GI system
Anatomy lecture#2

Today we will start by revising some information about salivary glands:

1-parotid gland:

- Its surrounded by two capsules:
    1- The outer one: it comes from the deep investing fascia .
    2-the second one '' inner'': its connective tissue capsule which divides the gland into lobes and lobules.
    *since its surrounded by 2 capsules some of the infections like mumps which is viral infection that affects the parotid gland will be accompanied by severe pain; why severe pain ? Because it's surrounded by two capsules ,so enlargement or swelling is prevented by the two capsules.
-it's pyramidal in shape.
-it has base and apex (The apex is directed toward the wall of the pharynx) .
- The deep surface of the gland is anteromedial and posteromedial.
- The posteromedial surface is called parotid bed .
- Parotid bed is a group of structures which include:
    1- Styloid process.
    2- Styloid apparatus (apparatus means all structures associated or related to styloid process).
    3- Posterior belly of digastric muscle.
    4- Stylohyoid muscle and deep to this muscle we have last 4 cranial nerves (glossopharyngeal, vagus, accessory, hypoglassal).
    5- Facial nerve which cross superficial to styloid process and become one of the contents of the parotid gland.
    6- Internal jugular vein .
    7- External and internal carotid arteries.
-contents of the parotid gland:
    1- Facial nerve and its 5 branches: it's the most superficial structure .
        *Branches of facial nerve:
        a- temporal branch: it supplies frontalis muscle.
        b- Zygomatic branch: it supplies zygomaticus major and minor muscles.
        c- Buccal branch: it supplies buccinator muscle.
        d- Mandibular branch: it supplies mentalis muscle and all muscles which surround the oral cavity like levator lebii superioris and depressor anguli inferioris .
        e- Cervical branch: it supplies platysma (which is the superficial muscle of the neck).
        '' Any cut or injury to one of these branches will cause paralysis to the muscles which are innervated by this nerve''.
    2- Retromandibular vein: The second content which lies in the middle .
        *retromandibular vein is formed by the union of superficial temporal vein and maxillary vein.
        * At the lower border of the parotid gland retromandibular vein will divide into:
            1-posterior division which will join the posterior auricular vein forming the external jugular vein.
            2-anterior division which will join facial vein forming common facial vein which will end in the internal jugular vein.
    3- External carotid artery and its 2 terminal branches: it's the deepest structure of the contents .

* The 2 terminal branches are the maxillary artery and superficial temporal artery and these branches will provide blood supply to the parotid gland.

'' So the blood supply to the parotid gland is derived from the external carotid artery and its 2 terminal branches''

4- Parotid lymph nodes: it's present on the surface of the gland within the substance of the gland.

5- The auriculotemporal nerve:

* Auriculotemporal nerve is branch from mandibular nerve .

*Auriculotemporal nerve gives sensory and parasympathatic innervation to the parotid gland.

*some textbooks don't consider this nerve as one of the contents but we will consider it as one of the contents because:

a- it's clear that it lies close to the upper border of the gland.

b- It gives sensory innervation to the parotid gland .

c- It gives parasympathatic innervation to the parotid gland.

-how the parasympathatic innervation reaches to the parotid gland?

*The fibers Originate from inferior salivary nucleus in the medulla oblongata.

* Then it's carried by glossopharyngeal nerve which will give tympanic branch.

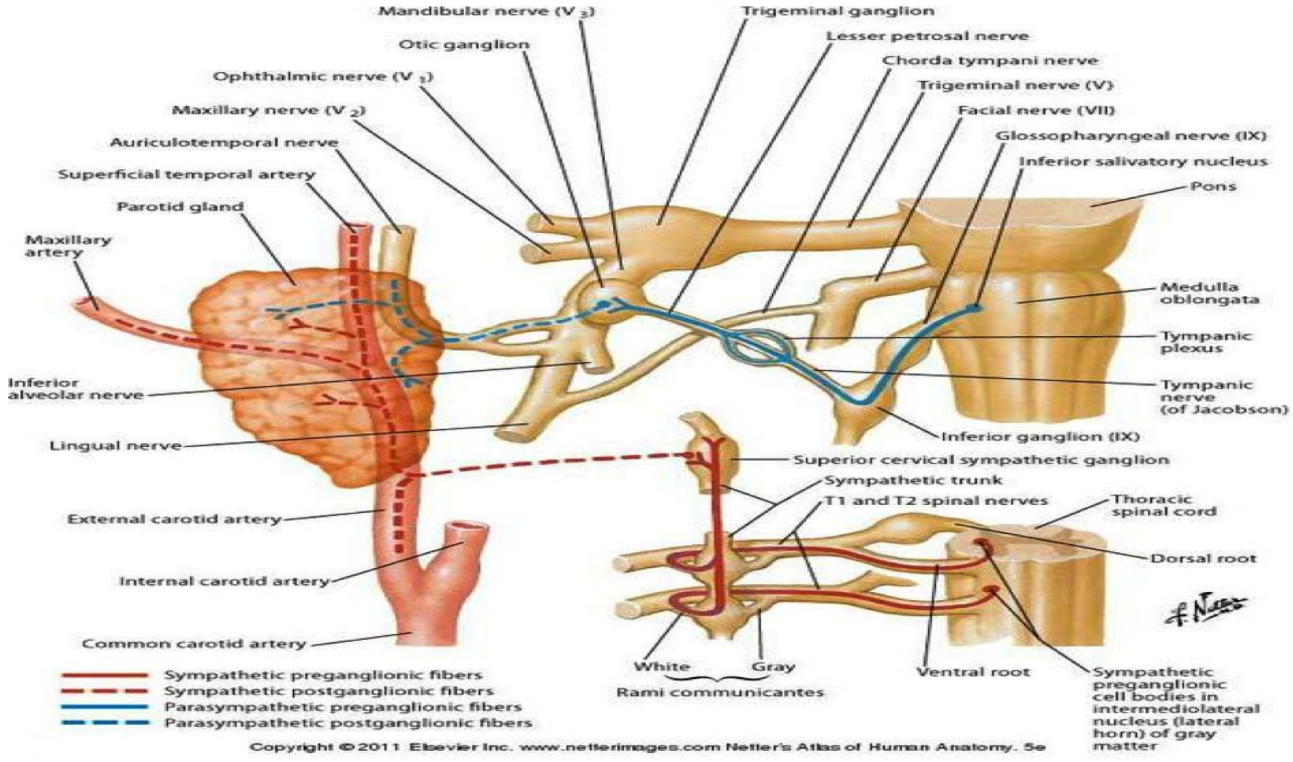
* Then through lesser petrosal nerve which is preganglionic to the otic ganglia.

* After otic ganglia we have postganglionic fibers which will reach to the gland by auriculotemporal nerve.

''So the auriculotemporal nerve is postsynaptic parasympathatic nerve and it's also sensory''

-sympathatic fibers to the parotid gland: it comes from superior cervical sympathatic ganglia through blood vessels (external carotid artery and its branches).

See the picture below for sympathatic and parasympathatic innervation of parotid gland

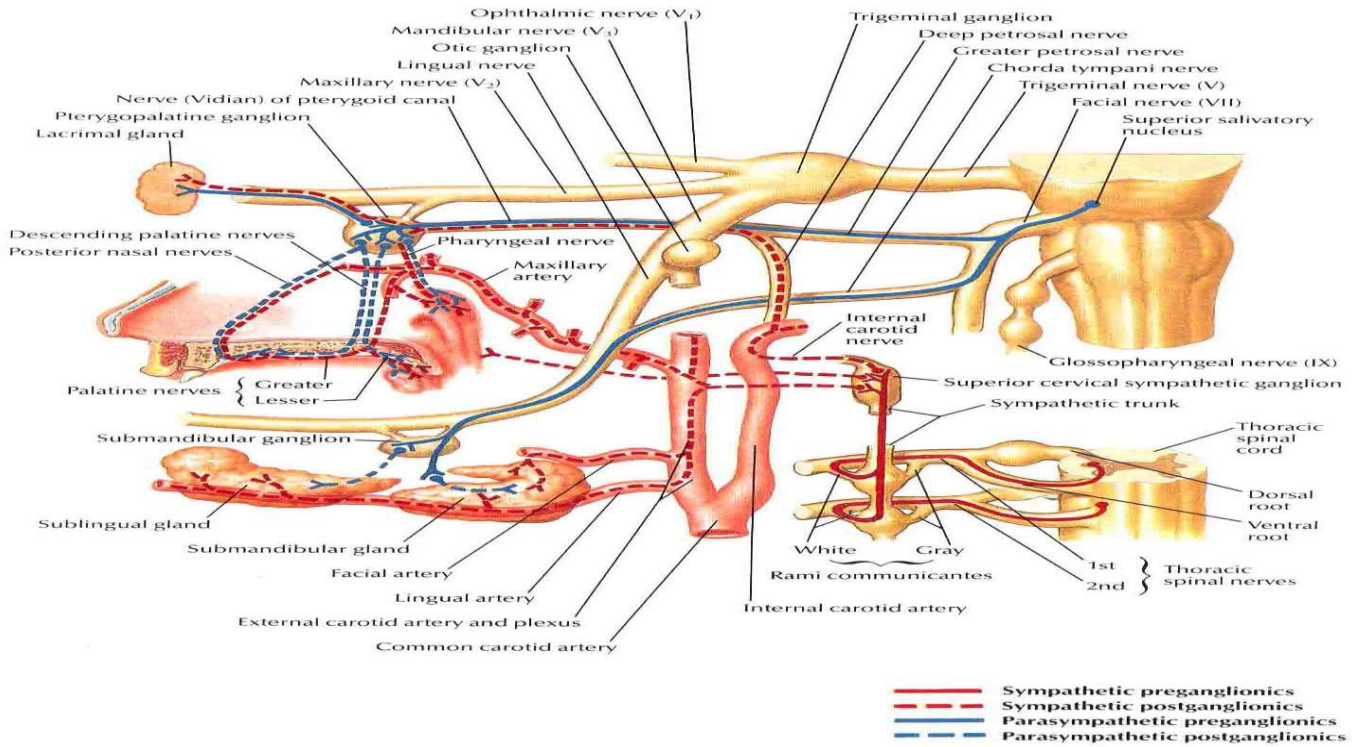


2- Submandibular gland

-it has two parts deep and superficial which are separated by mylohyoid muscle.

- Mylohyoid muscle separate the superficial part (which appear below the lower border of the mandible) and the deep part (which lies between two muscles mylohyoid and hyoglossus).

- So the deep part of submandibular gland lies between two muscles mylohyoid and hyoglossus.
- We said that we have 5 structures lie between mylohyoid and hyoglossus which are:
    1- Deep part of submandibular gland.
    2- Submandibular duct.
    3- Submandibular ganglia.
    4- Lingual nerve.
    5- Hypoglossal nerve.
    * all of the 5 structures mentioned above since they lie between 2 muscles then its logic to say that they are superficial to the deep muscle (hyoglossus) or deep to the superficial muscle (mylohyoid) or present between both muscles(hyoglossus and mylohyoid).
    " *Usually the question in the exam says that: all of the following structures lie (between mylohyoid and hyoglossus OR superficial to hyoglossus OR deep to mylohyoid) except:* ---------- ---------- *so whatever the question is we mean the above mentioned five structures".*
- Blood supply to the submandibular gland: it's supplied by (submandibular ganglia there 's facial artery) which will make a groove on the posterior surface of the submandibular gland.
- Sympathatic fibers to the submandibular gland: it's carried by facial artery from superior cervical ganglia to the submandibular gland.
-parasympathatic innervation:
    * It is from superior salivary nucleus through facial nerve.
    * Facial nerve will carry parasympathatic innervation and then it continues through chorda tympani (chorda tympani is a branch of facial nerve and it carries preganglionic parasympathatic fibers).
    * Chorda tympani in the infratemporal fossa will make acute angle and join the lingual nerve .
        - Lingual nerve provides innervation to many structures:
            1- It's a general sensory (touch, temprature, pain …..) to the anterior 2/3rd of the tongue and to the floor of the oral cavity .
            2- It's also sensory to the submandibular gland.
            3- but in relation to the preganglionic parasympathatic its just autostop where the fibers of chorda tympani pass with fibers of lingual nerve but these fibers are not mixed the will remain separated ''so chorda tympani fibers will pass with the lingual nerve and synapse within the submandibular ganglia''.
    * Chorda tympani will make synapse in the submandibular ganglia.
    *then the postganglionic will go as separate fibers to the gland or it again passes through the lingual nerve.



3- Sublingual gland:

-parasympathetic innervation: its postganglionic fibers come from submandibular ganglia through lingual nerve to the sublingual gland.
- Sensory innervation: it is also from lingual nerve.
-sympathatic innervation: it is from superior cervical sympathatic ganglia through the lingual and facial arteries.
- Sublingual gland lies in the sublingual fossa above the mylohyoid muscle.
-sublingual gland has a depression in the inner surface of the mandible.
- It lies deep to the tongue where it makes fold on the base of the tongue.
- We have important structures medial to the sublingual gland:
    1- Lingual nerve.
    2- Submandibular duct.
    3- Lingual vessels.
-triple relation between submandibular duct and lingual nerve:
    * First ligual nerve lies lateral to the duct, then below, then medial (and this when you are looking to the mandible from inside).
    ''Remember that Lingual nerve lies between the two muscles (mylohyoid and hyoglossus)''.

Now starting with another topic which is the pharynx and palatine tonsils

Pharynx:
-it extends from the base of the skull to(the lower border of the 6th cervical vertebra ''C6''/ lower border of cricoid cartilage/ lower border of the larynx) all of them are the same.
- Its funnel shaped which means that it's wide at the beginning , narrow at the end.
-it continues as esophagus.
- About 5 inches in length .
-wide above and narrow below.
-it's divided into 3 parts according to the spaces which lie anteriorly:

*1st part: nasopharynx which lies behind the nasal cavity.

*2nd part: oropharynx which lies behind the oral cavity.

*3rd part: laryngopharynx which lies behind the larynx.

'' So larynx, oral cavity, and nasal cavity all are anterior to the pharynx''.

-pharynx is a muscular tube which makes U shape because anteriorly we have openings.

- Its wall is muscular which means that we have the layers of the GIT (remember that layers of the GIT was: first from inside mucosal layer, then submucosa, then muscular layer, lastly adventecia which is a connective tissue fascia) but in the wall of the pharynx we have 5 layers:

1- Mucosa.

2- Submucosa.

3- Fascial layer (so here we have a difference).

4- Muscular layer.

5- Outer fascial layer (connective tissue fascia).

''So we have 5 layers 2 of them are fascia''.

-muscular layer of the pharynx is made up by 3 constrictor muscles (superior, middle, and inferior constrictor muscles) how these constrictor muscles are arranged?

*The superior muscle is the narrow one, then the middle which envelope the superior, then the inferior which envelope the middle ; like antennae .

'' This means that the 3 muscles are present inside each other''.

-fibers of the 3 constrictors are circular.

-also we have another 2 muscles within the pharynx which are salpingopharyngeus and stylopharyngeus:

*both of them have oblique fibers.

* Their function is to move the pharynx upward.

-the pharynx lies anterior to cervical vertebrae starting from atlas (1st one) , axis (2nd one), 3rd …… and so on till the 6th cervical vertebra:

*nasopharyngeal part: anterior to atlas and part of axis.

*oropharyngeal part: anterior mainly to axis.

* Laryngopharynx: anterior to the remaining cervical vertebra .

-what do we call the openings in the anterior part of the pharynx?

1- choanae'' also called posterior nares'' : it's the opening behind the nasal cavity (when you breath the air it will gush through the anterior nares then it goes to the posterior nares '' choanae'' then to the nasopharynx).

2- Oropharyngeal isthmus'' also called fauces'': it's the opening behind the oral cavity and on both sides of oropharyngeal isthmus we have palatine tonsils.

3- Inlet of the larynx: air enters to the inlet of the larynx.

4-auditory tube (Eustachian tube): it is the opening between the middle ear and nasopharynx and this opening has advantages and disadvantages:

* Advantages: it allows passage of air and equalizes the pressure on the ear drum (balance on the tympanic membrane) ; will give you a gum especially seen when you dive or go on airplane .

* disadvantage: in children vomiting can go to the nasopharynx and here food particle , virus, bacteria can go through the Eustachian tube to the middle ear and causes otitis media(so always if you are in the emergency and a child come to you then you have to examine the tympanic membrane to know whether there is otitis media or not).

-Notice the following on the pic below:

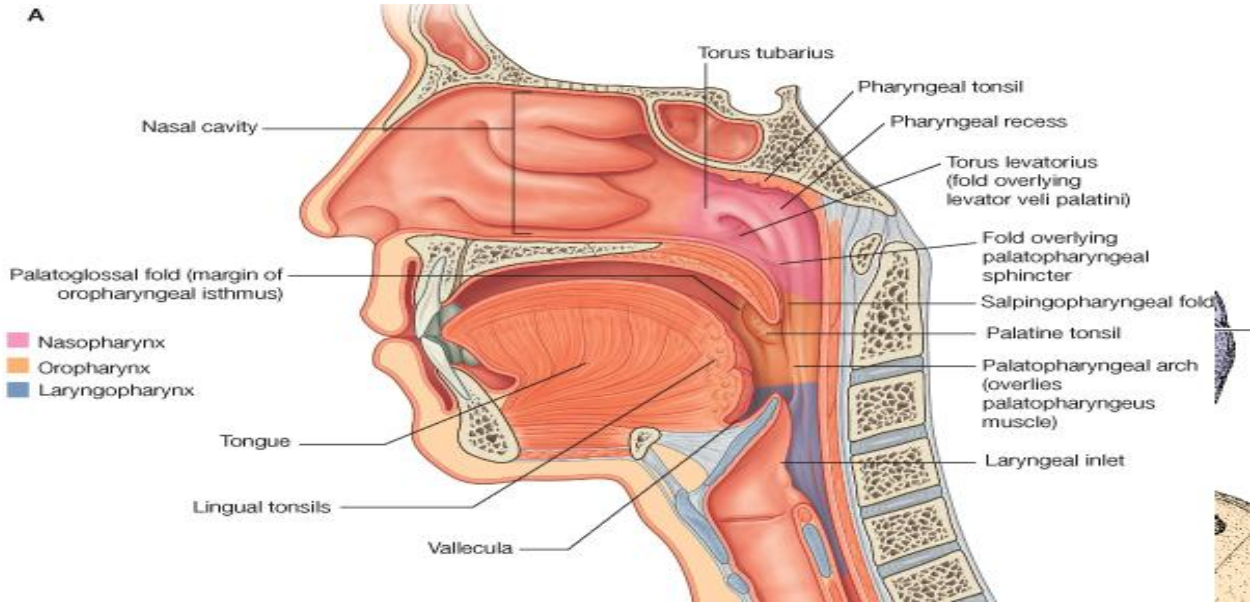
1-tubal elevation (on the pic its written torus tubarius and they are the same according to Wikipedia but in the lecture the doctor said that it's tubal elevation).

2- Salpingopharyngeal fold (inside it there is salpingopharyngeus muscle): it's present on the lateral wall of nasopharynx.

3- On the roof of the nasopharynx we have lymphatic nodule we call it ''pharyngeal tonsil'' and it's also called adenoid and it's important clinically:

** sometimes you notice that a child is breathing from his oral cavity because enlargement of adenoid will block the nasopharynx and the face will be adenoid face and you will notice that the ala of the nose will start to move with respiration and on such a case you have to do a surgery to remove the adenoids.

'' So enlargement of the pharyngeal tonsils is also called adenoid''



Now back again to the muscles of the pharynx

- notice the following on the pic below:

1- Buccinator muscle.

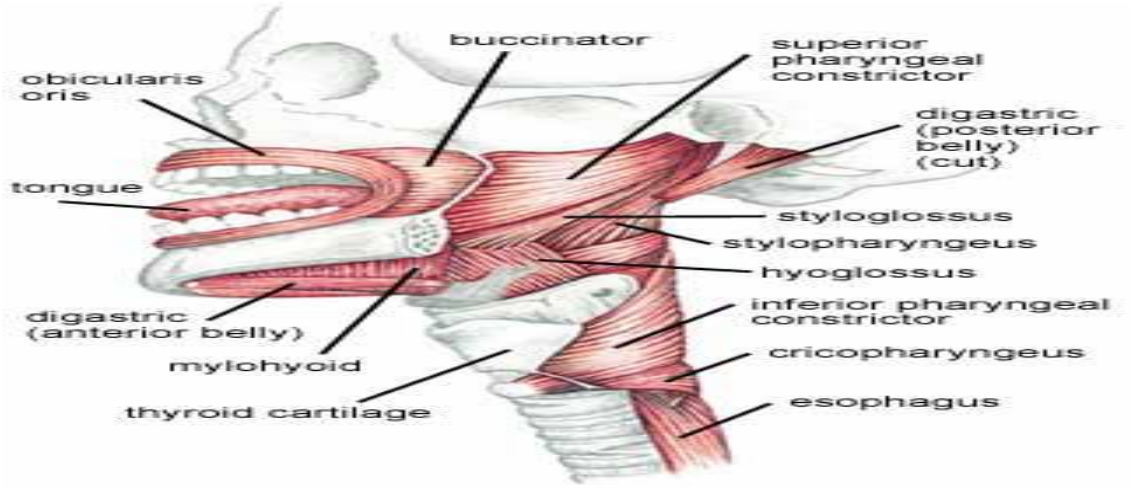
2-superior pharyngeal constrictor muscle.

3- Also notice the raphe: present between buccinator and superior constrictor muscle and it's for the insertion of both of them.

4-inferior constrictor muscle.

5-middle constrictor.

6- The 2 oblique muscles: stylopharyngeus and salpingopharyngeus (which is present on the lateral wall of nasopharynx).



-inferior constrictor muscle is two parts:

1- Cricopharyngeus.

2- Thyropharyngeus.

*what is the difference between them?

''All constrictor muscles are innervated by pharyngeal plexus of nerves and their function is propulsion of the bolus toward esophagus except for cricopharyngeus ''.

*cricopharyngeus muscle:

1- It is present at the lower part of the pharynx (at the beginning of esophagus) .

2- Also it has circular fibers.

3- action: it's always closed but when the bolus reach it then it will be stimulated to open and allow the passage of the bolus, and this is important to prevent passage of air to the esophagus ,so the air is going continuously to the larynx and when it goes downward it will find closed esophagus so it goes to the larynx again ;but despite all of these mechanisms to prevent passage of air to the GIT some air will pass and reach to the stomach (this occur due to continues opening and closing and deglutition)and this air will accumulate on the fundus of the stomach that's why when you do X-Ray to the stomach you will see black spots on the fundus of the stomach .

- The Dr said that you have to know the origin and insertion and nerve supply to all of the muscles of the pharynx but he didn't mention them in the lecture you can refer to them in the slides.
- Killian's dehiscence: an area on the posterior pharyngeal wall above cricopharyngeus muscle (it's a land mark for the upper border of cricopharyngeus muscle).
- Innervation of the muscles of the pharynx: it is by pharyngeal plexus (it's a plexus of nerves around the pharynx which come from cranial accessory nerve through the vagus nerve).
- Middle constrictor muscle will insert into pharyngeal raphe (pharyngeal raphe: it is a connective tissue line that extend from pharyngeal tubercle at the base of the skull and descends in the midline till it reaches the esophagus and it's the site of insertion of all constrictor muscles).

''All constrictor muscles will insert into this raphe''

-cricopharyngeus muscle: it's the lowest fibers of the inferior constrictor muscle and it works as a sphincter at the lower part of the pharynx.

-stylopharyngeus muscle: it's the only muscle among muscles of the pharynx that's innervated by glossopharyngeal nerve.

''All muscles of the pharynx are innervated by pharyngeal plexus except stylopharyngeus''

-salpingopharyngeus muscle: it is present in the salpingopharyngeal fold and its action is to elevate the pharynx and larynx upwards .

-Interior of the pharynx (if we look to the pharynx from inside) look to the pic below:

- Its coronal section through the skull.

-you can see choanae of the nasal cavity.

-you can see vomer: which is a septum present between 2 nasal cavities.

- Soft palate: the action of soft palate is that it moves backwards and upwards and at the same time the posterior wall of the pharynx will move forward(the movement of soft palate and the movement of posterior wall of the pharynx together will lead to the closure of the nasopharyngeal isthmus and this is important in deglutition and vomiting).

*so the soft palate will move downward and closes the oropharyngeal isthmus in mastication to increase the pressure inside.

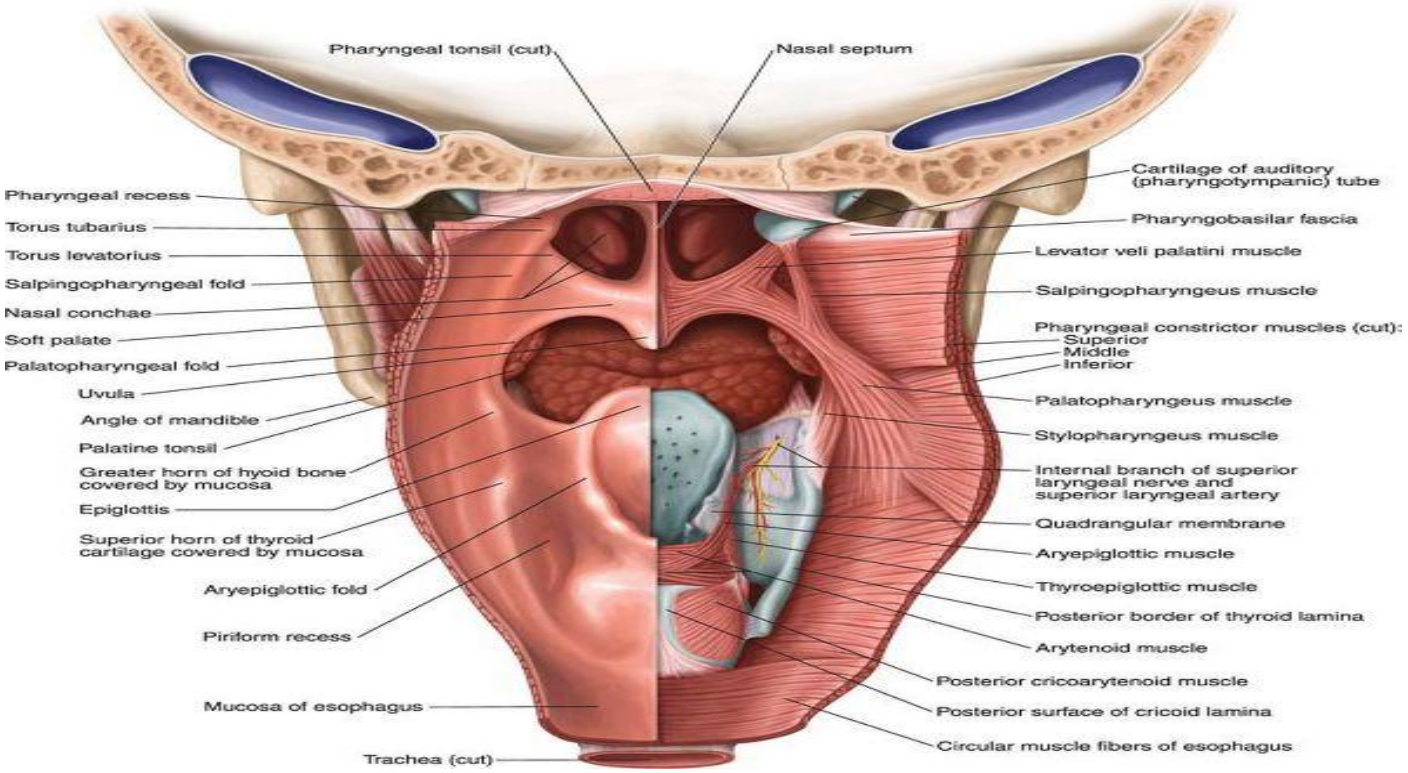
* It relaxes at the middle in the case of respiration.

-uvula.

- Inlet of the larynx.

- Epiglottis.

-aryepiglottic fold.



- what's important for us in the process of swallowing is the passage of bolus to the esophagus and not to go to the inlet of larynx ; so swallowing will close the larynx and cause movement of the larynx upward how does this occur?

1-The aryepiglottic fold contains a muscle called aryepiggliticus muscle which will contract and as a result both sides of the inlet of the larynx will be shorter .

2-Also we have 2 muscles interarytenoid and posterior arytenoids which close the posterior part of the larynx.

3-During deglutition the bolus will push the epiglottis downward causing complete closure to the inlet.

''so when the sides become shorter, posterior part closes, and epiglottis pushed down all of this will lead to complete closure to the inlet of the larynx and the bolus will go to esophagus and the larynx

will move upward toward the base of the posterior 1/3rd of the tongue and this movement also help the bolus to descend and pass the inlet of the larynx'' and this is the mechanism of deglutition.

-now if we look to the posterior wall of the larynx (which is the same as the anterior wall of the pharynx) we notice the presence of piriform fossa which is a space surrounded by mucosa present posterolateral to the larynx (the same as if we are saying anterolateral to of the pharynx) but what is the importance of this space?

Clinically it's a site for lodge of the foreign body so when you swallow foreign body (especially needles and fish spine) it can lodge to the piriform fossa so when you are looking for lodged foreign bodies by the gastroscope you will look to the piriform fossa.

-remember that we have palatine tonsil which lies between 2 folds palatoglossal anteriorly and palatopharyngeal posteriorly.

-innervations of the pharynx we have:

1- Motor innervation : as we said all muscles of the pharynx are innervated by pharyngeal plexus except for stylopharyngeus muscle (which is innervated by glossopharyngeal nerve).

2- Sensory innervation is as follow:

a- nasopharynx: from maxillary nerve.

b- Oropharynx: from glossopharyngeal nerve.

c- Laryngopharynx: from internal laryngeal nerve:

*it is branch from superior laryngeal nerve which is branch from vagus nerve.

*internal laryngeal nerve will pass between middle and inferior constrictor muscles and its important land mark for the surgeon.

* Internal laryngeal nerve also will give sensory innervation to the larynx above the vocal cords''.

-Three structures pass between superior and middle constrictor muscles:

1- glossopharyngeal nerve .

2- Stylohyoid ligament.

3- Stylopharyngeus muscle.

-blood supply to the pharynx: all are branches from external carotid artery

1- Ascending pharyngeal .

2- Tonsillar branch of facial.

3- maxially artery.

4- Lingual artery.

-lymphatic drainage of the pharynx

1- Direct to the deep cervical lymph nodes.

2- Indirectly to the retropharyngeal and paratracheal lymph nodes.

'' But at the end all of it will go to the deep cervical lymph nodes''

-palatine tonsils:

- present on both sides of the fauces '' oropharyngeal isthmus''.

-present between 2 folds palatoglossal and palatopharyngeal folds.

-in children this palatine tonsils might cause acute tonsillitis, but if not treated the child might get chronic tonsillitis (this occurs mainly in children because they pick anything'' that might be contaminated with bacteria or virus'' from the ground and put it in his mouth and this might cause infection to the tonsils since their function is to make filtration to the bacteria and viruses)

-In the case of repetition of infection 4 or 5 times per year it's better to make tonsillectomy why? Because one of the complications of streptococcus bacteria that it might reach to the heart, joints, and kidneys causing their infection so it's better to treat it as fast as possible.

- What's the anatomical importance of palatine tonsils? Palatine tonsils have medial and lateral surfaces:

  * medial surface : when you light the oral cavity you will notice the crypts (depressions) that are present on this surface and these crypts come as a result of repetition of infection * Lateral surface: it is covered by capsule (connective tissue capsule) and it separates the lateral surface from superior constrictor muscle of the pharynx.

    What is the lateral relation to the capsule '' the lateral wall''?

    1- Carotid sheath which contains (vagus nerve, internal jugular vein, internal carotid artery)

    2- Superior constrictor muscle of the pharynx

-in adults palatine tonsils undergo rudimentation and their infection become rare (esp. medial surface) .

- In some cases repeated infections might occur in adult also here we advice to do tonsillectomy.
- when you do tonsillectomy all what you are going to do is opening in the capsule and then you will make inoculation to the tonsils , of course this after the ligation of the tonsillar artery(branch from facial artery) and the external palatine vein(its drainage goes to the pharyngeal venous plexus)
- The source of bleeding after tonsillectomy is from the external palatine vein why? Because it comes through superior constrictor muscle of the pharynx and once this muscle contracts it might induce bleeding from the external palatine vein.
- After the surgery you will put the patient 24 hours under observation in the hospital because with contraction of superior constrictor muscle the external palatine vein might cause bleeding.
- This tonsils provides immunity to children .
- Blood supply: tonsillar branch of facial artery.

-lymphatic drainage: upper deep cervical lymph nodes or digastrics lymph nodes which lies behind the angle of the mandible.

- Waldeyer's Ring of Lymphoid Tissue:

  * You notice around the oropharyngeal isthmus we have:

  1- Lingual tonsil on the posterior $1/3^{rd}$ of the tongue .

  2-palatine tonsils on both sides of oropharyngeal isthmus .

  3-adenoids on the roof of the nasopharynx .

  4- Tubal tonsil around the opening of the auditory tube.

  '' All of these lymph nodes are called Waldeyer's Ring of Lymphoid Tissue and it's important in the immunity of the children since they filtrate bacteria and viruses''.

Good luck

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