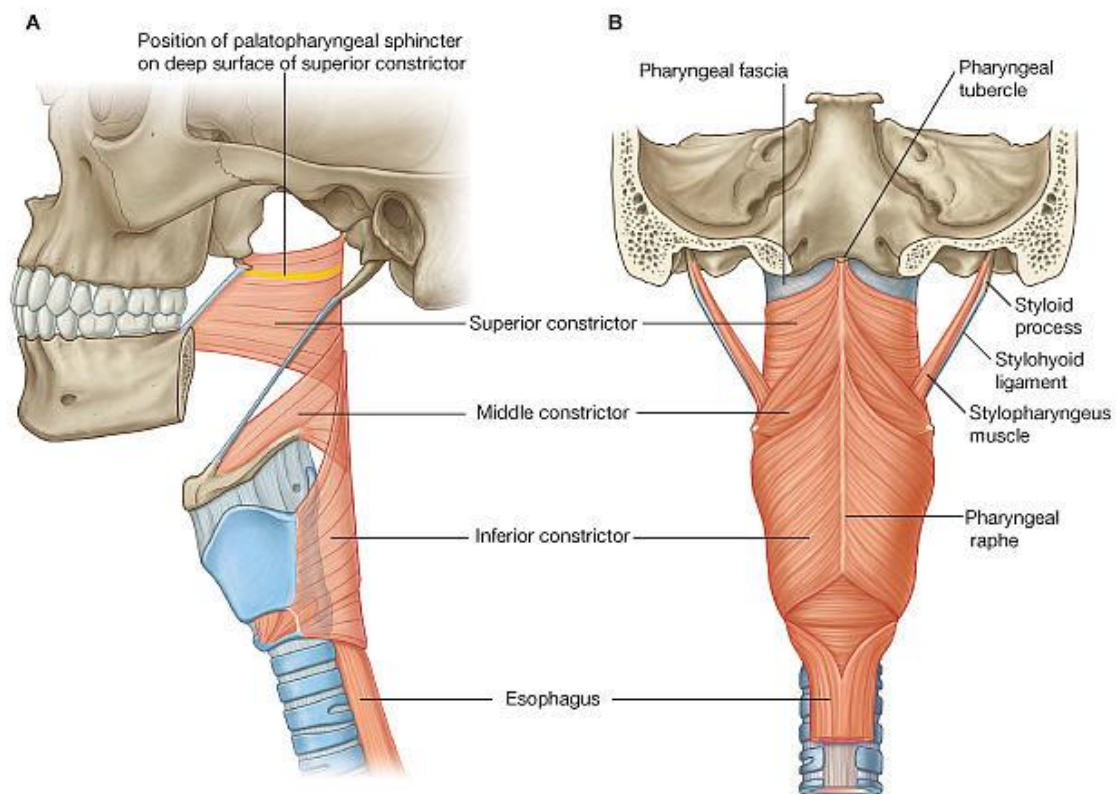
It lies in the wall of the oral and nasal parts

Origin: it arises from

- posterior border of the medial pterygoid plate
- pterygoid hamulus
- pterygomandibular raphe [interlacing tendinous fibers of the superior constrictor and the buccinator muscles]
- the mandible [from the posterior end of the mylohyoid line]

Insertion:

- The upper fibers are curved upwards to the pharyngeal tubercle [small prominence on the undersurface of the basilar part of the occipital bone] , leaving a gap between it and the skull. This gap is filled by the pharyngobasilar fascia and by the levator palati and tensor palati with auditory tube between them. The levator palati and the auditory tube enter the pharynx above the superior margin of the superior constrictor together with the ascending palatine artery; while the tensor palati passes external to the upper part of the superior constrictor
- the middle fibers are inserted into the median fibrous raphe
- The inferior fibers passes downward to be inserted into median fibrous raphe .it is overlapped by the middle constrictor. the stylopharyngeus muscle and the glossopharyngeal nerve enter the pharynx between them.

**2. The middle constrictor:** fan shaped muscleOrigin:

Lesser and greater horns of the hyoid bone and from the stylohyoid ligament.

Insertion:

Its fibers fan out into the pharyngeal wall to be inserted into the median fibrous raphe.

- the upper fibers run upward and overlap the superior constrictor

- the middle fibers run horizontally
- The lower fibers run downward and overlapped by the inferior constrictor, but are separated from it laterally by an interval through which the internal laryngeal nerve and the superior laryngeal artery pass to pierce the thyrohyoid membrane and enter the pharynx.

3. The inferior constrictor muscle:

Origin:

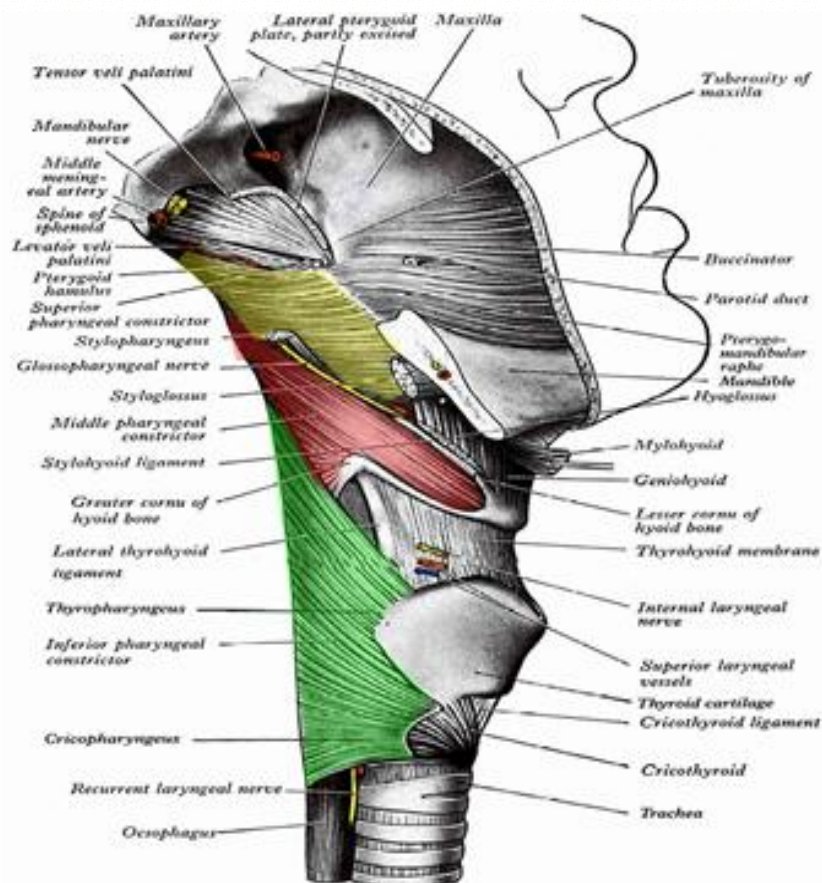
It arises from

- Side of the cricoid cartilage.
- Oblique line of the thyroid cartilage.
- Fascia covering the cricothyroid muscle.

Insertion:

It is inserted into the median fibrous raphe.

- The upper fibers run upward obliquely and overlap the middle constrictor
- The lower fibers run horizontally and overlap the beginning of the esophagus. The recurrent laryngeal nerve and the inferior laryngeal artery passing between them to enter the larynx.



Longitudinal muscles of the pharynx

1. The stylopharyngeus muscle

Origin:

Styloid process

Insertion:

The muscle runs anteroinferiorly [with the glossopharyngeal nerve] between the internal and external carotid artery and enters the pharynx between the superior and middle constrictor muscles. Part of it joins the palatopharyngeus muscle and part of it is inserted into the lateral aspect of the epiglottis.

Nerve supply:

The glossopharyngeal nerve

Action:

It elevates the larynx and pulls the base of epiglottis upwards and backwards during the swallowing

2. Salpingopharyngeus muscle

Origin:

Inferior border of the cartilaginous part of the auditory tube

Insertion:

It descends in the salpingopharyngeal fold to join the palatopharyngeus muscle.

Nerve supply:

Pharyngeal plexus

Action:

It elevates the pharynx

3. Palatopharyngeus muscle

Origin:

It arises from posterior margin of the hard palate and the superior surface of the soft palate.

Insertion:

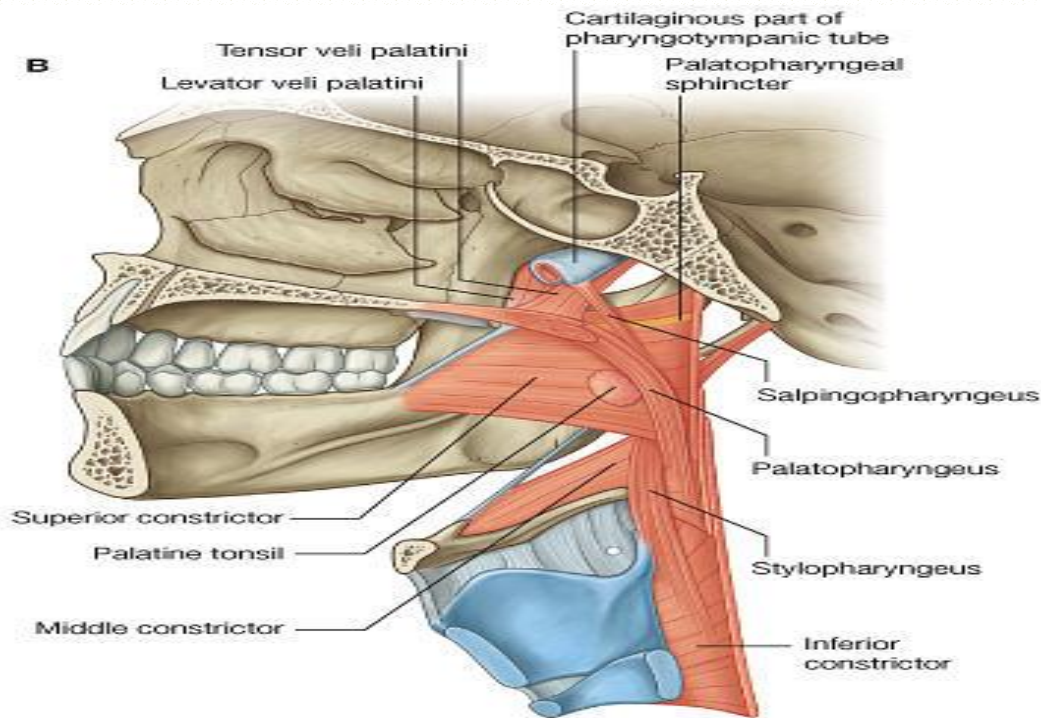
It passes backwards and downwards beneath the mucous membrane of the pharynx [in palatopharyngeal fold] to be inserted into the posterior border of the lamina of the thyroid cartilage. It is joined, superiorly the salpingopharyngeus muscle, and inferiorly by the stylopharyngeus muscle. Few of its fibers run horizontally to surround the pharyngeal isthmus (palatopharyngeal isthmus).

Nerve supply:

Pharyngeal plexus

Action:

- Elevates the pharynx
- Narrows the pharyngeal isthmus [the horizontal fibers].



Interior of the pharynx

The pharynx is lined with the mucous membrane. the submucosa contains numerous mucous glands [pharyngeal glands]and nodules of lymph tissue. Aggregations of these nodules form:

- Pharyngeal tonsil
- Palatine tonsils
- Tubal tonsil
- Lingual tonsil

The cavity of the pharynx is divides into three parts

1. Nasal part of the pharynx [nasopharynx]:

It lies behind the nasal cavities above the soft palate and is continuous inferiorly with the oral part through narrow pharyngeal isthmus.

The walls of the nasal part:

Roof: it is formed by the body of the sphenoid and the basilar part of the occipital bone. The pharyngeal tonsil is present in the submucosa of this part [mainly in its junction with the posterior wall].

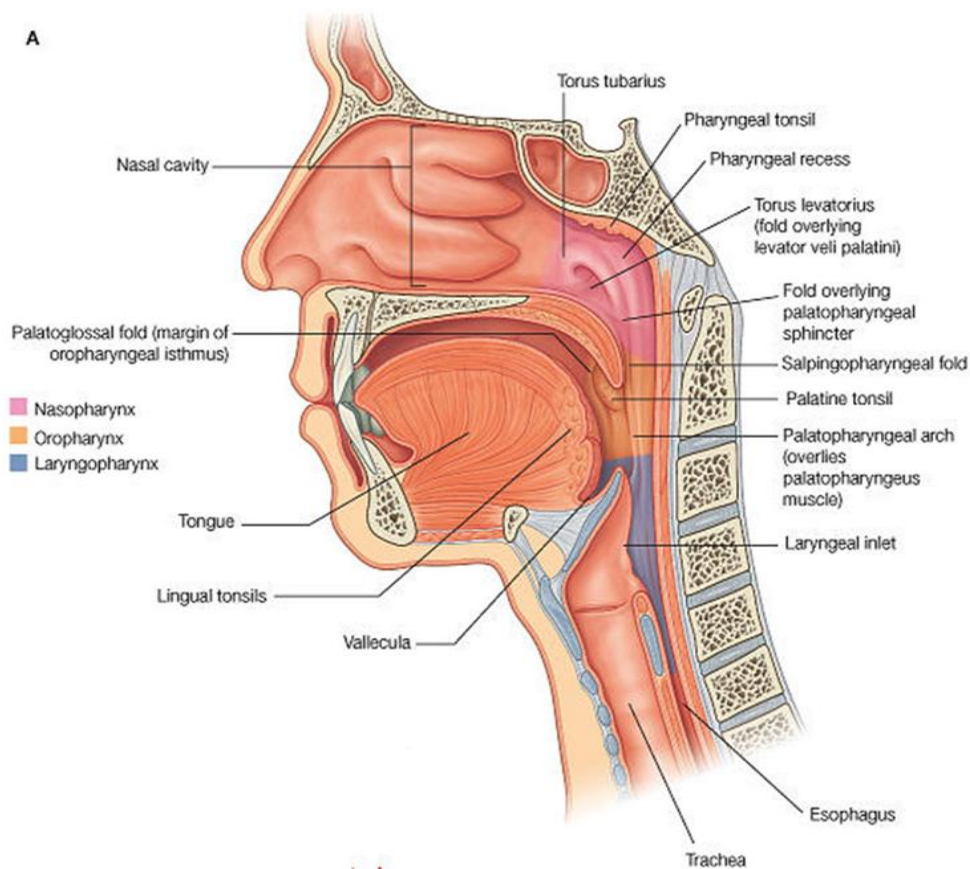
Floor: sloping upper surface of the soft palate and the pharyngeal isthmus.

Posterior wall: forms continuous sloping surface with roof and is supported by the anterior arch of atlas [C1vertebra].

Anterior wall: is formed by posterior nasal apertures [choanae].

Lateral wall: it contains the following:

- The pharyngeal opening of the auditory tube. this opening is bounded superiorly and posteriorly by a firm, round tubal ridge around it lies the tubal tonsil.
- Salpingopharyngeal fold: it is a ridge of mucous membrane extends from the lower part of the tubal ridge and descends vertically [this fold contains the salpingopharyngeus muscle]
- Pharyngeal recess: it is a small depression lies behind the tubal ridge.
- Levator palati fold: fold of the mucus membrane [covered the levator palati muscle] just below the tubal opening.



2. Oral part of the pharynx [oropharynx]:

It lies behind the oral cavity; posterior to the palatoglossal fold. It extends from the soft palate to the upper border of the epiglottis.

The walls of the oral part:

Roof: formed by the under surface of the soft palate and the pharyngeal isthmus.

Floor: formed by the posterior third of the tongue and the interval between the tongue and the anterior surface of the epiglottis. The posterior third of the tongue, has irregular appearance because of the presence of the lingual tonsil, and is connected to the epiglottis by two laterals and one median glossoepiglottic folds. There is a small depression on each side of median glossoepiglottic fold called the valleculae.

Anterior wall: oropharyngeal isthmus of the mouth.

Posterior wall: is supported by the body of the second and third cervical vertebrae.

Lateral wall: lies on each side, and have the palatoglossal arch and the palatopharyngeal arch with the palatine tonsils between them [in the tonsillar sinus].

The palatoglossal arch is a fold of mucous membrane covering the underlying palatoglossus muscle.

The palatopharyngeal arch is a fold of mucous membrane covering the underlying palatopharyngeus muscle.

Palatine tonsils

Are two masses of the lymphoid tissue [almond-shaped], located in the lateral wall of the oral part of the pharynx in the tonsillar sinuses. Its medial surface is covered by mucous membrane with 12-15 crypts [the largest crypt is the intratonsillar cleft], and it projects into the cavity of the oropharynx. The lateral surface is covered by a layer of the fibrous tissue called the capsule.

Relation of the palatine tonsils:

Anteriorly: palatoglossal arch

Posteriorly: palatopharyngeal arch

Superiorly: the soft palate

Inferiorly: posterior third of the tongue

Medially: the cavity of the oropharynx

Laterally: the capsule is separated from the superior constrictor by loose areolar tissue and the pharyngobasilar fascia. The external palatine vein descends from the soft palate in this loose tissue to join the pharyngeal venous plexus. Lateral to the superior constrictor lies the loop of the facial artery. The internal carotid artery lies 2.5 cm posterolateral to the tonsil.

Blood supply of the palatine tonsils:

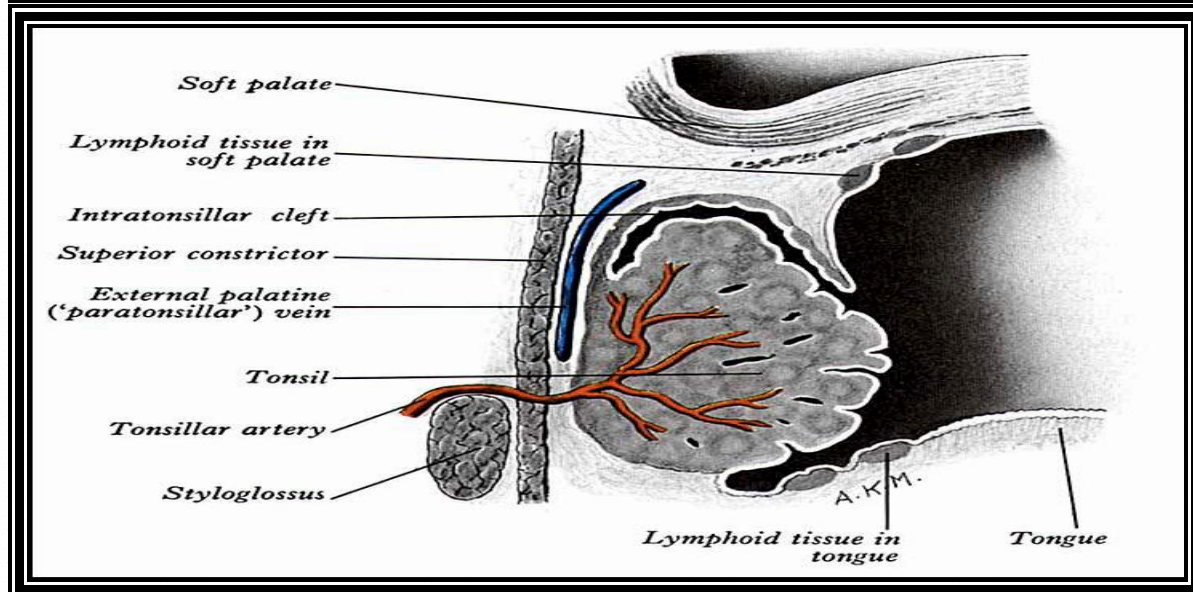
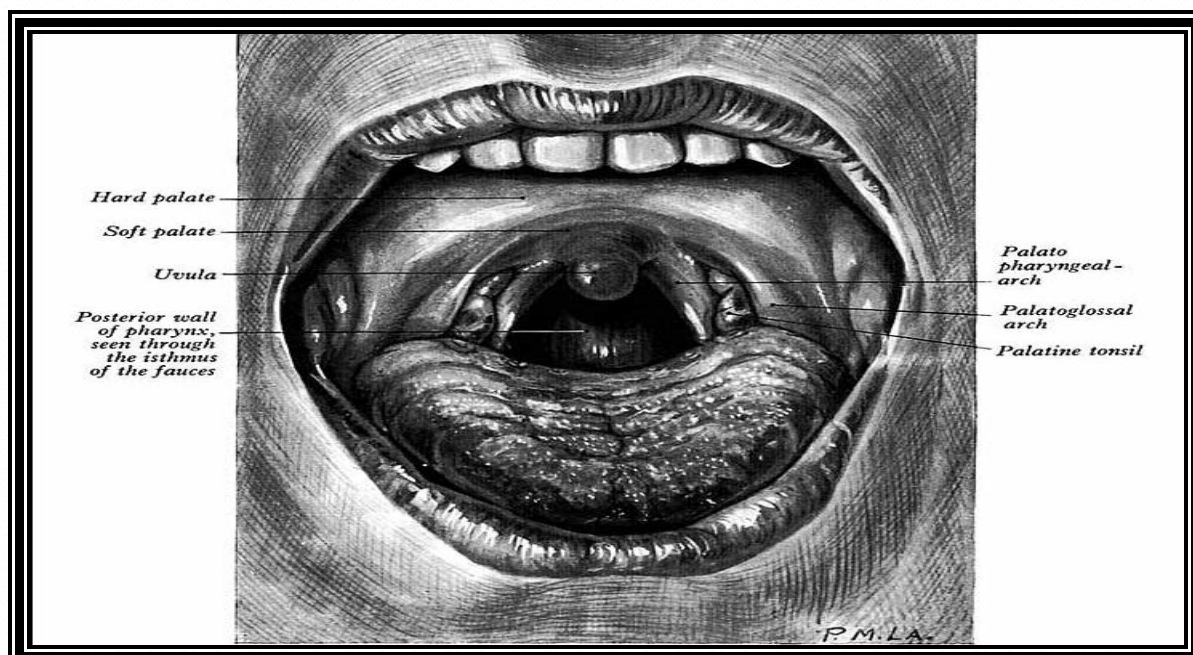
1. Tonsillar branch of the facial artery.
2. Ascending palatine artery of the facial artery.
3. Dorsal lingual artery of the lingual artery.
4. Ascending pharyngeal artery of the external carotid artery.
5. Greater palatine artery of the maxillary artery.

Venous drainage

One or more of tonsillar veins leaves the lower part of the tonsil; to join the external palatine vein which descends from the soft palate, lateral to the capsule .then it pierces the superior constrictor to join the pharyngeal venous plexus or the facial vein.

Nerve supply of the palatine tonsils

Glossopharyngeal nerve and lesser palatine nerve.



3. Laryngeal part of the pharynx [laryngopharynx]:

It lies behind the inlet of the larynx and the posterior surface of the larynx. It extends from the upper border of the epiglottis to the lower border of the cricoid cartilage.

The walls of the laryngeal part of the pharynx

Anterior wall:

- inlet of the larynx
- mucous membrane covering the posterior surface of the cricoid and arytenoid cartilages.

Posterior wall:

- Supported by the bodies of the third, fourth, fifth and sixth cervical vertebrae.

Lateral wall:

- It is supported by the thyroid cartilage and the thyrohyoid membrane.
- Piriform recess: deep gutter fossa separates the lateral wall of the laryngeal inlet [the aryepiglottic fold] from the posterior part of the lamina of the thyroid cartilage and the thyrohyoid membrane. it is lined by the mucous membrane and ends inferiorly as blind pocket.

Inlet of the larynx

It is large vertical opening bounded by

Anterosuperiorly: epiglottis.

Posteroinferiorly: apex of the arytenoid and the interarytenoid fold of the mucous membrane.

Laterally: aryepiglottic fold. It is thin deep fold extends from the margins of epiglottis to the arytenoid cartilage. It contains the aryepiglottic ligament, the aryepiglottic muscle and near its inferior end, two small pieces of the cartilages [corniculate and cuneiform cartilages].

Nerve supply of the pharynx

Motor nerves: the pharyngeal plexus to the all muscles of the pharynx [except the stylopharyngeus muscle by the glossopharyngeal nerve].

Sensory nerves:

Nasopharynx by the pharyngeal branch of the pterygopalatine ganglion

Oropharynx by the glossopharyngeal nerve

Laryngopharynx by the internal laryngeal nerve.

Pharyngeal venous plexus: it is a venous plexus lies on the posterior wall and border of the pharynx. It receives blood from the pharynx and the soft palate. Two or more veins drain into internal jugular vein. It communicates with cavernous sinus and the pterygoid venous plexus

Auditory tube

[The Eustachian tube or the pharyngotympanic tube]

1. It is a tube that connects the nasopharynx with the middle air cavity
2. About 4 cm long and is directed forwards, downwards and medially.
3. It has two parts:
 - bony posterolateral part [1.5 cm long]: it lies between the tympanic and petrous part of the temporal bone and opens into the middle air cavity
 - Cartilaginous anteromedial part [2.5 cm]: it lies between the apex of the petrous bone and the posterior border of the greater wing of the sphenoid. Most of this part is surrounded by the tensor palati and levator palati muscles.
4. The cartilaginous part and levator palate enter the pharynx above the superior margin of the superior constrictor.
5. The lumen of the tube is narrowest at the junction of the two parts [called the isthmus]
6. The tube equalizes the pressure in the middle ear with atmosphere to permit free movement of the tympanic membrane
7. It forms a route of infection from the pharynx to the middle ear
8. The salpingopharyngeal muscle, tensor palati and the levator palati are attached to its walls
9. Blood supply: artery of the pterygoid canal and the ascending pharyngeal artery
10. Nerve supply: pharyngeal branch of the pterygopalatine ganglion [to the cartilaginous part] and the tympanic plexus [to the bony part]

Adenoiditis

Inflammation of the pharyngeal tonsils (adenoids) is called *adenoiditis*, which can obstruct the passage of air from the nasal cavities through the choanae into the nasopharynx, making mouth breathing necessary. Infection from the enlarged pharyngeal tonsils may spread to the tubal tonsils, causing swelling and closure of the pharyngotympanic tubes. Impairment of hearing may result from nasal obstruction and blockage of the pharyngotympanic tubes. Infection spreading from the nasopharynx to the middle ear causes *otitis media* (middle ear infection), which may produce temporary or permanent hearing loss. Sometimes the palatine and pharyngeal tonsils are removed during the same operation.

Tonsillectomy: The palatine tonsils are a common site of infection, producing the characteristic sore throat and pyrexia.

Tonsillectomy (removal of the tonsils) is performed by dissecting the palatine tonsil from the tonsillar bed. Because of the rich blood supply of the tonsil, bleeding commonly arises from the large *external palatine vein* or, less commonly, from the tonsillar artery or other arterial twigs. The glossopharyngeal nerve (CN IX) accompanies the tonsillar artery on the lateral wall of the pharynx. Because this wall is thin, the nerve is vulnerable to injury. The internal carotid artery is especially vulnerable when it is tortuous and lies directly lateral to the tonsil.