



Pharyngeal pouches & clefts – development of neck structures

The 5 week embryo is characterized by the presence of **4 pairs of pharyngeal clefts** and **5 pairs of pharyngeal pouches**, the last pouch is often considered a part of the 4th

The epithelial endodermic lining of pouches gives rise to important organs.

Cross section of the pharyngeal arches shows **pouches on the inner surface** of the pharyngeal arches and **clefts on the outer surface**

Derivatives of pharyngeal pouches :

1st pharyngeal pouch : (forms a tube)

- The **distal portion** of this pouch forms the **primitive tympanic cavity (middle ear cavity)** –will later contain (**incus +malleus + stapes bones**)
- The **proximal portion** forms the **auditory tube (Eustachian / pharyngeotympanic tube)** this tube connects the middle ear cavity to the pharynx (a way for spread of the infections)
- **The lining of the tympanic cavity aids in the formation of the eardrum (separates between external ear and middle ear)**

2nd pharyngeal pouch : (forms a depression)

- Forms palatine tonsil
- During 3 – 5 months the tonsil is infiltrated by lymphatic tissue
- Part of the pouch is found in adults as tonsillar fossa

3rd pharyngeal pouch : (forms 2 proliferations)

In the 5th week :

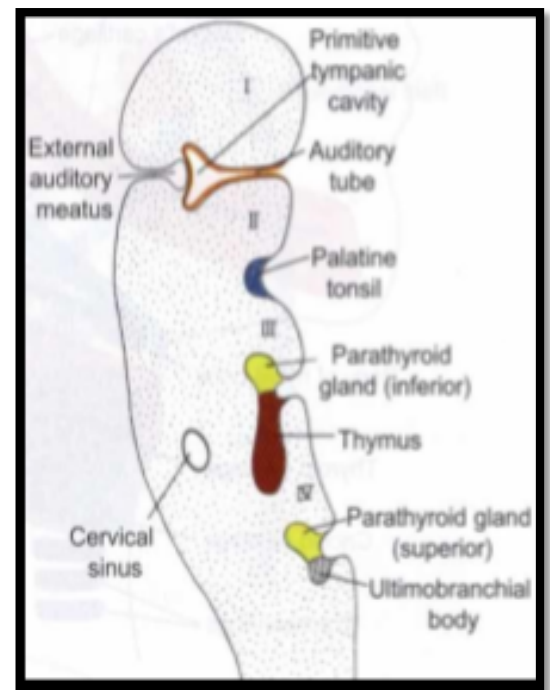
1. The epithelium of the **dorsal wing** of the 3rd pouch differentiates into **inferior parathyroid glands**
2. the **ventral wing** forms the **thymus**

Recall : parathyroid glands are 4 small glands are located at the **dorsal surface of the thyroid gland**,

- Both glands primordia lose their connection with the pharyngeal wall .
- The thymus migrates pulling the inferior parathyroid glands with it
- The thymus moves to it's final position in the thorax (where it fuses with it's counterpart)
- The parathyroid tissue of the 3rd pharyngeal pouch finally come to rest at the dorsal surface of the **thyroid gland**

4th pharyngeal pouch :

The epithelium of this pouch forms the **superior parathyroid glands**





When the parathyroid gland loses its contact with the **pharynx** it attaches itself to the migrating thyroid and finally it is located on the dorsal surface of the thyroid gland

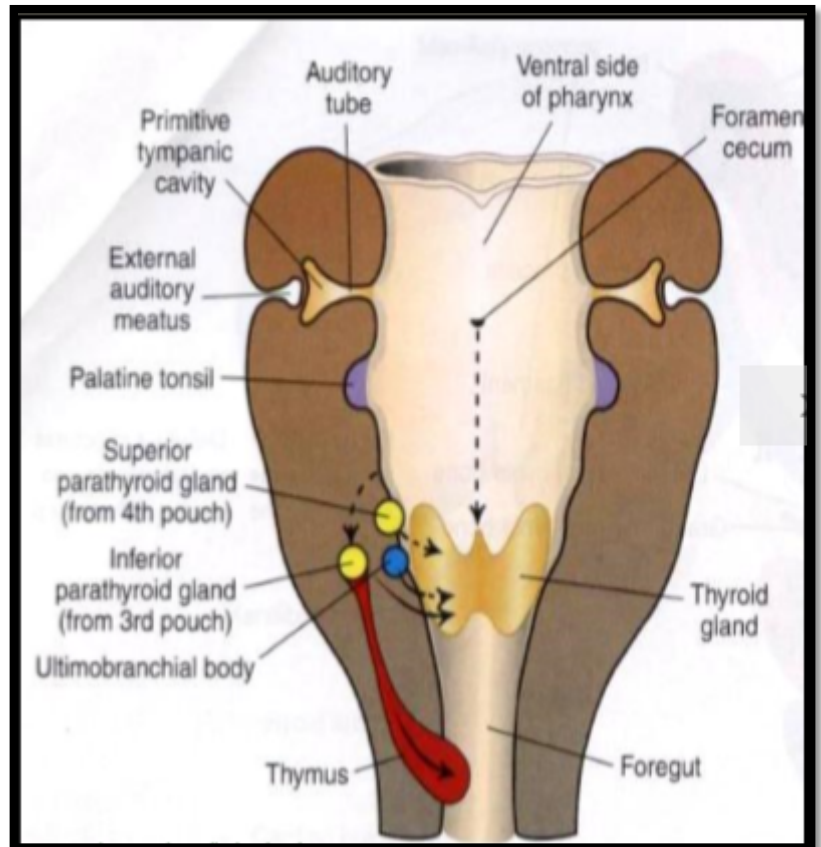
Q: the location of the parathyroid glands does not reflect their embryonic origin ?

A: the 4th pharyngeal pouch will form the superior parathyroid (remains in place) while the 3rd pharyngeal pouch forms the inferior parathyroid (will be pulled by the thymus)

5th pharyngeal pouch : (some books consider it to be part of the 4th others consider it to be separated)

It gives rise to the **ultimobranchial body** :

1. Incorporated into the thyroid gland
2. Gives rise to the c-cells (secrete calcitonin – a hormone involved in the regulation of calcium level in the blood)



Di – George syndrome : (3rd and 4th pharyngeal pouch syndrome)

(Low immune response due to problems in the thymus and parathyroid glands)

Abnormality in chromosome 22 → affects immunity due to the absence or underdevelopment of thymus and parathyroid glands

Symptoms :

- thymus hypoplasia
- hypoparathyroidism
- cleft palate
- micrognathia (reduced jaw)



Pharyngeal clefts

- pharyngeal clefts are seen in **5 week embryo** and in development almost completely disappear
- **1st pharyngeal cleft** gives the **external auditory meatus** + **participates in the formation of the ear drum**
- **2nd, 3rd, 4th clefts** are **overlapped by the proliferation of 2nd pharyngeal arch** and form a space lined by epithelium called **cervical sinus (lined by epithelium coming from ectoderm)** – finally these clefts lose contact with the outside
- **Failure of this embryonic process leads to the formation of cysts and fistulas**
- Cervical sinus disappears later on, **remnants of the cervical sinus (if the cervical sinus remains it will grow bigger in size)** causes **lateral cervical cysts in childhood (on one side or 2 sides – but normally one side only)**
If the cyst is open either to the internal or external → forms a fistula
 - Q: Ear drum is only formed by 1st pharyngeal cleft? FALSE- formed by 1st pharyngeal cleft and pouch
 - Q: cervical sinus is formed by? The 2nd, 3rd, 4th cervical clefts
 - Swelling at the lateral side of the neck (sterno mastoid muscles) → lateral cervical cysts due to the remnants of the cervical sinus

Development of thyroid gland

Thyroid =

1. Largest endocrine gland
 2. First endocrine gland to develop in the body (4th week of IUL)
 3. Originates as **proliferation of endoderm cells** in the floor of the **primitive pharynx** – 2nd pouch at the foramen cecum region
 4. The thyroid descends in front of the pharyngeal gut as **bilobed diverticulum** – with further development the thyroid gland descends in front of the hyoid bone and laryngeal cartilages
 5. During this migration the gland remains connected to the tongue by the **thyroglossal duct**
 6. By week 7 of embryonic development, the gland reaches its final position (anterior to the trachea) – now it has a median isthmus and 2 lateral lobes – the thyroglossal duct disappears
- Thyroid begins to function by 3rd month – **follicular cells** produce the **colloid that serves as a source of thyroxine and triiodothyronine**
 - **C-cells serve as a source of calcitonin**

NOTE : cecum = one end opening

The thyroid gland forms as one mass (structure) – the thymus gland forms as 2 halves

The developing thyroid is connected to its origin by the thyroglossal duct



Thyroid gland abnormalities :

- **Thyroglossal cyst :**

1. cystic remnant of the thyroglossal duct
2. may be located at any point along the pathway of the developing thyroid gland (middle of the neck)

- **Ectopic thyroid gland :**

1. Very rare
2. The thyroid fails to descend from the tongue area → lingual thyroid at the base of the tongue -Subjected to the same diseases as the gland itself
3. Must take this abnormality in consideration with any swelling at the tongue -Patient should be sent for thyroid gland investigations to exclude this abnormality
4. Incomplete descend (rare) results in cervical thyroid that is seen in the neck or just below the hyoid bone

Q : abnormal swelling in the middle of the neck → either ectopic thyroid gland or thyroglossal cyst

NOTE : usually ectopic thyroids are not treated , but cysts must be removed surgically

Ear development

External ear

1. Auricle = **originated from 1st & 2nd pharyngeal arches (6 hillocks)**
2. External auditory meatus (auditory canal) = **from the 1st pharyngeal groove**
3. Eardrum / tympanic membrane = **from ectoderm lining external auditory meatus and endoderm lining tympanic cavity**

Middle ear

- Tympanic cavity and auditory tube** = from 1st pharyngeal pouch (endoderm)
- The 3 ossicles (malleus , incus , stapes)** from the 1st and 2nd pharyngeal arches

Inner ear

Sacule + cochlea +organ of corti = from otic placodes (ectoderm)



DENTISCOPE.ORG



ASK@DENTISCOPE.ORG



DENTISCOPE