



GI ANATOMY

Sheet no. 3



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2020
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(muscular tube extends from the base

The pharynx

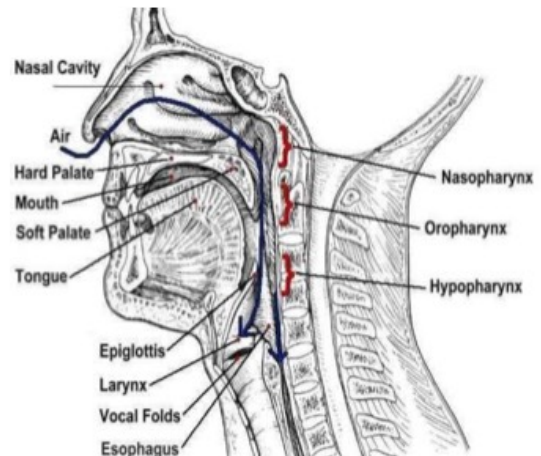
of skull and ends on the lower border of pterygoid cartilage C6)

- Muscular tube (5 inches long) with musculo-membranous wall which is *deficient* anteriorly. (open anteriorly). It's situated behind the nasal cavities, the mouth, and the larynx and may be divided into: nasal, oral, and laryngeal parts:

→ At the sides and posteriorly, it has a wall made of constrictor muscles with the inner surface of the wall made up of mucus membrane (musculo-membranous wall)

→ Anteriorly its open and is replaced by:

- ☆ the posterior openings into the nose (choanae) *into the nasopharynx*
- ☆ the opening into the mouth (Oropharyngeal isthmus) *into the oropharynx*
- ☆ the inlet of the larynx *into the laryngopharynx (hypopharynx)*



- The pharynx is funnel shaped, its upper **wider** end lying under the skull and its lower **narrow** end becoming **continuous with the esophagus** opposite the sixth cervical vertebra
- Difference between esophagus and pharynx Esophagus: a fingerlike structure, muscular tube
- By means of the auditory tube, the mucous membrane is also continuous with that of the tympanic cavity.
- Lined by mucosa interiorly: non-keratinized stratified squamous epithelium (like esophagus), then we find muscular layer (constrictor muscles), and externally it is surrounded by connective tissue which covers the wall of the pharynx and esophagus

Pharynx is a muscular tube that is open anteriorly into 3 openings:

- 1) nasal cavity thus the name nasopharynx
- 2) oral cavity thus the name oropharynx
- 3) opening of the larynx thus the name laryngopharynx

- The pharynx is funnel shaped, which means it is wide upwards and narrow downwards.
- Begins at: Base of skull Ends at: 6th cervical vertebra and continues as the esophagus.
- The pharynx is also C-shaped, open anteriorly but closed on the sides and posteriorly.

On the inside, it is covered with mucosa (stratified squamous non-keratinized) just like the mucosa covering the esophagus. Then areolar connective tissue, muscular layer, connective tissue. Thereby, we describe the pharynx and its wall musculo-membranous.

so in order: mucosa (stratified squamous non-keratinized) -> areolar connective tissue -> muscular layer -> connective tissue.

Muscles of the Pharynx

- The muscles in the wall of the pharynx consist of the superior, middle, and inferior constrictor horizontal fibers all of them

are horizontal or oblique but the most horizontal one is the cricopharyngeus (because it lies above the esophagus, always contraction to prevent the air from entering the stomach)

- whose fibers run in a somewhat circular direction, and the stylopharyngeus and salpingopharyngeus muscles, whose fibers run more obliquely in a somewhat longitudinal direction

- The three constrictor muscles extend around the pharyngeal wall to be inserted into a fibrous band or raphe that extends from the pharyngeal tubercle in front of the foramen magnum on the basilar part

of the occipital bone of the skull down to the esophagu

- The three constrictor muscles overlap each other so that the middle constrictor lies on the outside of the lower part of the superior constrictor and the inferior constrictor lies outside the lower part of the middle constrictor

There are three constrictor muscles whose fibers are circular:

- 1) superior constrictor of the pharynx
- 2) middle constrictor of the pharynx
- 3) inferior constrictor of the pharynx

- These three muscles overlap each other. (middle constrictor of the pharynx the superior, and the inferior the middle)

مثل الطبقات :

Out side

Out side

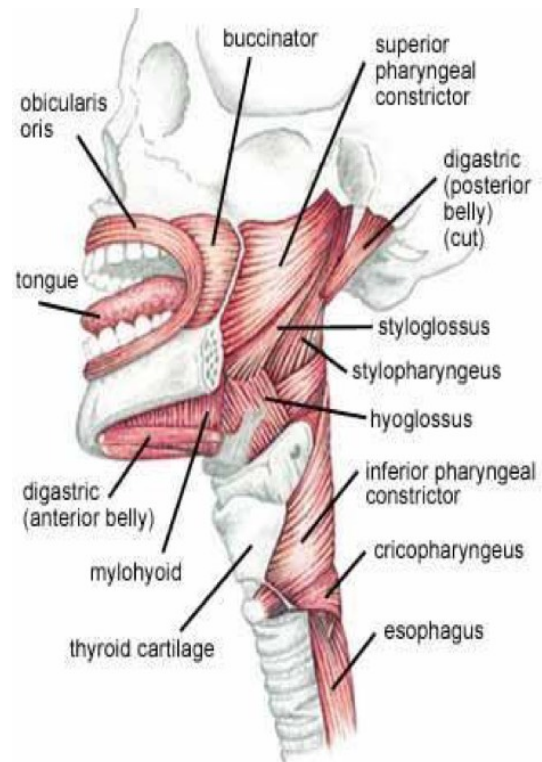
- There are other muscles whose fibers lie obliquely, like the salpingopharyngeus and stylopharyngeus

- However, the main muscles of the pharynx (its wall) are the three muscles mentioned above (superior, middle, inferior constrictor muscles of the pharynx).

- All the constrictor muscles insert into the pharyngeal raphe (fibrous tissue) found on the mid posterior part which starts from the pharyngeal tubercle that is in front of the foramen magnum and near the midline.

The lower part of the inferior constrictor, which arises from the cricoid cartilage, is called the cricopharyngeus muscle

- The fibers of the cricopharyngeus pass horizontally around the lowest and narrowest part of the pharynx and act as a sphincter (always contracting)



Concerning the inferior constrictor of the pharynx:

- The inferior constrictor muscle is made of two parts, where the lower part is called the cricopharyngeus muscle.

Origin: cricoid cartilage Insertion: pharyngeal raphe in the pharynx.

Direction of fibers: Horizontally Function: always works as a sphincter (to constrict the lower portion of the pharynx, preventing passage of air so it is always closed).

This means that it is always contracting (closed) unless (1) a bolus reaches it, stimulates it, causes it to relax and open O R (2) when vomiting, the intra-abdominal pressure causes it to open.

- Thereby, we conclude that its main function is to prevent air passage because the air is supposed to reach the inlet of the larynx -> trachea.

- However, some air can still enter despite the presence of the cricopharyngeus to the pharynx -> esophagus -> stomach -> goes upwards to the upper portion of the stomach called Fundus.

- Dr mentioned the presence of gas in the fundus of the stomach displayed as black dots in X -ray imaging of the abdomen (I added an image to further clarify for you).



Killian's dehiscence is the area on the posterior pharyngeal wall between the upper propulsive part of the inferior constrictor and the lower sphincteric part, the cricopharyngeus.

Concerning Killian's dehiscence:

- It is a small area that lies above the cricopharyngeus muscle.
- It is very sensitive, so any stimulation causes the muscles to contract -> make us cough/vomit.

You need to know the origin, insertion, nerve supply and action of each muscle.

- The insertion for all the constrictor muscles is raphe.
- You can tell the origin of each muscle from its name.
- Nerve supply: all of them are supplied by the pharyngeal plexus except one.

Reminder: pharyngeal plexus is made of 3 nerves (vagus, accessory and glossopharyngeal nerves) on the posterior wall of the pharynx

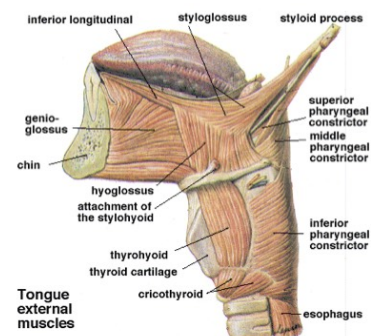
- Action: peristaltic contraction helping in the peristaltic movements and thereby helping the bolus to descend downwards to the esophagus.

- Superior constrictor

- O: Medial pterygoid plate, pterygoid hamulus, pterygomandibular ligament, mylohyoid line of mandible

- Ins: Pharyngeal tubercle of occipital bone, raphe in midline posteriorly

- Innerv: Pharyngeal plexus Aids soft palate in closing off nasal pharynx, propels bolus downward



- Middle constrictor

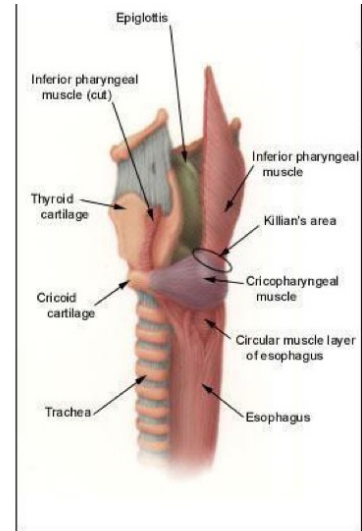
- O : Lower part of stylohyoid ligament, lesser and greater cornu of hyoid bone

- Ins: Pharyngeal raphe

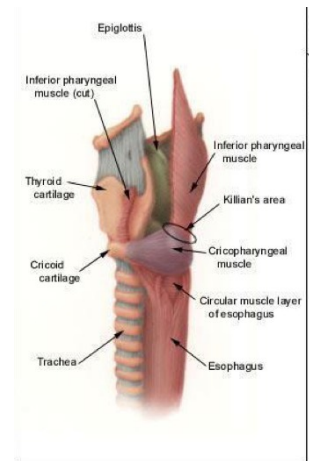
- Innerv: Pharyngeal plexus

- Action: Propels bolus downward

- Inferior constrictor
- O: Lamina of thyroid cartilage, cricoid cartilage
- Ins: Pharyngeal raphe
- Innerv: Pharyngeal plexus
- Action: Propels bolus downward



- Cricopharyngeus
- Lowest fibers of inferior constrictor muscle
- Sphincter at lower end of pharynx
- Stylopharyngeus
- Styloid process of temporal bone
- Posterior border of thyroid cartilage
- Glossopharyngeal nerve the only muscle that is innervated by this nerve
- Elevates larynx during swallowing



* Salpingopharyngeus: found in the lateral wall of nasopharynx

- Auditory tube
- Blends with palatopharyngeus
- Innervation: Pharyngeal plexus
- Function: Elevates pharynx

* Palatopharyngeus

- Palatine aponeurosis
- Posterior border of thyroid cartilage
- Innervation: Pharyngeal plexus

Palatopharyngeal fold (Post. Palatine tonsils)

- Function: Elevates wall of pharynx, pulls palatopharyngeal arch medially

During deglutition (swallowing), the larynx is closed to prevent entry of air or food to larynx, entry can cause coughing. Closure by descent of the epiglottis (keeps larynx open during breathing, closed on deglutition), the descent of epiglottis induced by pressure from the bolus, in concurrence, the elevation of the wall of the pharynx (palatopharyngeus func.) ensures food enters the esophagus.

Closure of the inlet of the larynx by: 1. Epiglottis.

2. Movement of larynx+pharynx upwards.

Interior of the Pharynx coronal section Posteriorly

- The pharynx (function: passage of air(enters

from the choanae to inlet and then from the larynx to trachea, bronchi, and fills the lungs))

is divided into three parts: the nasal pharynx, the oral pharynx, and the laryngeal pharynx.

- Nasal Pharynx (Choanae)
- This lies above the soft palate and behind the nasal cavities
- In the submucosa of the roof is a collection of lymphoid tissue called the pharyngeal tonsil

The pharyngeal isthmus (function is

swallowing the bolus so it moves to the pharynx (laryngopharynx) the inlet must be closed (1. bolus itself will push the epiglottitis downwards and backwards, larynx

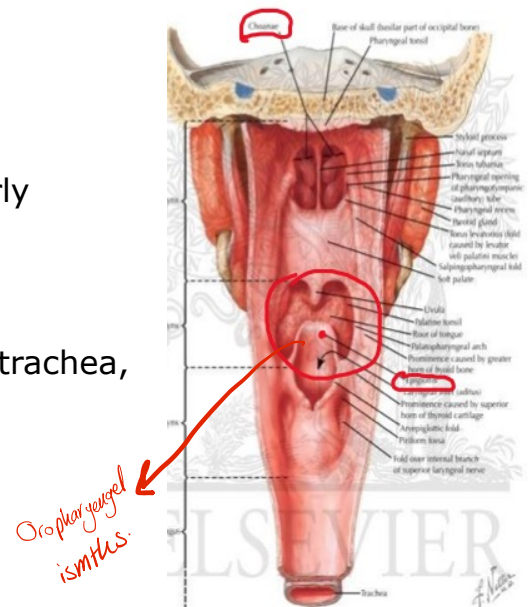
is the opening in the floor between the soft palate and the posterior pharyngeal wall

through the laryngeal muscles it will rise up)

- On the lateral wall is the opening of the auditory tube (advantage: deliver air to the middle ear and balance pressure to tympanic membrane, disadvantage it can spread infection from the nasal cavity to the middle ear and cause otitis media)

the elevated ridge of which is called the tubal elevation

- The pharyngeal recess is a depression in the pharyngeal wall behind the tubal elevation
- The salpingopharyngeal fold is a vertical fold of mucous membrane covering the salpingopharyngeus muscle



pharyngeal recess is a depression in the pharyngeal wall behind the tubal elevation ◦ The salpingopharyngeal fold is a vertical fold of mucous membrane covering the salpingopharyngeus muscle.

Muscles of the pharynx

-3 constrictors (Circular fibers)

Superior constrictor, middle constrictor, Inferior constrictor

-2 oblique/longitudinal fibers

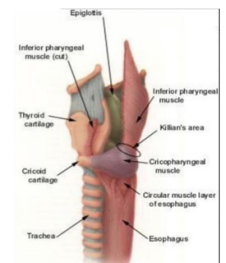
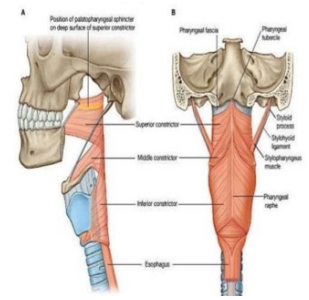
Salpingopharyngeus, Stylopharyngeus The constrictor muscles overlap each other so that the middle constrictor lies on the outside of the lower part of the superior constrictor and the inferior constrictor lies outside the lower part of the middle constrictor muscles, the 3 extend around the pharyngeal wall to be inserted into pharyngeal raphe. t Pharyngeal raphe: a fibrous band that extends from

pharyngeal tubercle which is found in the basilar part of the occipital bone in front of the foramen magnum to the level of C6 vertebra where it blends with the posterior wall of the esophagus

o The lower part of the inferior constrictor, which arises from the cricoid cartilage, is called the cricopharyngeus muscle (located above the esophagus). The fibers of the cricopharyngeus pass horizontally around the lowest and narrowest part of the pharynx and act as a sphincter, it is always contracted and only opens by the stimulation of bolus of food. v Advantage: prevents passage of air to the stomach Only little amount of air passes through and is collected in the fundus of the stomach

Killians dehiscence is a very sensitive area located in the

posterior pharyngeal wall between the upper propulsive part of the inferior constrictor and the lower sphincter part, the cricopharyngeus.



the inferior constrictor

Muscle	Origin	Insertion	Innervation	Action
Superior constrictor	Medial pterygoid plate, pterygoid hamulus, pterygomandibular ligament, mylohyoid line of mandible	Pharyngeal tubercle of occipital bone, raphe in midline posteriorly	Pharyngeal plexus	Aids soft palate in closing off nasal pharynx, propels bolus downward
Middle constrictor	Lower part of stylohyoid ligament, lesser and greater cornu of hyoid bone	Pharyngeal raphe	Pharyngeal plexus	Propels bolus downward
Inferior constrictor	Lamina of thyroid cartilage, cricoid cartilage	Pharyngeal raphe	Pharyngeal plexus	Propels bolus downward
Cricopharyngeus (lowest fibers of inferior constrictor muscle)	Sphincter at lower end of pharynx			
Stylopharyngeus	Styloid process of temporal bone	Posterior border of thyroid cartilage	Glossopharyngeal nerve	Elevates larynx & pharynx during swallowing
Salpingopharyngeus	Auditory tube	Blends with palatopharyngeus	Pharyngeal plexus	Elevates pharynx
Palatopharyngeus	Palatine aponeurosis	Posterior border of thyroid cartilage	Pharyngeal plexus	Elevates wall of pharynx, pulls palatopharyngeal arch medially

| Oral Pharynx

This lies behind the oral cavity ◊ The floor is formed by the posterior one third of the tongue and the interval between the tongue and

epiglottis ◊ In the midline is the median glossoepiglottic fold and on each side the lateral glossoepiglottic fold.

◊ The depression on each side of the median glossoepiglottic fold is called the vallecula ◊ On the lateral wall on each side are the palatoglossal and the palatopharyngeal arches or folds and the palatine tonsils between them ◊ The interval between the two palatoglossal arches is called the oropharyngeal isthmus and marks the boundary between the mouth and pharynx.

The presence of the Eustachian pharyngotympanic tube on the lateral wall may cause the spread of infection to middle ear when a child vomits in supine position. Diagnosis by observing tympanic membrane.

Pharyngeal tonsil clinically: Enlargement causes block to nasopharynx, which causes facial expression (adenoid), so starts breathing via mouth rather than nose, removal by surger

On the lateral wall on each side are the palatoglossal and the palatopharyngeal arches or folds and the palatine tonsils

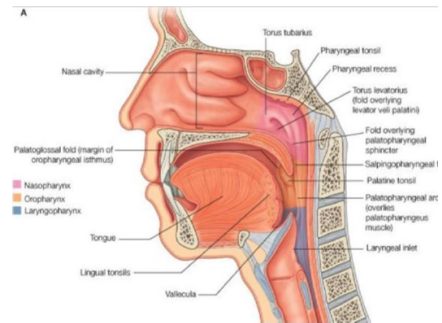
in some of the children the tonsils will grow and block the nasopharynx (adenoid, removed by surgery between them

Laryngeal Pharynx

This lies behind the opening into the larynx

- The lateral wall is formed by the thyroid cartilage and the thyrohyoid membrane
- The piriform fossa is a depression in the mucous membrane on each side of the laryngeal inlet

Piriform fossa (important) A depression, antero-lateral to laryngopharynx Foreign bodies such as fish bones are lodged into



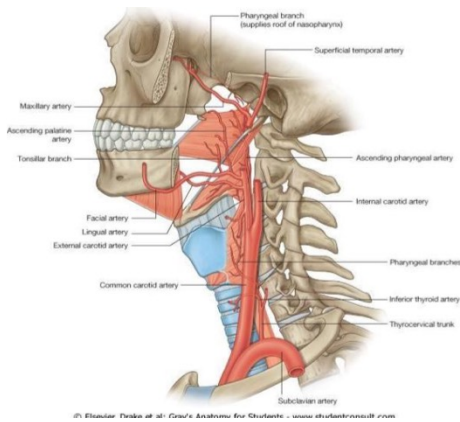
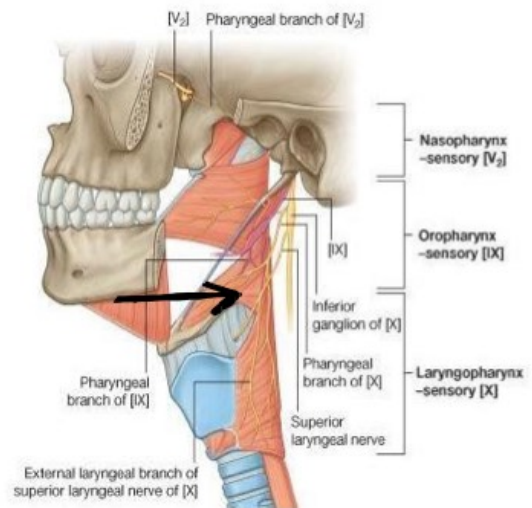
Sensory Nerve Supply of of pharynx the Pharyngeal Mucous Membrane

o Nasal pharynx: The maxillary nerve (V2)

o Oral pharynx: The glossopharyngeal nerve
o Laryngeal pharynx (around the entrance into the

larynx): The internal laryngeal branch of the vagus nerve

Note: the internal laryngeal nerve pierces the thyrohyoid membrane and passes between the middle and inferior constrictor muscles.



Important Anatomical Note: Internal Laryngeal branch of vagus between middle and inferior constrictor pharynx muscles

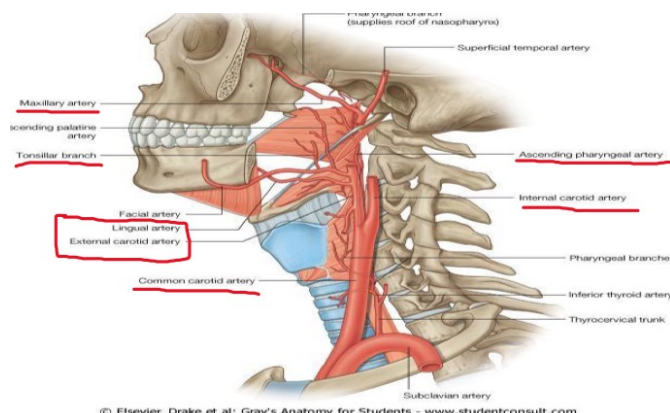
Blood Supply of the Pharynx

o Ascending pharyngeal, tonsillar branches of facial arteries, and branches of maxillary and lingual arteries (branches from external carotid artery)

o Venous drainage Veins that also drain into internal jugular vein

Lymph Drainage of the Pharynx

o Directly into the deep cervical lymph nodes or indirectly via the retropharyngeal or paratracheal nodes into the deep cervical nodes



The Process of Swallowing (Deglutition)

- Masticated food is formed into a ball or bolus on the dorsum of the tongue and voluntarily pushed upward and backward against the undersurface of the hard palate
- This is brought about by the contraction of the styloglossus muscles on both sides, which pull the root of the tongue upward and backward
- The palatoglossus muscles then squeeze the bolus backward into the pharynx.

From this point onward the process of swallowing becomes an involuntary act.

- The nasal part of the pharynx is now shut off from the oral part of the pharynx by the elevation of the soft palate
- the pulling forward of the posterior wall of the pharynx by the upper fibers of the superior constrictor muscle, and the contraction of the palatopharyngeus muscles. This prevents the passage of food and drink into the nasal cavities
- The larynx and the laryngeal part of the pharynx are pulled upward by the contraction of the stylopharyngeus, salpingopharyngeus, thyrohyoid, and palatopharyngeus muscles
- The main part of the larynx is thus elevated to the posterior surface of the epiglottis, and the entrance into the larynx is closed
- The laryngeal entrance is made smaller by the approximation of the aryepiglottic folds, and the arytenoid cartilages are pulled forward by the contraction of the aryepiglottic, oblique arytenoid, and thyroarytenoid muscles.
- The bolus moves downward over the epiglottis, the closed entrance into the larynx, and reaches the lower part of the pharynx as the result of the successive contraction of the superior, middle, and inferior constrictor muscles
- Some of the food slides down the groove on either side of the entrance into the larynx, that is, down through the piriform fossae
- Finally, the lower part of the pharyngeal wall (the cricopharyngeus muscle) relaxes and the bolus enters the esophagus.

Palatine Tonsils

The palatine tonsils are two masses of lymphoid tissue, each located in the depression on the lateral wall of the oral part of the pharynx (oropharyngeal isthmus) between the palatoglossal and palatopharyngeal arches

Important in immunity

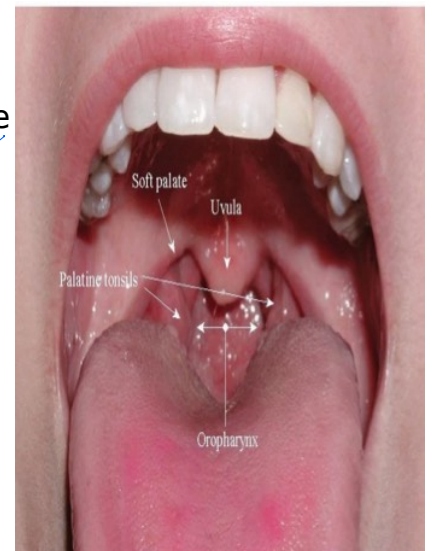
Each tonsil is covered by mucous membrane, and its free medial surface projects into the pharynx

- The surface is pitted by numerous small openings that lead into the tonsillar crypts.

The tonsil is covered on its lateral surface by a fibrous capsule
Venous drainage blood supply (tonsillar branch of facial artery)

Tonsillitis: occurs occasionally in children due to putting foreign objects inside their mouth, causing bacterial and viral infections

- Tonsillectomy: removal of the tonsils surgically
- If the infection happened more than 4 times a year, we need to remove the tonsils as a precaution to prevent streptococcus from spreading to the heart, kidney, and joints (causing rheumatoid arthritis), causing their infections



The capsule is separated from the superior constrictor muscle by loose areolar tissue

- and the external palatine vein descends from the soft palate in this tissue to join the pharyngeal venous plexus

Lateral to the superior

constrictor muscle lie the styloglossus muscle, the loop of the facial artery, and the internal carotid artery. () inside the carotid sheath

The tonsil reaches its maximum size during early childhood, but after puberty it diminishes considerably in size.

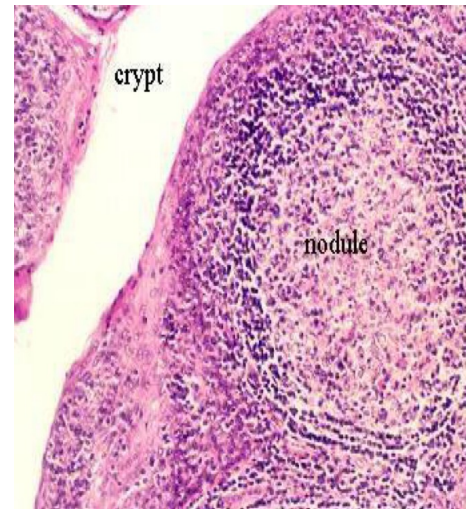
- Because there are other lymphoid tissues that take immunity function

Injury? Bleeding by vein, not artery

Blood Supply

The tonsillar branch of the facial artery. The veins pierce the superior constrictor muscle and join the external palatine, the pharyngeal, or the facial veins.

- Lymph Drainage of the Tonsil
- The upper deep cervical lymph nodes, just below and behind the angle of the mandible



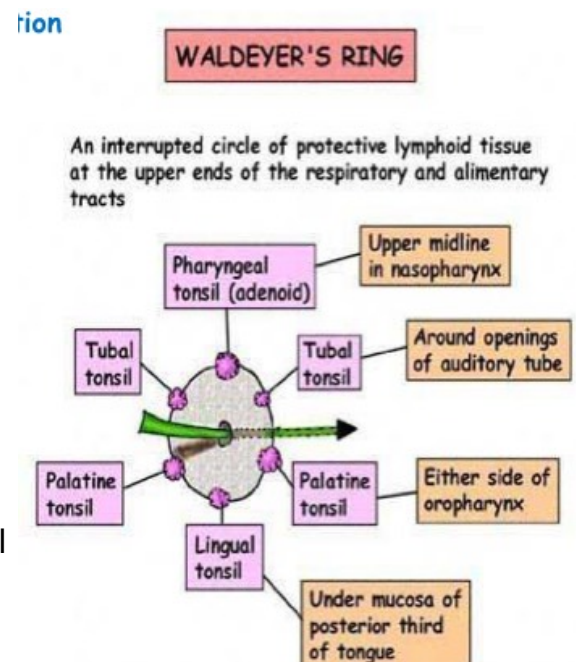
Waldeyer's Ring of Lymphoid Tissue

Function: filtration of bacteria + viruses

The lymphoid tissue that surrounds the opening into the respiratory and digestive systems forms a ring

The lateral part of the ring is formed by the palatine tonsils and tubal tonsils (lymphoid tissue around the opening of the auditory tube in the lateral wall of the nasopharynx)

The pharyngeal tonsil in the roof of the nasopharynx forms the upper part, and the lingual tonsil on the posterior third of the tongue forms the lower part.



- Typically, tonsillectomy is through the oral cavity by extending an index to the lateral surface; by using the scalpel, the surgeon opens the lateral capsules to have better access to the tonsils and removes them.

- Ligation and cutting of the tonsillar artery and done to prevent any bleeding.

vein(two ligations) must be

*After tonsillectomy we enroll the patient for 24 hours in the hospital for further supervision if any postoperative bleeding took place (caused by the vein, why? The vein pierces the constrictor muscle, and the contraction of this muscle can cause the release of the ligation of the vein, causing bleeding)

- Enlargement in pharyngeal tonsil can cause blockage in the nasopharynx

- Enlargement in palatine tonsils leads to difficulty in swallowing

اللهم صلّ وسلم وبارك على سيدنا محمد

لا تنسوننا من دعائكم

V2

- These three muscles overlap each other. (middle constrictor of the pharynx the superior, and the inferior the middle)

فشل الطبقات :

Out side

Out side