

THYROID GLAND SURGICAL ANATOMY

M. Shuja Tahir, Irfan Ahmad Mughal

Abstract: Thyroid gland is first endocrine gland to develop in the embryo. Thyroid gland is a brownish red and highly vascular organ. Thyroid gland is a bilobed structure present in the front of the neck. Its two lobes are joined by isthmus in front of the second and third tracheal rings. The thyroid gland has an abundant blood supply provided by four major arteries. Innervation of the gland is by sympathetic fibers from the superior and middle cervical sympathetic ganglia. The right recurrent nerve arises from descending vagus nerve, moves superiorly deep to common carotid artery and ventral to inferior thyroid artery.

Key words: Thyroid Gland, Superior thyroid artery, Recurrent Laryngeal Nerve, Foramen Cecum.

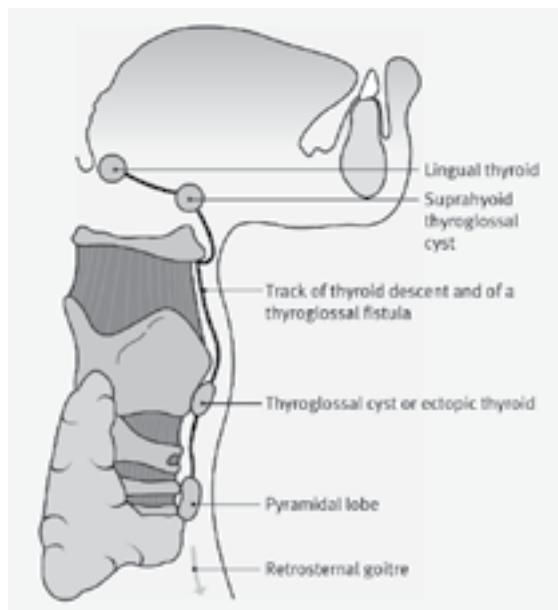
DEVELOPMENT OF THE THYROID GLAND

Thyroid gland is first endocrine gland to develop in the embryo.

Origin

It begins to form about 24 days after fertilization from a median endodermal thickening in the floor of the primordial pharynx. It arises between the primitive tongue bud and copula as a structure called foramen caecum. This thickening soon forms a small out pouching; the thyroid diverticulum. The developing thyroid gland descends in the neck and for a short time, the developing

thyroid gland is connected to the tongue by a narrow tube, the thyroglossal duct.



The path of descent is anterior to pharyngeal gut, hyoid bone and laryngeal cartilages.

The thyroid reaches in its final position in front of the trachea by the end of 2nd month of gestation.

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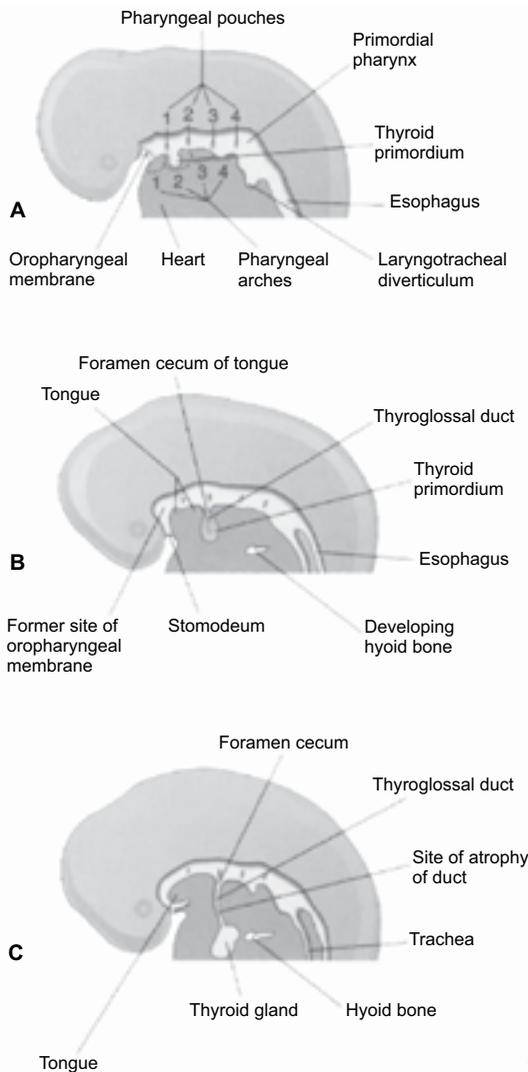
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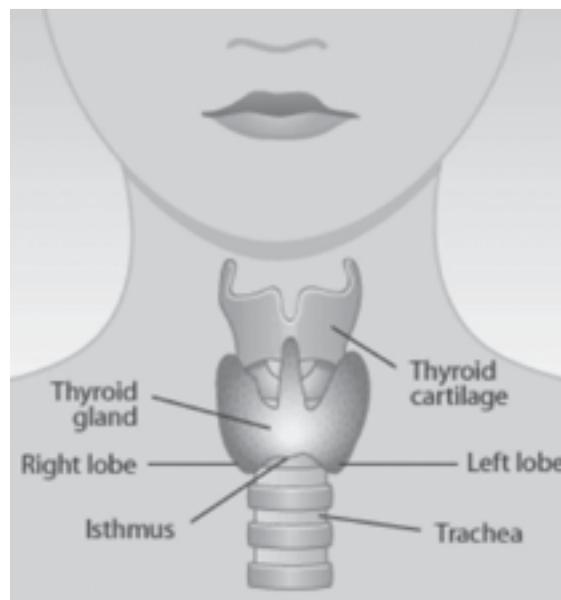


Thyroid Gland (Development)

The thyroglossal duct tissue, which has become solid, usually breaks up and disappears. If it is persistent, Thyroglossal duct may change into a cystic swelling of the neck called thyroglossal cyst which moves on sticking out tongue and swallowing. It may also open up to exterior in the neck as thyroglossal fistula which also moves on swallowing and sticking out tongue.

The pyramidal lobe is the portion of the gland often seen projecting upwards from the isthmus usually on left side to the midline. This is the representative of glandular tissue from caudal end of the thyroglossal duct. It is sometimes attached to the hyoid bone by fibrous tissue.

It is joined laterally by a pair of components originating from the ultimobranchial bodies of the fourth and fifth branchial pouches while descending to neck. These lateral components supply the “C” cells of the thyroid gland; Para-follicular cells (calcitonin producing cells).



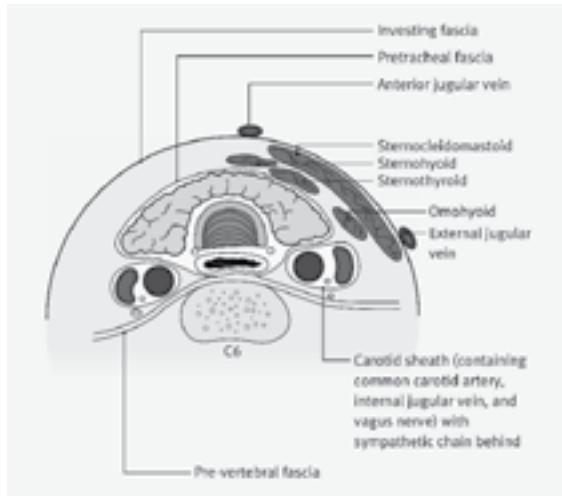
Thyroid Gland (Gross Anatomy)

GROSS ANATOMY

Thyroid gland is a bilobed structure present in the front of the neck. Its two lobes are joined by isthmus in front of the second and third tracheal rings.

Thyroid gland is a brownish red and highly vascular organ. It is placed anteriorly in the lower neck, level with the fifth cervical to the

first thoracic vertebra.



It looks like a butterfly or shield. It has its own fascial capsule and a surgical capsule which consists of investing layer of the pre-tracheal fascia. This anchors the gland posteriorly with the trachea and laryngopharynx causing it to move during swelling.

Thyroid gland is slightly heavier in females, and enlarges during menstruation and pregnancy.

Thyroid gland lies under the cover of sternothyroid and sterno-hyoid muscles to the sides of larynx and trachea.

The posterior surface of the isthmus is adherent to the trachea and so is the covering fascia. This fixation is responsible for the movement of thyroid with the larynx while swallowing.

A conical pyramidal lobe often ascends towards the hyoid bone from the isthmus or the adjacent part of either lobe. It is occasionally detached in two or more parts. Small masses of thyroid tissue may occur above the lobes or isthmus as accessory

thyroid glands.

Occasionally accessory thyroid tissue is found near the hyoid bone, superior mediastinum or beneath the sternomastoid muscle. Ectopic thyroid tissue can present as;

- a). Lingual.
- b). Median ectopic.
- c). Intra thoracic
- d). lateral aberrant.

Each lobe is about 5cm long. Its greater transverse and antero-posterior extents being about 3cms and 2cms respectively. Isthmus connects the lower parts of the lobes measuring about 1.2cms transversely and vertically.

Its weight in a newborn is about 1.5 grams and in adults about 25 grams. Each lateral lobe is pear shaped having narrow upper pole and wider base.

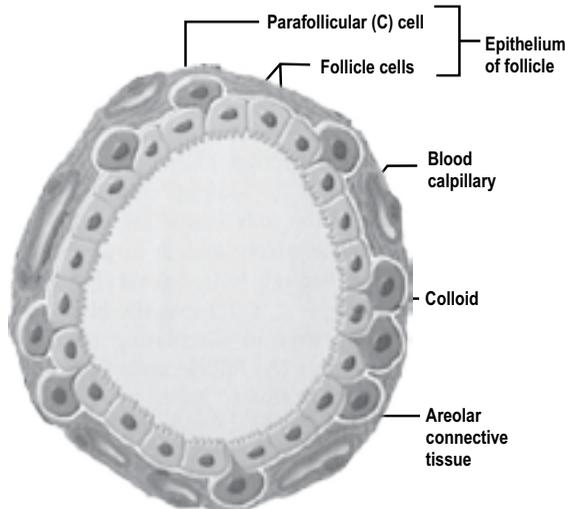
STRUCTURE

The thyroid is an important gland, but not essential to life. Its impaired development or impaired function during early gestational period may lead to severe disabilities such as cretinism or mental retardation. One fifth of the gland suffices to maintain its normal functioning. The thyroid gland is covered by a thin connective tissue capsule, from which five septa pass into the gland to divide it into distinct lobules.

The stroma is highly vascular and consists of reticular connective tissue containing lymphocytes and macrophages.

The parenchyma of the gland consists of follicles made up of a single layer of epithelial cells, enclosing a cavity, the follicular cavity,

which is usually filled with a gelatinous material called colloid. Amount of colloid varies according to the functional state of the gland.



Thyroid Gland (Transverse Section)

The thyroid follicles consist of follicular cells, which secrete thyroid hormones, Tri-iodothyronine and thyroxine (T3 & T4). In addition to follicular cells, the thyroid parenchyma also contains para-follicular cells, which secrete thyrocalcitonin.

BLOOD SUPPLY

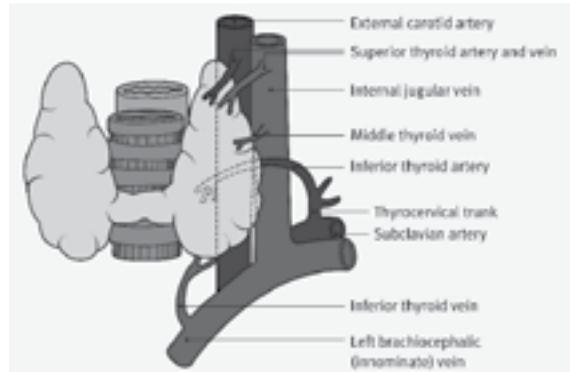
The thyroid gland has an abundant blood supply provided by four major arteries (two pairs).

It is very vascular organ. It receives 5% of the cardiac output, which is high in proportion to its weight and size. Normally it is supplied by two arteries and is drained by three veins.

Superior Thyroid Artery

The paired superior thyroid arteries arise as the first branch of the External Carotid Artery (ECA).

Each artery lies in relation to external laryngeal nerve. Its anterior branch supplies front of the gland and anastomose with the opposite counter part. Its posterior branch supplies the posterior side of gland and anastomose lower down with inferior thyroid artery on that side.



BLOOD SUPPLY

Inferior Thyroid Artery

The paired inferior thyroid arteries arise from the thyrocervical trunk of the subclavian arteries and enter the gland from a posterolateral position.

Each artery lies intimately in relation to the recurrent laryngeal nerve which normally lies behind the branches of inferior thyroid artery.

It supplies the lower pole and sends ascending branches which anastomose with the branches of superior thyroid artery.

The recurrent laryngeal nerve is likely to get injured during surgery of thyroid gland unless it is protected carefully after recognizing at the time of dissection.

Thyroid Ima Artery

It is seen in 3-12% of people. It is a branch of innominate artery or arises directly from arch of aorta.

Occasionally a fifth artery, the thyroid Ima artery is present, originating directly from the aortic arch or the innominate artery and ascending in front of the trachea to enter the gland in the midline inferiorly.

VENOUS DRAINAGE

A rich venous plexus forms under the capsule and drains to the internal jugular vein on both sides via the superior thyroid veins and the middle thyroid veins. The inferior thyroid veins leave the inferior poles bilaterally, usually forming a plexus that drains into the brachiocephalic vein.

The venous blood is drained by the following veins;

Superior Thyroid Veins

These drain the upper pole into internal jugular or common facial vein.

Middle Thyroid Veins

These drain from the middle of the lobe into internal jugular vein.

Inferior Thyroid Veins

These drain from lower pole of the gland into the brachiocephalic vein.

LYMPHATIC DRAINAGE

Lymphatic drainage of the thyroid gland is primarily to the internal jugular nodes.

Lymphatics follow the arteries and drain into following groups of cervical lymph glands:

Antero-Superior Group

The lymphatics from the upper pole and isthmus drain into antero-superior group of deep cervical lymph glands.

Postero-Inferior Group

The lymphatics from lower pole drain into postero-inferior group of cervical lymph glands.

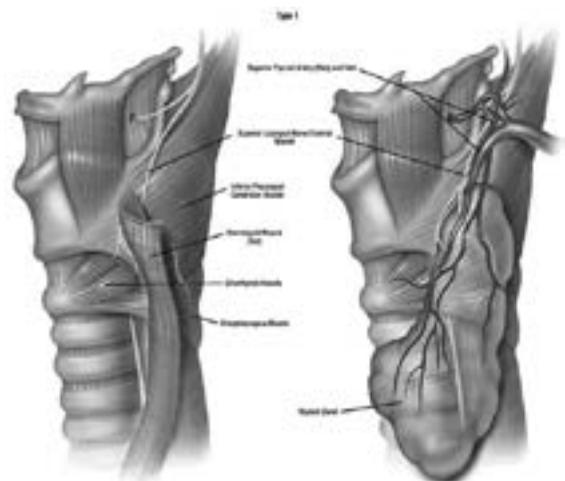
Pre-Tracheal Group

The inferior group drain the lower gland and empty into pre-tracheal and para-tracheal nodes.

Nerve Supply Of Thyroid Gland

Innervation of the gland is by sympathetic fibers from the superior and middle cervical sympathetic ganglia.

Parasympathetic fibers are derived from the vagus nerve and reach the gland via branches of the laryngeal nerves.



Superior Laryngeal Nerve

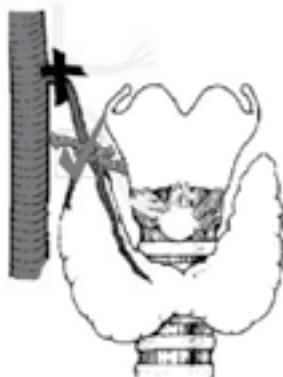
Superior Laryngeal Nerve

The superior laryngeal nerve arises from the inferior vagal ganglion in the retromandibular region and descends along the lateral wall of the pharynx deep to internal carotid artery. It follows the descending course of the superior thyroid artery and then bifurcates into internal and external branches.

Recurrent Laryngeal Nerve

The recurrent laryngeal nerve runs a different course on the right and left sides of the body. The right recurrent nerve arises from descending vagus nerve, moves superiorly deep to common carotid artery and ventral to inferior thyroid artery. After reaching the inferior pole of the thyroid, the nerve continues superiorly in the tracheoesophageal groove close to the posterior capsule of the thyroid gland. It passes beneath the inferior pharyngeal constrictor muscle and enters the larynx through the cricothyroid membrane.

To avoid injury to the external laryngeal nerve, the superior thyroid artery is ligated and sectioned near the superior pole of the thyroid gland where it is **not** so closely related to the nerve as it is at its origin.



In 1% of patients right recurrent laryngeal nerve arises from vagus nerve, passes medially from its origin with looping under inferior thyroid artery. This is non recurrent laryngeal nerve. On left side non recurrent laryngeal nerve is seen less often.

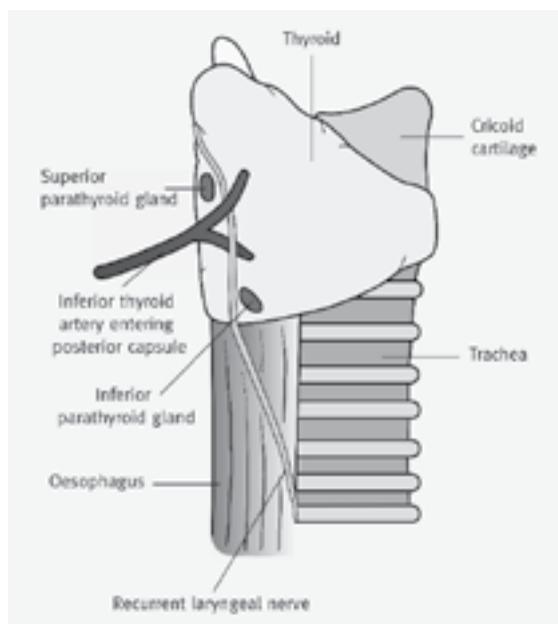
This anomaly is asymptomatic but surgeon must be aware of it.

The left recurrent laryngeal nerve arises from the vagus nerve. It lies anterior to the left surface of the descending aorta. The left recurrent laryngeal nerve at first runs superiorly and medially and becomes closely related to the ligamentum arteriosum and the

pulmonary artery. It reaches the left lateral surface of the thoracic trachea after ascent.

It approaches the medial surface of the gland from below. It lies in front of the groove between trachea and oesophagus at this level.

The recurrent laryngeal nerve passes through the branches of inferior thyroid artery. It is likely to be injured or caught in the ligature at this place.



Recurrent Laryngeal Nerve

The left recurrent laryngeal nerve lies behind the inferior thyroid artery. It always lies behind the pre-tracheal fascia. The nerve is recognized after careful dissection and protected from injury. The ligation of inferior thyroid artery is performed at the most peripheral part to avoid injury to recurrent laryngeal nerve.

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