Anatomy of Waldayer's Ring

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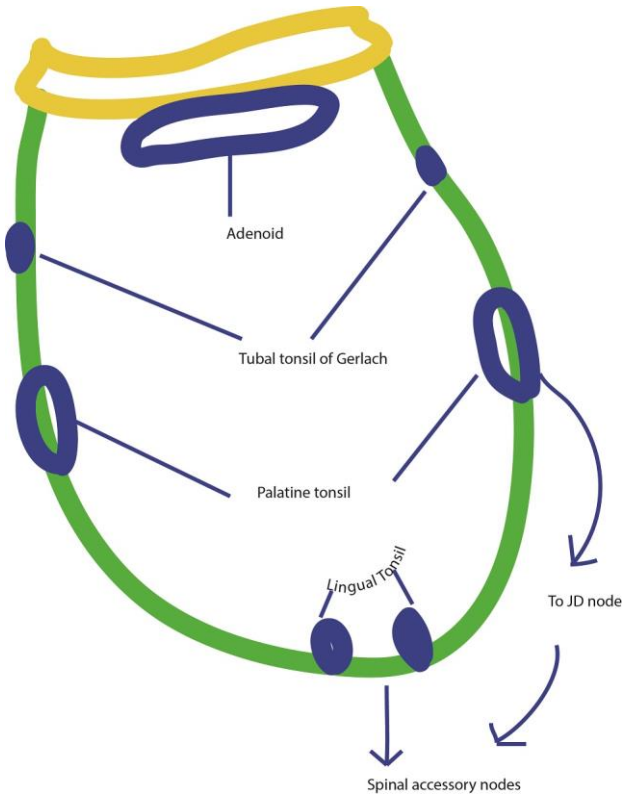
Components of Waldayer's ring



Adenoid one in number
Palatine tonsils two in number
Tubal tonsils two in number
Lingual tonsil two in number

Waldayer's ring also known as pharyngeal lymphoid ring named after named after the nineteenth-century German anatomist Heinrich Wilhelm Gottfried von Waldeyer-Hartz. This is a ringed arrangement of lymphoid tissue in the pharynx. It surrounds the naso and oropharynx. Some of the tonsillar tissue are located above and some below the soft palate.

Waldayer's ring can be classified into outer and inner rings of lymphoid tissue. The cervical lymph nodes constitute the outer ring.

Waldayer's ring is involved in the production of both B and T lymphocytes. It serves as an antigen sampling centre where extraneous antigens are caught and sampled in order to stimulate the immune mechanism. Antigen from inspired air are trapped by adenoid and tubal tonsils. Ingested antigen are sampled by palatine and lingual tonsils.

Components of Inner Waldayer's Ring

1. Adenoid
2. Palatine tonsils
3. Tubal tonsils
4. Lingual Tonsils

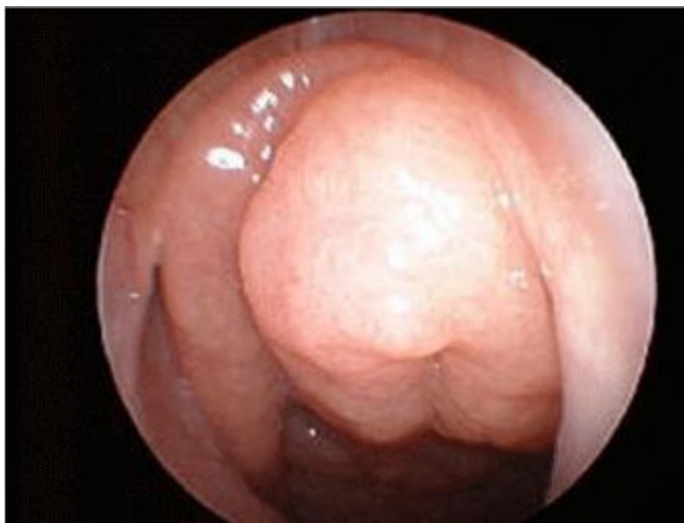
Adenoid

Nasopharyngeal tonsil or adenoid was first described by Santorini in 1724. He used the term Luschka's tonsil to describe the adenoid tissue. In 1868 the Danish physician Meyer termed adenoid as vegetations in the nasopharyngeal cavity.

1. Adenoid tissue can be identified at the 4-6th week of gestation
2. It lies within the mucous membrane of the roof and posterior wall of nasopharynx
3. Adenoid tissue may extend up to the fossa of Rosenmuller and up to the Eustachian tube orifice as Gerlach's tonsil
4. Adenoid is visible from the age of 4 months. It grows continuously during infancy and plateaus between 2 and 14 years of age.
5. Volume wise adenoid is relatively large when compared to the volume of nasopharynx in children belonging to 7 age group

Embryology

Adenoid tissue develops from median pharyngeal recess which forms just under the basi occipital area as a depression or recess of mucous membrane. This pocket of tissue was erroneously named SeesseVs pocket and is known to disappear in the human embryo during the development of pituitary gland. Its embryological significance is still under doubt, but the site corresponds to the point at which the notochord remained unseparated from the dorsal wall of the embryonic pharynx. Lymphoid tissue is developed in its walls immediately after birth, and in the mucous membrane around it. It develops behind the oral plate. The adenoid tissue of the nasopharynx continues to increase in size until puberty after which it undergoes atrophy.



Blood supply:

1. Ascending pharyngeal artery

2. Ascending palatine artery

3. Pharyngeal branch of internal maxillary artery

4. Artery of pterygoid canal

5. Contributions from tonsillar branch of facial artery

Venous drainage from the adenoid is through the pharyngeal plexus which in turn drain into the internal jugular vein.

The adenoid normally enlarges during childhood between 3 - 4 years. This is a period during which the child is most prone to respiratory infections. As the child grows older the adenoid regresses in size, may even disappear during puberty. The initial reduction in the size of adenoid has been attributed to the rapid enlargement of the nasopharynx when compared to the size of the adenoid.
A large adenoid causes nasal obstruction, mouth breathing, snoring and restless sleep. It even causes change in voice i.e. rhinolalia clausa. Enlarged adenoid causes typical changes in the face of young children. These changes are collectively clubbed under the term adenoid facies. This is caused due to chronic mouth breathing during active stage of facial skeletal growth.

Lymphatic drainage – To the retropharyngeal group of nodes and from there to upper deep cervical nodes. Drainage commonly occurs to the nodes in the posterior triangle of neck.

Nerve supply – Sensory nerve supply usually is from glossopharyngeal and vagus nerves.

Adenoid Facies:

1. Elongated face

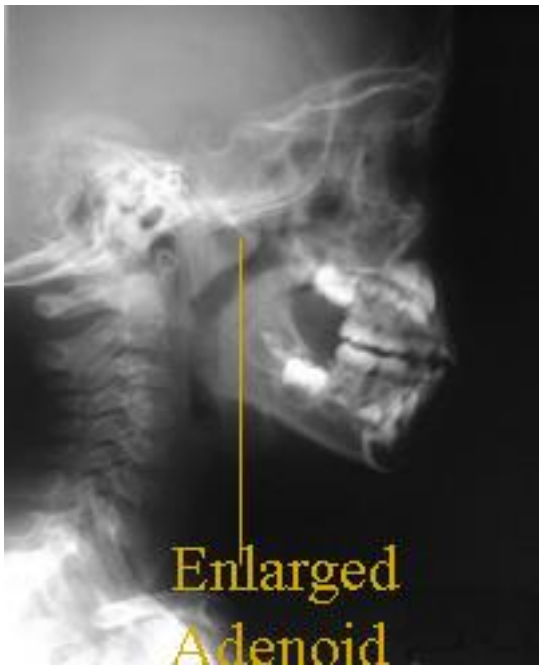
2. Pinched nostrils

3. Open mouth

4. High arched palate

5. Shortened upper lip

6. Vacant expression



Differences between adenoid and palatine tonsils

Adenoid	Tonsils
Single	Two in Number
Unencapsulated	Encapsulated
Has furrows	Has crypts
Present in nasopharynx	Present in oropharynx
Lined by ciliated columnar	Lined by squamous
Has both afferent and efferent Lymphatics	Has no efferents

Immune function of Adenoid

1. Adenoid produces antibodies

2. Adenoid produces B cells giving rise to IgG and IgA plasma cells

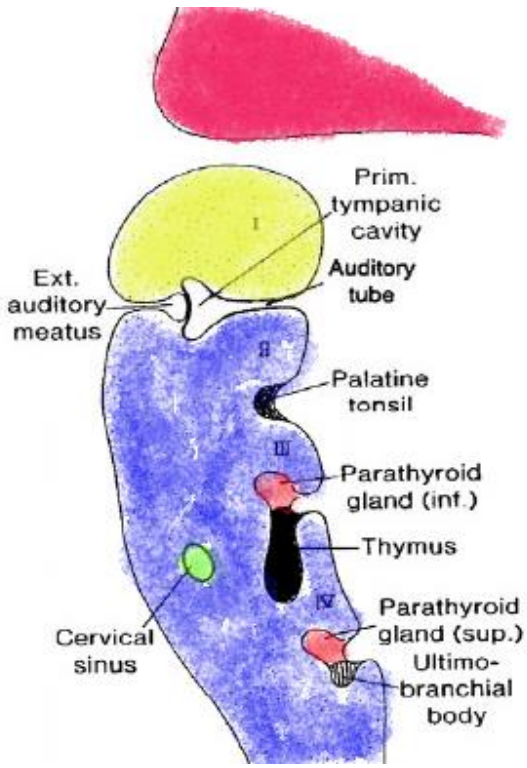
3. Plays an important role in the development of immunological memory in children

4. It is not desirable to remove adenoid during early childhood

Palatine Tonsils

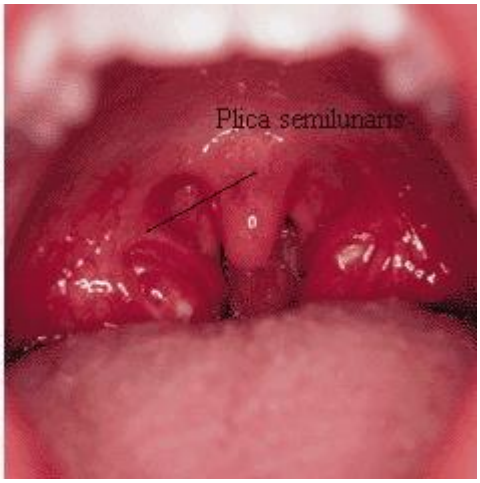
Palatine tonsils are the largest member of the inner waldayer's ring. It is almond shaped and lie on either side of the oropharynx. Developmentally tonsils arise from the ventral portion of the second pharyngeal pouch, i.e. ideally named as sinus tonsillaris. The trace of this sinus is present in tonsil as supra tonsillar cleft.

Embryology of Tonsil



Tonsil is lodged in the tonsillar fossa on either side of oropharynx. The tonsillar fossa lies between two pillars, anterior and the posterior pillars. The anterior pillar is formed by palato glossus muscle, the posterior pillar is formed by palato pharyngeus muscle. The outer aspect of tonsil is lined by condensed capsule formed by the pharyngobasilar fascia a specialized portion (it is also known to course the surface of the tonsil and extend into it to form septa that conduct nerves and vessels), deep to which lie the superior constrictor muscle, lateral to which is the Bucco pharyngeal fascia. The glossopharyngeal nerve and the stylohyoid ligament pass downwards and forwards beneath the lower edge of the superior constrictor in the lower part of the tonsillar fossa. These structures collectively constitute the tonsillar bed. The tonsil is virtually inseparable from its capsule, but the capsule is united by loose connective tissue to pharyngeal muscles, hence the tonsillar dissection is carried out in this plane.

The medial surface of the tonsil is free and faces the oropharynx. It is covered by non-keratinizing stratified squamous epithelium which is continuous with that of the lining of the oropharynx. A triangular fold of mucous membrane extends back from the palatoglossal fold to cover the anteroinferior part of the tonsil. This fold of mucous membrane is known as plica triangularis. In childhood, this fold is usually invaded by lymphoid tissue and becomes incorporated into the tonsil. A semilunar fold of mucous membrane passes from the upper aspect of the palatopharyngeal arch towards the upper pole of tonsil, thus separating it from the base of the uvula.



Tonsillar bed:

Structures forming tonsillar bed include – Superior constrictor muscle and Styloglossus muscle
Tonsil is separated from its bed by the presence of loose areolar tissue. This tissue facilitates easy dissection of tonsil from the tonsillar bed during tonsillectomy surgery.

Structures related to tonsillar bed:

1. Styloid process (if enlarged)
2. Glossopharyngeal nerve
3. Facial artery
4. Submandibular salivary gland
5. Posterior belly of digastric
6. Medial pterygoid muscle
7. Angle of mandible

Tonsillar pits:

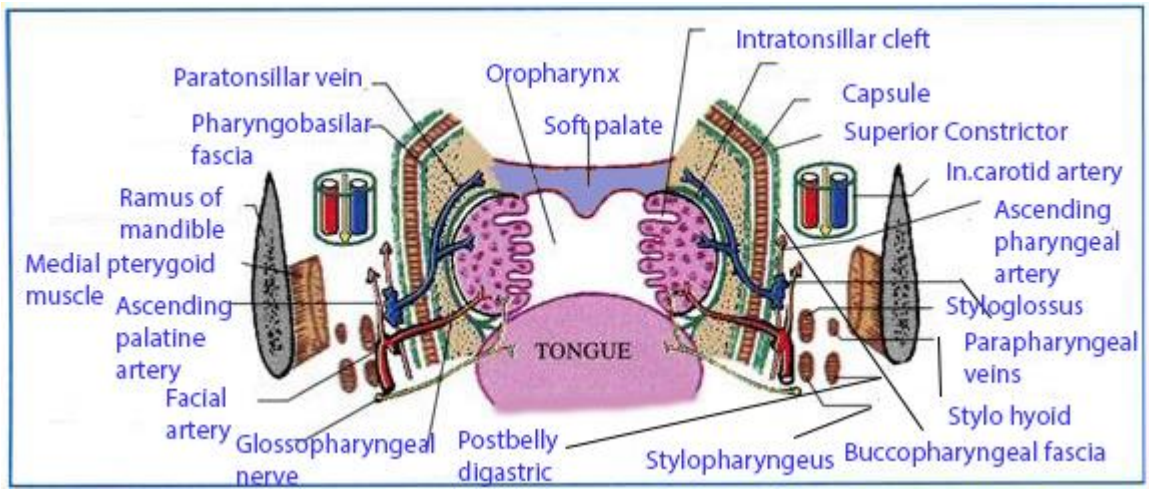
These are small openings present in the medial surface of tonsil. There are about 12 – 15 pits in each tonsil. Each of these pits lead to a mucosal tubule known as the tonsillar crypt. These crypts are surrounded by numerous lymphoid follicles.

Intratonsillar cleft:
This is a deep semilunar fissure present close to the superior pole of the tonsil and is present in nearly 40% of cases. This cleft is a remnant of second pharyngeal pouch.

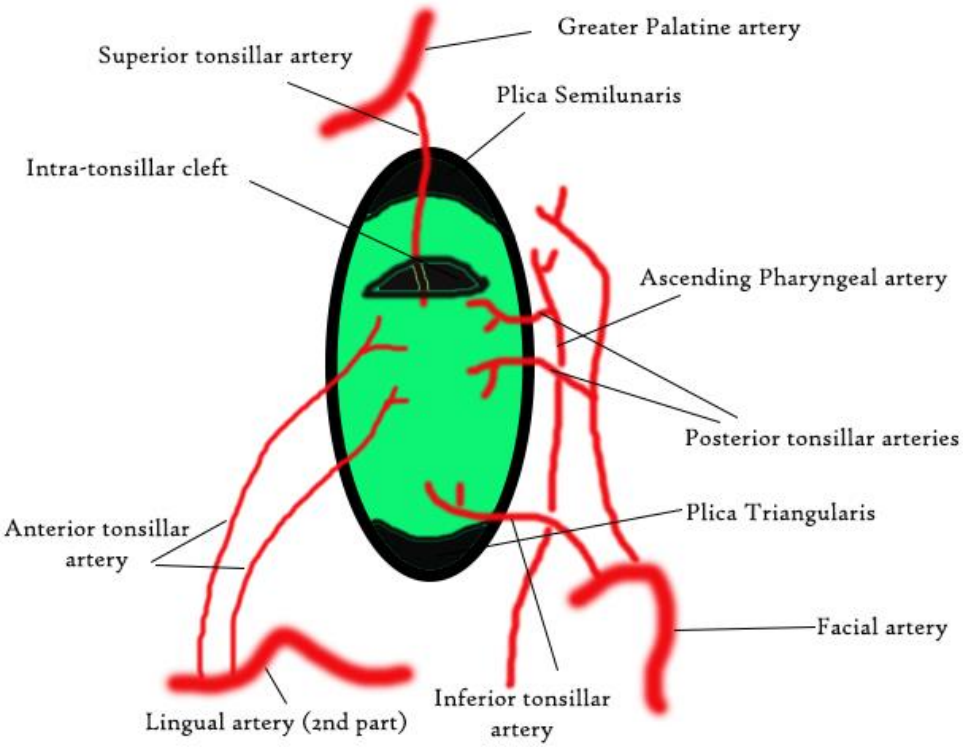
Embryonic folds:

Plica triangularis – This is a triangular fold of mucous membrane extends backwards from the lower part of palatoglossal arch. After birth this fold usually gest replaced by lymphoid tissue.

Plica semilunaris – This is a semilunar fold of mucous membrane arches backwards from the upper part of palatoglossal arch. After birth it is usually replaced by lymphoid tissue.



Blood supply of tonsil



The main artery of the tonsil is the tonsillar branch of the facial artery which enters the tonsil near its lower pole by piercing the superior constrictor just above the styloglossus muscle. Other arteries supplying the tonsil are lingual artery through its dorsal lingual branches, ascending palatine branch of facial artery, and ascending pharyngeal vessels.

Venous drainage occurs through the para tonsillar vein, and the vessels also pass through to the pharyngeal plexus or facial vein after piercing the superior constrictor.

Lymphatic vessels from the tonsil pierce through the buccopharyngeal fascia and pass to the upper deep cervical group of nodes, particularly to the jugulodigastric group.

Nerve supply to the tonsil is from the glossopharyngeal nerve.

Lingual Tonsil

lingual tonsils one on either side of posterior third of tongue close to its base. The circumvallate papillae lies anterior while the base of epiglottis lie posterior to it.

Embryology: Lymphoid aggregates seen in the posterior third of the tongue which develops between the 2nd and 3rd pharyngeal arches. This portion of tongue is studded with mucous glands and is also surrounded by lymphoid tissue. Presence of lingual tonsillar enlargement is usually asymptomatic. Sometimes lingual tonsil hypertrophy could lead to complications like difficulty in swallowing. Common cause of lingual tonsil hypertrophy is following tonsillectomy due to compensatory hypertrophy. GERD could well be another cause for lingual tonsil enlargement.