

L'enseignement de l'anatomie des appareils digestif, urinaire et génital par l'utilisation de vidéos d'anatomie 3D en anglais, intérêts pédagogiques par rapport aux méthodes classiques d'enseignement



PHARYNX

I. INTRODUCTION

The pharynx is a fibromuscular tube applied to the back of the face in the same way as a respirator is applied to the front of the face. Its anterior wall is largely deficient so that it has wide communication with the nose, mouth and larynx.

The pharynx extends downwards from the base of the skull to the level of C6 vertebra, where it becomes continuous with the oesophagus. It is an aerodigestive crossroads and communicates with the middle ear through the auditory tube.

The pharynx is responsible of four main functions, deglutition, respiration, communication and hearing.

II. DESCRIPTIVE ANATOMY

A- SITUATION

The pharynx is situated in front of the prevertebral fascia behind the nasal and oral cavities and the larynx. It stands vertically at the midline and extends downwards from the base of the skull to the commencement of the oesophagus towards C6 vertebra and the lower border of cricoid cartilage.

B- SHAPE

The pharynx is unique and symmetrical. It is funnel-shaped and opened in front. It is continuous with the oesophagus at its commencement.

C- DIMENSIONS

The pharynx, in its entirety, is fifteen centimetres long, twelve when contracted. It remains widely opened and its anteroposterior diameter measures at least two centimetres when its width narrows from top to bottom.

Behind the nasal cavity, this portion of the pharynx is named the nasopharynx and is five centimetres wide.

Behind the oral cavity, this portion is the oropharynx and is four centimetres wide.

Behind the larynx, the pharynx is named laryngopharynx and is two centimetres wide.

D- PARTS OF THE PHARYNX

Inspection of the outside of the pharynx gives no hint of its division just as the blank and windowless wall of a tall building. The soft palate and the epiglottis are the two reference points behind the segmentation of the pharynx.

Three parts or levels are distinguished. (Figure 1)

The upper part is the nasopharynx, it extends from the base of the skull to the lower border of the soft palate and communicates with the nasal cavity.

The middle part is, namely, the oropharynx and extends from the lower border of the soft palate to the upper border of the epiglottis towards the anterior arch of atlas and C2 and C3 vertebrae, it communicates with the oral cavity.

The lower part is the laryngopharynx, it extends from C4 to C6 vertebrae and communicates with the larynx.

The nasopharynx is strictly aerial.

The upper part of its anterior wall communicates with the nose through the choanae. The latter are two oval three centimetres high and one centimetre and half wide openings separated by the vomer. Below, the soft palate forms the lower part of its anterior wall.

The oropharyngeal isthmus is the space between the lower border of the soft palate and the posterior pharyngeal wall through which the nasopharynx joins the oral part of the pharynx.

The superior and posterior walls are continuous. They form a vault concave forwards and downwards and are sloping backwards and downwards then stand vertical. They contain the pharyngeal tonsil which is a collection of lymphoid nodules prominent in children at the level of the basiocciput. It has a pleated appearance with folds diverging from a median recess, the pharyngeal bursa.

The lateral walls of the nasopharynx are wide.

They contain the pharyngeal recess or fossa of Rosenmüller, a narrow vertical slit behind the opening of the auditory tube.

The opening of the auditory tube lies one centimetre and half behind the inferior nasal concha above the soft palate and is guarded above, behind and in front by a prominent rounded ridge, the torus or tubal elevation in the shape of an inverted J, the long limb lying posteriorly and being continued downwards as the salpingopharyngeal fold and below there is a very slight bulge, the levator elevation.

The oropharynx stands in front of C2 and C3 vertebrae and is continuous with the nasopharynx through the nasopharyngeal isthmus above the soft palate, with the oral cavity through the gap between the soft palate and epiglottis and with the laryngopharynx towards the hyoid bone. It is limited downwards by the posterior part of the tongue, laterally by the palatoglossal and palatopharyngeal arches, the pillars of the fauces, with the palatine tonsil between them.

The palatoglossal arch constitutes the boundary between the pharynx and the mouth.

The palatine tonsil is a paired large collection of lymphoid tissue in the tonsillar fossa opened in its medial face by some twenty crypts and covered by a capsule and a small semilunar fold of mucosa extending from the palatopharyngeal fold to the upper pole of the tonsil.

The valleculae are two shallow pits between the epiglottis and the posterior surface of the tongue limited laterally by the glossoepiglottic folds and separated by the median glossoepiglottic fold.

The soft palate hangs down from the back of the hard palate as a mobile fold that fuses at the sides with the lateral wall of the pharynx.

The laryngopharynx extends from the upper border of the epiglottis to the lower border of cricoid cartilage towards C6 vertebra in front of C4, C5 and C6 vertebrae.

Its anterior wall, known as the aditus, is formed of the epiglottis forwards, the aryepiglottic folds backwards and the lateral glossoepiglottic folds laterally separating the laryngopharynx from the oropharynx.

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Its lateral walls contain the piriform recesses, two vertical gutters, on either side. Its superior medial margin is folded and contain the internal branch of the superior laryngeal nerve and its artery.

The lower part of the laryngopharynx is, namely, the hypopharynx. Its anterior wall is flat and its posterior wall appears as a transverse fold that obliterates the piriform recess and constitutes the commencement of the oesophagus.

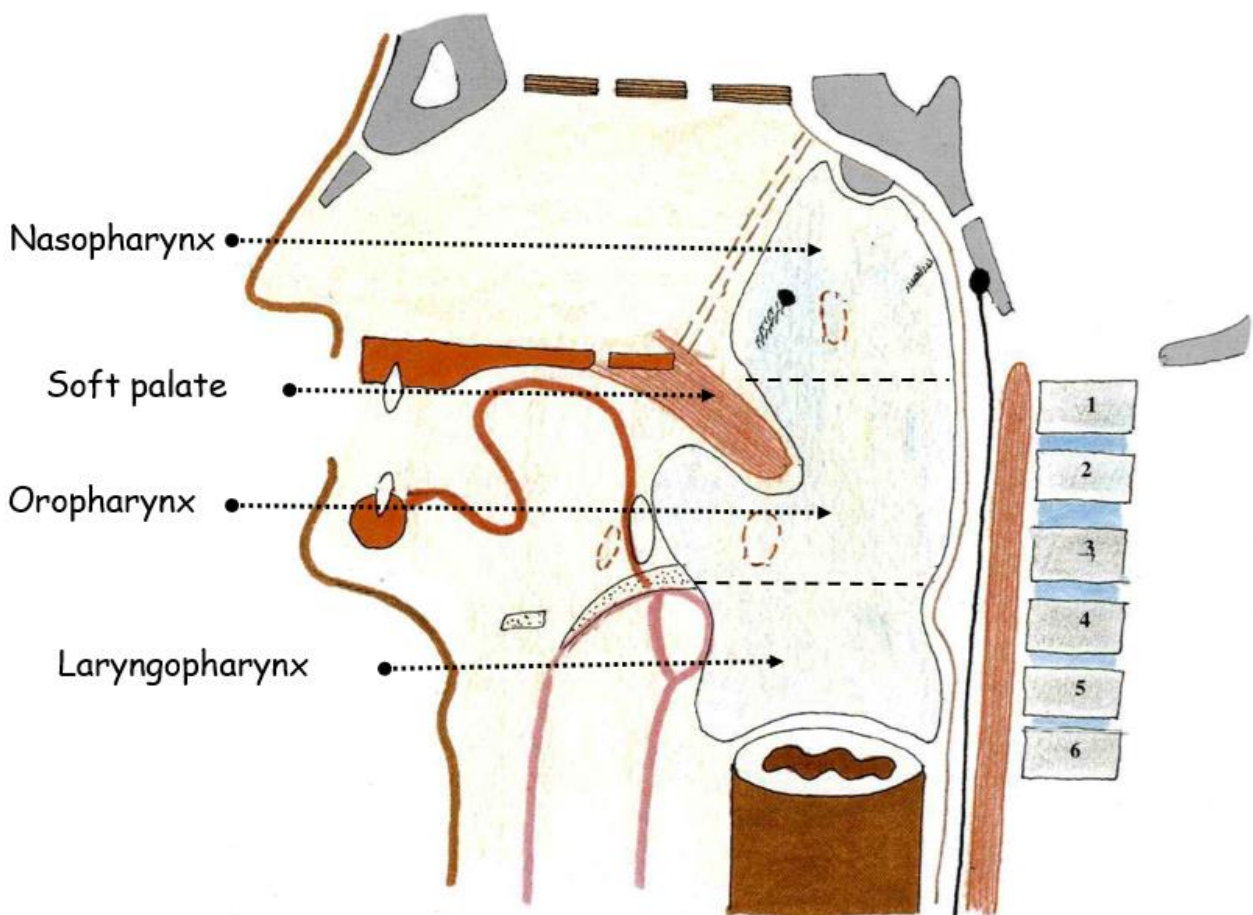


Figure 1: Sagittal section of the pharynx showing its three parts

III. STRUCTURE

The fibromuscular wall of the pharynx is made of four layers.

A- MUCOUS MEMBRANE

From the outer to the inner layer, the mucous membrane is lined by a squamous non-keratinizing epithelium in the oropharynx and laryngopharynx and by a ciliated columnar epithelium in the nasopharynx; they rest on a lamina propria rich in elastic fibres.

The submucosa contains mucous glands and lymphoid follicles, the pharyngeal tonsil, tubal tonsils towards the tubal elevation in the nasopharynx, lingual tonsils on both sides of the posterior part of the tongue and palatine tonsils in the oropharynx forming the Waldeyer's ring.

The tubal elevation is formed by the trumpet-shaped medial end of the tubal cartilage.

The pillars of the fauces are formed by underlying corresponding muscles.

The soft palate consists of an aponeurosis acted by the pillars muscles as well as the tensor palati, levator palati and the muscle of the uvula.

B- PHARYNGOBASILAR FASCIA

The pharyngobasilar fascia is a rigid immobile membrane consisting of a dense thickening of the submucosa. It fills in the gap between the skull and the upper border of the superior constrictor and represents the aponeurosis of the soft palate.

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The pharyngobasilar fascia keeps the pharynx always open for breathing. Although, its resistance decreases from the top to the bottom and is continuous with the adventitia of oesophagus.

On the pharyngeal tubercle, is inserted the pharyngeal raphe, a midline thickening of the fascia, that receives fibres from the constrictor muscles. The pharyngobasilar fascia is also inserted on the front of the carotid canal in the petrous part of the temporal bone and along the sphenopetrosal suture. It has a large recess almost filled by levator palati muscle towards the pharyngeal recess, the cartilaginous part of the auditory tube slopes backwards and laterally below it. Forwards, the fascia is inserted on the sharp posterior border of the medial pterygoid plate down to the hamulus towards the site of Passavant's ridge and on the thyrohyoid membrane and the thyroid and cricoid cartilages through the sphenomandibular ligament and the mylohyoid line of the mandible.

C- MUSCULAR WALL

The muscular wall of the pharynx is surprisingly thin despite being made of three curved sheets of muscle. They overlap posteriorly being telescoped into each other like three stacked cups; they unite at the level of the median raphe that constitutes their insertion.

Namely, three muscles are distinguished, the superior constrictor, the middle constrictor and the inferior constrictor. They are supplemented by three smaller muscles, the stylopharyngeus, the palatopharyngeus and the salpingopharyngeus muscles.

The palatoglossus muscle rises the palatoglossal arch.

The palatopharyngeal muscle rises the palatopharyngeal arch.

The superior constrictor muscle of the pharynx is inserted, from top to bottom, onto the sharp posterior border of the medial pterygoid plate just below the cartilaginous part of the auditory tube down to the hamulus, the pterygomandibular raphe behind buccinator muscle, the posterior end of the mylohyoid line towards the posterior border of the last molar tooth and the lateral border of the tongue.

It sweeps around the pharynx, its fibres diverging mostly upwards to meet their opposite fellows at the midline pharyngeal raphe.

The gap laterally between the superior and middle constrictors is plugged by the back of the tongue and traversed by structures that pass from outside the pharynx to inside the mouth, namely, the stylopharyngeus muscle, the glossopharyngeal and the lingual nerves.

The middle constrictor muscle of the pharynx arises from the angle between the stylohyoid ligament on the lesser horn and the greater horn of hyoid bone, it sweeps around the pharynx to end in the median raphe.

The middle constrictor encloses the superior constrictor and is enclosed by the inferior constrictor.

The gap between the middle and inferior constrictors is closed by the thyrohyoid membrane.

The inferior constrictor has a trapezoidal shape and consists of two muscular heads named from their origins.

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The thyropharyngeus arises from the oblique line of the thyroid cartilage and from a fibrous arch continuous with the latter and spanning the cricothyroid muscle, it encloses the middle and superior constrictors as its fibres curve around to the midline raphe.

The cricopharyngeus is rounded and thicker, it extends uninterruptedly from one side of the cricoid arch to the other around the pharynx with no raphe and is continuous with the circular muscular coat of the oesophagus for which it acts like a sphincter.

Between the two heads, is a weak zone, Killian's dehiscence.

The contraction of the constrictors of the pharynx narrows the pharyngeal cavity, the superior constrictor forms a mucous fold isolating the nasopharynx during deglutition and the inferior constrictor is a sphincter that inhibits airflow in the oesophagus. Its action produces the elevation of the pharynx and larynx.

The stylopharyngeus muscle arises from the deep aspect of the styloid process high up, it slopes down and expands across the internal carotid artery, in front of which it crosses the lower border of the superior constrictor and passes down inside the middle constrictor.

The stylopharyngeus muscle lies behind the palatopharyngeus and is inserted into the posterior border of the thyroid lamina and the side wall of the pharynx.

Its action produces the elevation of the pharynx and larynx.

The salpingopharyngeus muscle is a very slender muscle that arises from the lower part of the cartilage of the auditory tube and runs downwards to blend with palatopharyngeus. It raises

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the salpingopharyngeal fold. Its action produces the elevation of the pharynx and opens the auditory tube during swallowing.

The palatopharyngeus muscle is internal to superior constrictor muscle.

D- BUCCOPHARYNGEAL FASCIA

Unlike the pharyngobasilar fascia, the buccopharyngeal fascia is thin. It consists of a delicate epimysium of the pharyngeal constrictors continuous over the pterygomandibular raphe with the epimysium over buccinator.

IV. ANATOMICAL RELATIONS

A- BACKWARDS AND Laterally

The pharynx stands in front of the prevertebral fascia from which is separated by a dead space continuous with the posterior mediastinum, the retropharyngeal space.

Laterally, the retrostyloid region of the parapharyngeal space books passage to the internal carotid artery, the internal jugular vein, the vagus nerve, the glossopharyngeal nerve, the accessory nerve and the hypoglossus nerve.

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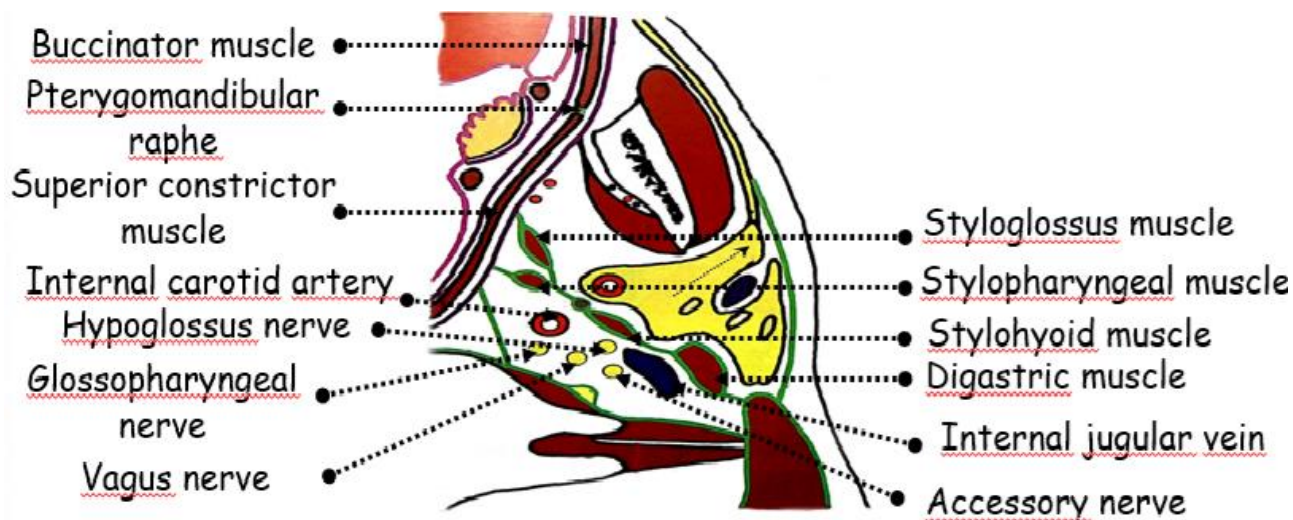


Figure 2: Horizontal section of the face at the level of the axis showing the parotid gland

B- FORWARDS

Forwards, the pharynx is widely opened. The three anterior openings of the pharynx are the choanae which open into the nasal cavity, the lateral glossoepiglottic folds and posterior part of the tongue that constitute the boundaries of the anterior wall of the oropharynx and the aditus which is the laryngeal inlet.

C- UPWARDS

Upwards, the pharynx is attached to the pharyngeal tubercle of basiocciput through its median strong raphe and more posteriorly to the body of the sphenoid. The auditory tubes open laterally in front of the pharyngeal recesses.

V. BLOOD SUPPLY; LYMPH DRAINAGE AND NERVE SUPPLY

A- ARTERIES

The arteries of the pharynx are branches of the external carotid and subclavian arteries.

The superior thyroid artery supplies the pharynx through the superior laryngeal artery.

The facial artery supplies the pharynx through the ascending palatine branch.

The ascending pharyngeal artery and maxillary artery through the artery of the pterygoid canal, the superior pharyngeal and the greater palatine arteries supply the pharynx.

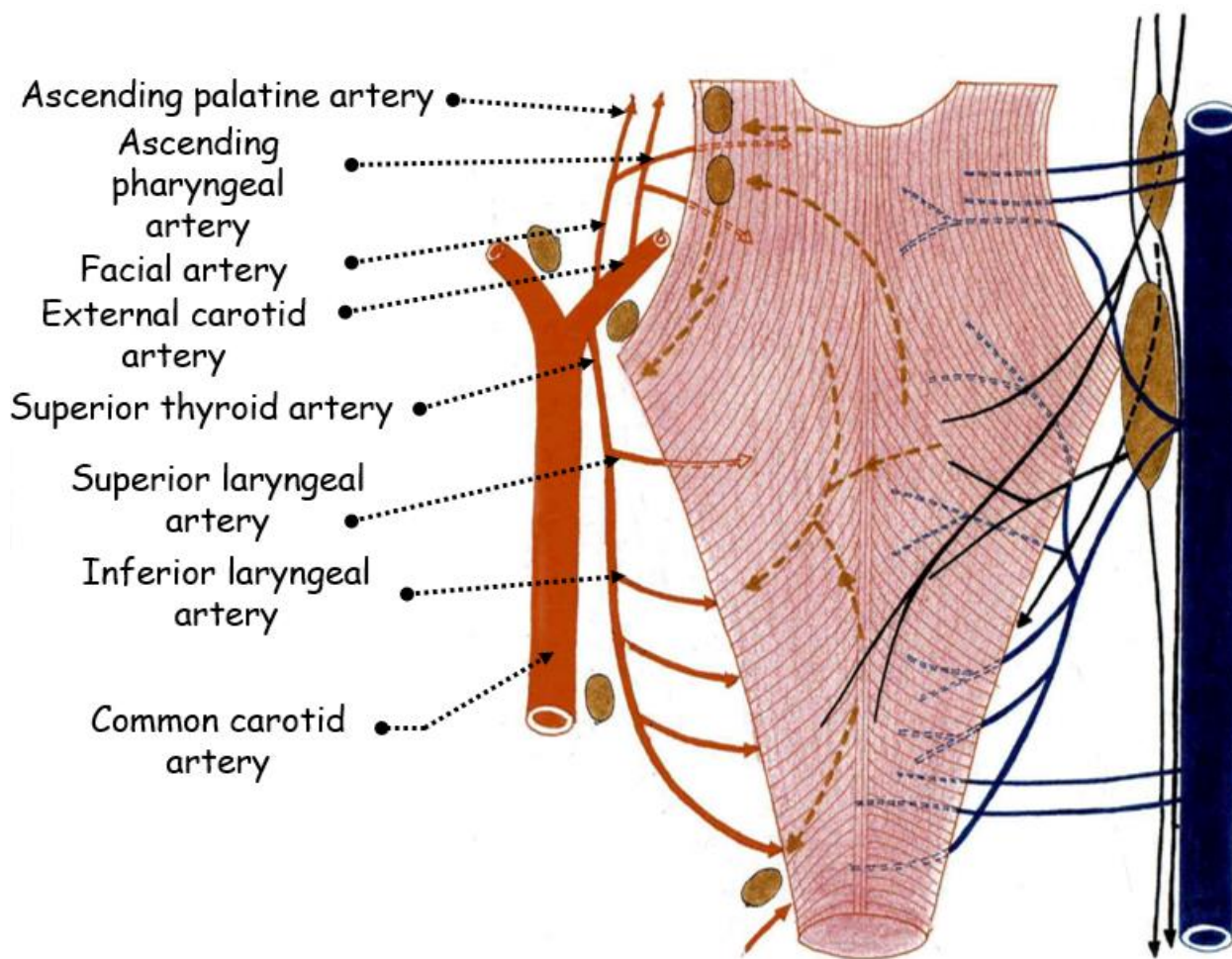


Figure 3: Posterior view of the pharynx showing its blood supply

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The inferior thyroid artery and the lingual artery through dorsal lingual branches are, also, arteries of the pharynx.

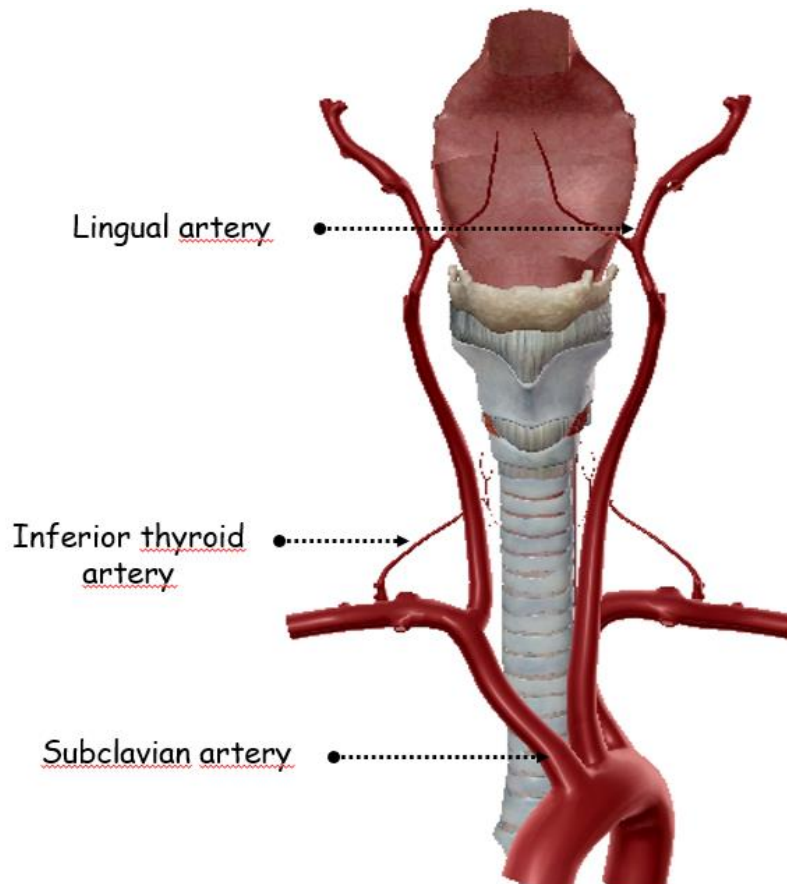


Figure 4: Anterior view of the aerodigestive tract showing the arteries of the pharynx

B- VEINS

The venous drainage of the pharynx flow into the pharyngeal venous plexus at the back of the middle constrictor.

The pharyngeal plexus drains into the pterygoid plexus or directly into the internal jugular vein.

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From the lowest part of the pharynx, blood finds its way to the inferior thyroid veins to the subclavian vein.

C- LYMPH DRAINAGE

The retropharyngeal nodes drain the pharynx and flow into upper and lower deep cervical nodes, namely, the jugulodigastric group and jugular group.

D- NERVES

The pharyngeal plexus at the back of the middle constrictor ensures the nerve supply of the pharynx. It is made up of the pharyngeal branches of glossopharyngeal, vagus and superior cervical ganglion.

Its sensitive fibres are held by the glossopharyngeal nerve.

The motor fibres come from the vagus for constrictors and glossopharyngeal for stylopharyngeal.

VI. SURGICAL APPROACH

The older method of removing tonsils by guillotine has given place to a more precise approach. The tonsil is dissected away from the tonsillar bed by cutting through the mucous membrane at the margins of the arches, starting at the upper pole and working down and keeping close to the tonsillar capsule. Undue haemorrhage may arise from the paratonsillar vein; arterial haemorrhage should only be a hazard if the tonsillar bed has been penetrated—the tonsillar and

ascending palatine arteries and rarely an unusually tortuous facial artery lies on the outer side of the superior constrictor. The internal carotid artery should be more than two centimetres away, but even this has been known to curl to the pharyngeal wall and be damaged. The glossopharyngeal nerve is at risk if the lower part of the superior constrictor is penetrated.

VII. CONCLUSION

The pharynx is a hollow muscular organ and represents the most posterior viscera of the neck.

It consists of three anatomically independent parts but functionally intricate ensuring multiple major functions. The pharynx has diverse blood supply, lymph drainage and nerve supply.
