Embryology and Histology of Thyroid and Parathyroid glands

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Thyroid and parathyroid gland
Thyroid gland

Thyroid gland stores its hormones (in the form of colloid which is iodine bounded to thyroglobulin (glycoprotein) in cavities, surrounded by secretory cells, making up follicles. Colloid is an inactive precursor of T3 and T4. To secrete the hormone, the colloid is re-absorbed from the cavity of follicles, and then released into the surrounding interstitial spaces. Thyroid gland secretes iodine containing hormones called Tri-iodo thyronine (T3) and thyroxine (T4) of which T3 is more active. It regulates the basal metabolic rate, and it is regulated by the pituitary hormone TSH. Thyroid gland also secretes calcitonin - which regulates blood calcium levels. Secretion of calcitonin causes blood calcium levels to drop. Calcitonin secretion is directly dependent on blood calcium levels.
Colloid is an inactive precursor of T3 and T4. It is made up of a glycoprotein called thyroglobulin, made by the epithelial cells, thyroglobuline is bound to iodine. Iodine binds to the tyrosine residues of thyroglobulin when released as T3 and T4.

**Histology**

Thyroid gland contains **follicles** which are surrounded by simple cuboidal epithelium. Thyroid gland also contains **clear cells, parafollicular cells (C, cells)** that are scattered among the follicular cells. Parafollicular cells have a pale cytoplasm and they have a different embryological origin to the follicular cells. Parafollicular cells secrete **calcitonin** in response to increased levels of blood calcium.

In case of **hyperthyroidism**, the thyroid becomes enlarged, and hyperactive, and the follicles look smaller.
Development of the thyroid gland

The thyroid gland is the first of the body's endocrine glands to develop, on approximately the 24th day of gestation. It develops as a proliferation of endodermal epithelial cells in the floor of the pharynx between the tuberculum impar and the copula. That point later on is indicated by foramen cecum.

Thyroid gland descends as a diverticulum in front of the pharyngeal gut. During its migration, the thyroid gland remains connected to the tongue by narrow canal, the thyroglossal duct (this duct disappears later on). Thyroid gland descends further in front of the hyoid bone and the laryngeal cartilages and settles down in front of the trachea in the 7th week. The diverticulum divides into two lobes and a small median isthmus. Thyroid gland begins to function at the end of the 3rd month of fetal life.
The tongue appears in the embryo approximately at the 4th weeks in the form of two lateral lingual swellings and one medial swelling, the Tuberculum impar. These 3 swellings develop from the 1st pharyngeal arch. The posterior third of the tongue develops from the 2nd, 3rd and 4th pharyngeal arches.
The **Copula** is a swelling develops from the second pharyngeal arch, late in the 4th week. During the fifth and sixth weeks the copula becomes overgrown and covered by the hypopharyngeal eminence.

The **hypopharyngeal eminence** or **hypobranchial eminence** is a midline swelling of the third and fourth pharyngeal arches, it contributes to the development of the tongue. It appears in the fifth and sixth weeks of embryogenesis.

The hypopharyngeal eminence develops mostly from the endoderm of the third pharyngeal arch and only partially from the fourth pharyngeal arch. **Hypopharyngeal eminence** quickly grows to cover the copula formed earlier from the second pharyngeal arch, and will form the posterior one third of the tongue.
Development of tongue
Development of thyroid gland

- Foramen cecum
- Thyroglossal duct
- Pharyngeal gut
- Esophagus
- Trachea
- Tongue

A

- Migratory path of thyroid gland
- Pyramidal lobe of thyroid gland
- Thyroid gland
- Tracheal rings

B
Descending of the thyroid gland
Parafollicular cells (C, cells) of thyroid gland are derived from the Ultimobranchial body (derived from the 4th pharyngeal pouch endoderm).
Congenital anomalies
Thyroglossal cyst

Ask patient to protrude their tongue (thyroglossal cyst will rise)
Embryology and Histology of the Parathyroid Glands
Histology of Parathyroid gland
The parathyroid glands are four, superior and inferior pairs. They are embedded in the capsule of the thyroid gland posteriorly. Each gland contains two types of cells - chief or principle cells and oxyphil cells. The chief cells are small and pale eosinophilic staining. They secrete parathyroid hormone (PTH). Resting cells have paler cytoplasm than active cells. In adults about 80% of the cells are resting. In children, more cells are active.
The oxyphil cells are larger and lighter staining than the parathyroid chief cell. These cells can be found in clusters. Oxyphil cells appear at the onset of puberty, but have no known function.
PTH acts on osteoclasts, and the epithelial cells of the renal tubule, to increase plasma calcium by promoting bone resorption and increasing renal calcium absorption.
Parathyroid gland

- Adipocytes (lipocytes)
- Blood vessel
- Oxyphil cells
- Chief cells
Embryology of the parathyroid gland

At the 6th week of gestation, the parathyroid glands appear as a diverticula originate from the 3rd and 4th pharyngeal pouches endoderm, initially hollow and then solidifying with cell proliferation.

Interestingly, the inferior parathyroid originates from the third pharyngeal pouch and the superior arises from the fourth pharyngeal pouch. The adult anatomical position is the opposite of the fetal pharyngeal rostro-caudal order. This occurs due to the third pharyngeal pouch also giving rise to the thymus, the superior pair descend along with the thymus and settles down below the inferior pair behind the thyroid gland.
A. Development of the pharyngeal clefts and pouches. The second arch grows over the third and fourth arches, burying the second, third, and fourth pharyngeal clefts. B. Remnants of the second, third, and fourth pharyngeal clefts form the cervical sinus, which is normally obliterated. Note the structures formed by the various pharyngeal pouches.
Descent of the parathyroid glands, originated from the 3\textsuperscript{rd} pharyngeal Pouches below those originated from the 4\textsuperscript{th} pouches.
Hyperparathyroidism (Pathological condition)
Thank You