Applied Anatomy and Physiology of Pharynx

13

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13.1 Applied Anatomy of Pharynx

1. Pharynx Anatomy

The pharynx could be divided into three parts: the nasopharynx, the oropharynx and the laryngopharynx (Fig. 13.1).

(a) Nasopharynx

Nasopharynx opens anteriorly to the cavum nasi through the choana, and its apex is the corpora ossis sphenoidalis and the occipital bone basement and inferiorly horinzonal to the first and second cervical vertebrae. The posterior apex wall is dome, abundant lymph tissue orange slice like walelined in mucosa, which is called the adenoid, also the pharyngeal tonsils. The hypertrophy adenoid can not only obstruct the cavum nasppharynx to influence the ventilation but also obstacle the eustachian tube pharynx aditus to evoke the hearing loss. The eustachian tube pharynx opening locates at bilateral nasopharynx about 1.0 cm posterior to the inferior nasal concha, surrounds by the lymph tissue, which is called the tonsilla tubaria. The apophysis superior to the eustachian tube pharynx aditus is called the torus tubarius. A depression posteriorsuperior to the torus is called the pharyngeal recess, which is also a favor site of the nasophrtnx carcinoma. The superior recess is adjacent to the foramen lacerum, through which the nasopharync carcinoma invades the encephalic; inferiorly opens to the oropharynx, while deglutition, the soft palate rises to contract with the inferior pharynx wall, the nasopharynx temporarily departs with the oropharynx.

(b) Oropharynx

Oropharynx locates posterior to the oral cavity between the horizontal soft palate and the upper epiglottis border. It anteriorly opens to the oral cavity through the isthmus faucium. What is called the isthmus faucium is that what superiorly ends at the uvula and soft palate free border, inferiorly at the annular narrow site made by the dorsal tongue, the bilateral palatoglossal arch and the palatopharyngeal arch. The depression between the palatoglossal arch and the palatopharyngeal arch is called the tonsillar pit, which contains the palatotonsil (Fig. 13.2). The wale strip lymph tissue posterior to each lateral palatopharyngeal arch is called the lateral pharyngeal bands. There are also free lymph follicles under the posterior pharynx wall mucosa.

The oral apex is called the palate. The front 2/3 is the hard palate, which is structured by the maxillary palatine process and the horizontal palatine sites; the posterior 1/3 is called the soft palate. Muscles constitute the soft palate include the velopharyngeal tensor, the velopharyngeal levator, the palatoglossus muscles, the palatopharyngeus muscles, the musculus uvulae, etc. The inferior oral cavum wall is the tongue and the oral base. The tongue is made with muscle plexus, with tough tongue back surface, covered with pseudo stratified squamous epithelium and is closely correlated with the lingualis; There is a foremen cecum at the inferior tongue, what is the embryoductusthyroglossus vestige. The posterior 1/3 tongue is the tongue lingual root, on which there is the lymph tissue mass, and the mass is called the lingual tonsil. The mucosa connective tissue protruded in the inferior tongue center and inferiorly metastasiss to con-

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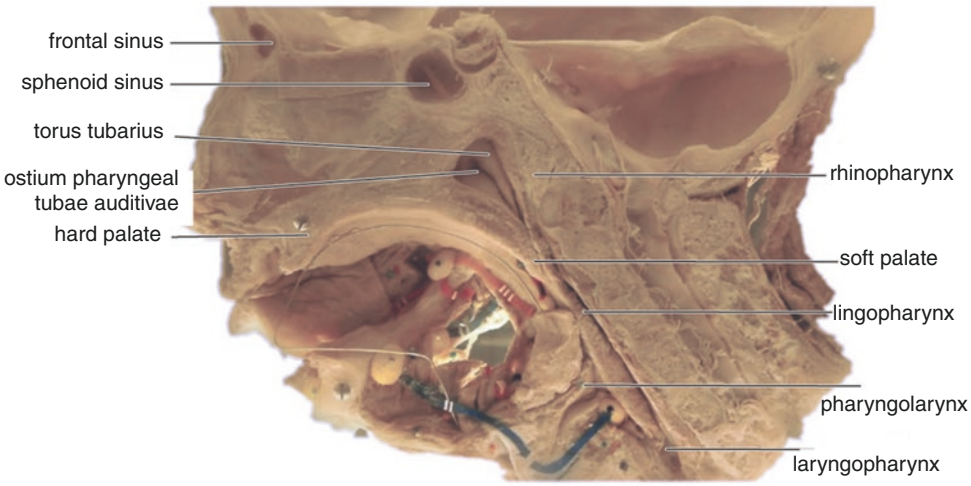

Fig. 13.1 Pharyngeal subsections

Fig. 13.2 Oropharynx sites. A: Soft palate; B. tonsil; C. uvula; D. tongue

stitute the frenum linguae, bilateral frenum are the aditus glandula sunmandibularis. The occasional ankyloglossia could influence and suffocate the articulation.

(c) Larynopharynx

It locates between the epiglottis superior edge and the cricoid cartilage laminae's inferior edge plate, opens superiorly to the oropharynx, inferiorly to the esophagus aditus and anteriorly to the laryno-cavum and surrounds by the cricopharyngeus muscles. The anterior laryngopharynx has an aditus constituted by the epiglottis, the aryepiglottis fold and the arytenoid cartilage, which is called the aditus laryngis. Piriform abcesses at bilateral aditus laryngis, deep crypts, are a most common incarceration site of foreign mass. Shallow crypts at left and right between the lingual root and the epiglottis are called the vallecula epiglottica and both of them are common remaining sites of the foreign mass. Between the piriform abcesses and the at posterior cricoid cartilage laminae, there is the post cricoid space (Fig. 13.3).

2. Pharyngeal Wall Anatomy

(a) Pharyngeal Walls

It has four layers: mucosa, fibrin, muscle and outer membrane.

- Mucosa

  Nasopharynx mucosa is the continuousness of the nasocavum mucosa and the eustachian tube mucosa, it has pseudostratified ciliated columnar epithelium and mixed glands in the lamina propria. The mucosa epithelium of the oropharynx and the larynopharynx are both the stratified squamous epithelium, the mucous glands exist at inferior mucosa and secret fluid to moist the pharyngeal mucosa. Plenty of the lymph tissues under the epithelium layer aggregate and substitute the inner ring of the pharynx waldeyer.

- Fibrous Layer

  It is also called the aponeurosis layer, mainly substituted by the pharyngobasilar fascia and it is connective tissue between the mucosa layer and the muscle layer. Raphe pharyngis formed in the middle postpharyngeal line and it is the attachment site of the constrictor naris.

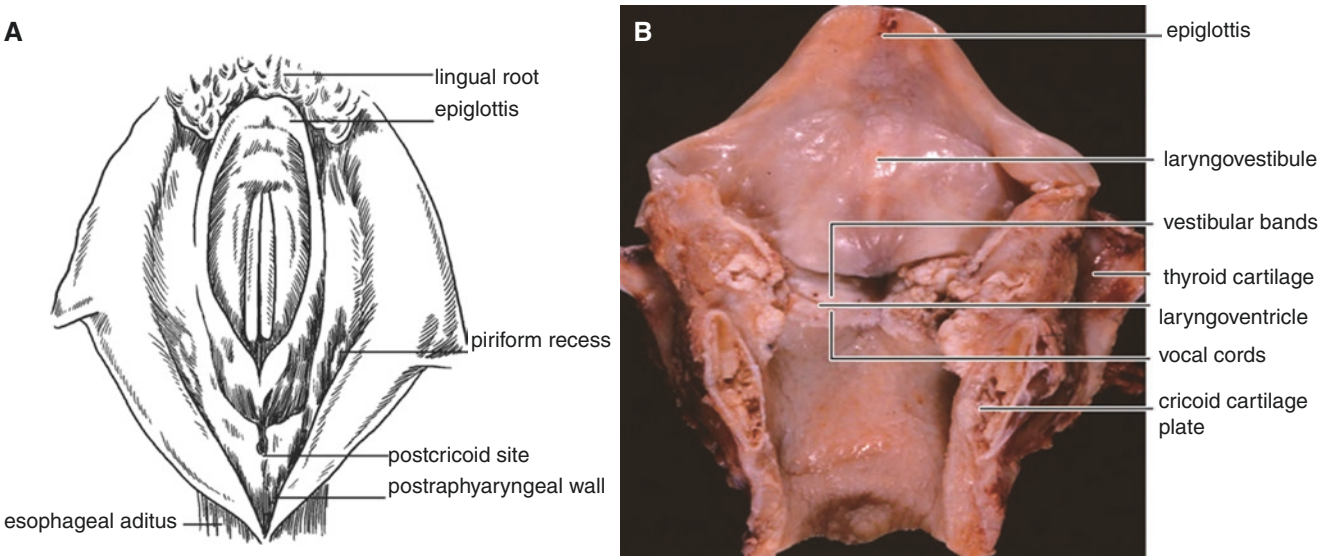

Fig. 13.3 Larynopharynx anatomy

- Muscle Layer

  According to the functions, it could be divided into three groups:

  – Constrictor Naris

  Superior, middle and inferior constrictor naris line imbricately from above down and when the constrictor naris contracts, the pharynocavum shrink to impress the food into the esopharyngeal.

  – Levator Myopharynx

  It mainly contains the stylopharyngeus, the palatopharyngeus muscles, etc. The levator myopharyngeus could raise the throat to assist the deglutition.

  – Velopharyngeal Muscle

  It contains evator, tensor muscle, palatopharyngus, palatoglossus, uvulae, etc. It could shrink the isthmus faucium, close the nasopharynx and temporarily separate the nasopharynx and the oropharynx.

- Outer Membrane Layer

  It covers out of the constrictor naris, substituted by the connective tissue surrounding the muscle layer. It is with thin superstratum and thick substratum and also the continuity of the fascia buccopharyngeal.

(b) Interfascial Spaces

Posterior to and bilateral pharyngeal wall, there are potential areolar tissue spatia made by the neck spatia and because of its existence, the soft tissue is under coordinate accordance to achieve the normal physical function while the swollen or the neck motion. Simultaneously, because of the division by the spatia interfasciale, the lesion would be limited inside the spatia, but it offers the approach for the lesion expanding in the spatia at the meantime. The more important spatia in the pharynx are the retropharyngeal space and the parapharyngeal space.

- Retropharyngeal Space

  It locates between the prevertebral interfascia and the buccopharyngeal interfascia, its upper ending is at the skull base and the lower ending is at the mediastium, which is equivalently the first or the second thoracic vertebra, and the pharyngeal raphe seperated it into the left part and the right part. In the space, there is lymph tissues, especially at infant, but its quantity reduces and its size shrinks as people grows, so there are only few lymph nodes at adults stage, who are used to drain the lymph at tonsil, mouth, postrarhinocavum, rhinolaryngx, Eustachian tube, etc., so any site's inflammation would cause the retro Pharyngeal space infection even the retropharyngeal abscess.

- Parapharyngeal Space

  It represents the space at bilateral retroparyngeal interval, each one at one side, pyramid and peak downwards. Its upper ending is the skull base, its lower ending is the big corner of hyoid bone, its internal side separates from the sacral tonsil by the buccal pharyngeal fascia and the pharyngeal muscle, its external wall is the ascending branch of the mandible, the deep part of the pterygoid muscle and the parotid gland, and the posterior wall is the anterior fascia. The styloid process and its nearby

muscles divide the gap into two parts. The forefoot is small and the medial side is adjacent to the tonsil. Inflammation of the tonsils can spread to this space; the posterior space is larger, and there are internal carotid artery, internal jugular vein, glossopharyngeal nerve, vagus nerve, hypoglossal nerve, accessory nerve and sympathetic trunk, and there are deep cervical lymph nodes. The infection can spread to this space.

3. Pharyngeal Lymph Tissue

The lymph tissue under the pharynx mucosa is abundant, of which the bigger black mass cyclicline is called the inner ring lymph, also the Waldeyer lymph ring; the outer ring lymph made by the pharynx tonsil (adenoid), the palatine tonsil, the tongue tonsil, the eustachian tube tonsil, the posterior pharynx wall lymph follicles and the lateral pharynx cord consists of the mandible angle lymph node, the inferior mandible lymph node, the submental lymph node, the posterior pharynx lymph node, etc. The inner ring lymph could be drainage into the outer ring lymph, so when the inner ring lymph tissue can't limit the pharynx infection or the tumor, it could diffuse or metastasis to the corresponding outer ring lymph node. The inner ring lymph tissue is at hyperplasia stage at childhood, and it could invoke after 10.

(a) Pharyngeal Tonsils

It is also named as the adenoid locating at the junction of the nasopharynx apex and the posterior wall, covered by the pseudostratified columnar ciliated epithelium, and with rough surface, so it is easy to retain the bacteria. The mid-fissure is the deepest one, where we could find the diverticulum depression of the residual embryo, which is called the bursa pharyngeal. The adenoid exists congenitally and invoke after 10. There isn't any connective tissues and the envelopes between the pharynx tonsil and the pharyngeal wall, so it's hard to be excised entirely.

(b) Palatine Tonsil

The palatine tonsil locates in the bilateral oropharynx tonsillar pit encircled by the palatoglossal arch and the palatopharyngeal arch and it is the oval clump lymph tissue, one at left and the other at right. It is the biggest pharyngeal lymph tissue. Its internal free surface mucosa epithelium is a squamous epithelium, it invaginate into the tonsil parenchyma and forms several branches of blunt duct irregular at depth. The blunt ducts opens abscess at the tonsil surface. so the bacteria could retain and breed at the blunt duct in the abscess and finally forms the infection 'lesion'.

(c) Tonsillar Blood Vessels and Nerves

- Arteries

It consists of five external carotid branches. Palatine descending limb arteries, the maxillary artery limbs, distributing in the superior palatine tonsil and the soft palate; efferent palatine arteries, from the facial arteries; tonsil limb of the facial arteries; the tonsil limb of the efferent pharynx arteries, all of the four above distribute at the palate tonsil and the palatoglossal arch and the palatopharyngeal arch; dorsal tongue artery from the lingual artery and distribute at the inferior palatine tonsil.

- Veins

There is a venous plexus out of the palatine tonsil diorama, flowing the veins to the pharyngeal veins and the lingual veins and affluxing into the jugular vein.

- Nerves

The pharynx plexus, the second trigeminal limb and the glossopharyngeal nerve.

4. Pharyngeal Blood Vessels, Nerves and Lymph

(a) Arteries

The pharynx limb of the efferent pharynx arteries, the efferent arteries of and the tonsil arteries the facial arteries, the dorsal tongue limbs of the tongue arteries and the tonsil descending arteries are all the external carotid arteries.

(b) Veins

Open to the pterygoid venous plexus through the pharynx venous plexus and afflux into the facial veins and the internal carotid veins.

(c) Nerves

The pharynx sensory nerve and motion nerve are all from the pharynx nerves plexus made by the glossopharyngeal nerve, the labyrinth pharynx limb and the sympathetic nerve; the superior nasopharynx sensation is from the trigeminal maxillary limb.

(d) Lymph

Pharynx lymph flows to the deep cervical lymph nodes. The nasopharynx lymph firstly flows into the retro pharynx lymph node and then the efferent deep cervical lymph nodes co group. The oropharynx lymph nodes afflux into the nodi lymphatici mandibulares; the laryngopharynx lymph tubes go through the hypothyroid and afflux into the middle deep cervical lymph node cogroup adjacent to the internal carotid veins.

13.2 Physiology of Pharynx

Pharynx is the common channel of the respiratory and the digestion and has several complex physiological functions.

1. Deglutition

Deglutition is a reflective cooperating activity by plenty muscles. Food was inserted into the cavum phar-

ynx through the oral cavity, the swallow reaction rises the soft palate, close the nasopharynx, contract the aryepiglotticus and the, retract the tongue, cover the laryngeal inlet with the epiglottis, and at the pharynx, it evokes the hypopharyngeal and the esophageal aditus opening, simultaneously with the pharyngeal contractor muscular contraction to oppress the food masses move down, then the food would enter the esophagus through the piriform recess, and if the pharyngomusle paralyzes, the dysphagia or the fold reflux would occur.

2. Respiratory

   The nasopharynx and the oropharynx are respiratory channels. There are abundant glands in or under the pharyngeal mucosa to help clear, humidify and adjust humidification the inhaled air while going through the pharynx sites, but its similar function in nasopharynx is better.

3. Resonance and Articulation

   The pharyngeal is one of the resonance cavities, while pronouncing, the tonsil could adjust the shape to fit the pronunciation requisitions to produce the resonance and enhanced the voice effect. It can also produce several kinds of languages with the help of the soft palate, the mouth, the tongue, the lips, the teeth etc. Corresponding change at the normal pharyngeal structures and the pharyngeal shape and size while making voice play an important role on forming a speech and articulation.

4. Defense and Protection

   The secretion from the nose, the nasal sinus and the eustachian tube could be spit out by the pharyngeal reflex reaction or be swollen to let the gastric acid eradicate microorganisms inside. Besides, the pharyngeal muscle reflex activity protects our flesh. While swallowing or vomiting, the pharyngeal muscle contracts to close the nasopharynx and the cavum larngis and eventually avoid the food or the vomitus regurgitating into the cavum nasi or being inhaled into the weasand. If foreign mass was mistakenly in the cavum pharyngis, the pharyngeal muscle can also contract to stop it falling and evoke nausea, vomiting to expel the foreign mass.

5. Adjust the Mid-Ear Air Pressure

   The eustachian tube aditus's opening is closely related to the deglutition. The aditus opens while deglutitions to balance the mid-ear air pressure and the foreign pressure to maintain the normal midear function and eventually remain the normal auditory ability.

6. Tonsil Immunity

   Tonsil locates at the aditus of the respiratory and the digestion channels and it is a positive immunity organ in infants. It contains several stagings' cyto lymph, including the B cell, the T cell, the plasma cell, the macrophage and it can produce several kinds of immunoglobin (IgG, IgA, IgM, IgE), so it occupies the main liquid immunity and effects at aspect on the cellular immunity. The adenoid is also an immunity organ though it effects less. Infants have more opportunity to touch the foreign allergen, so the adenoid enlargement is a normal condition but also it may be an immunity motion phenomenon. It would invoke.