

ANAESTHESIA AND THYROID GLAND

ESSAY

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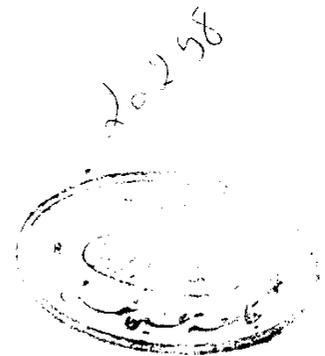
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ANATOMY OF THE THYROID GLAND

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The thyroid gland lies in the lower part of the front of the neck, opposite the fifth, sixth and seventh cervical and the first thoracic vertebrae, clasping the trachea and overlapping the sides of the larynx.

It is ensheathed by the pretracheal layer of the deep cervical fascia, and consists of a right and a left lobe united across the front of the trachea by the isthmus which overlies second, third and fourth tracheal rings. Its weight is somewhat variable but is usually 30gm, heavier in females in whom it slightly enlarges during pregnancy and menstruation.

The lobes are pyriform in shape, the apex of each is directed upwards and laterally reaching the level of the oblique line of the thyroid cartilage and below almost to the clavicle.

The base is at the level of the fourth or fifth tracheal ring. Each lobe is about 5cm long, its greatest width is about 3cm and thickness is about 2cm.

The postero medial part is attached to the sides of the cricoid cartilage by a ligamentous band while the lateral part is superficial and convex.

The gland is covered superficially with sternohyoid, sternothyroid and the upper part of the omohyoid (superior belly) and overlapped below by the anterior border of the sternomastoid. Its medial surface is moulded over the larynx and trachea, above it is in contact with inferior constrictor Ms. of the pharynx, the external laryngeal nerve passes deep to the muscle on its way to the cricothyroid muscle. (**Warwick & Williams, 1976**).

Below, it is related to the sides of the trachea in front and to the recurrent laryngeal nerve and to the oesophagus behind.

The postero-lateral surface is related to the carotid sheath and overlaps the common carotid artery.

The anterior border is related to the anterior branch of the superior thyroid artery. The posterior border is related to the inferior thyroid artery and its anastomosing branch with posterior branch of the superior thyroid artery.

The parathyroid gland is usually related to this border but is may be found in association with the posterolateral surface.

The isthmus is separated anteriorly by the pretracheal fascia from sternothyroid muscle, sternohyoid muscle more superficially the anterior jugular veins, the superficial fascia and skin. The anastomotic branch uniting the two superior thyroid arteries runs along its upper border. At its lower border the inferior thyroid leaves the gland. An occasional pyramidal lobe may be present attached to the isthmus or the left lobe. Levator glandulae thyreoidae is a muscular band that may be found between the hyoid bone above and the isthmus below.

Accessory thyroid glands are small detached portions which may be present on the isthmus or among the lobes. (Warwick & Williams, 1976).

The gland is supplied by the superior thyroid artery which arises from the first part of external carotid; it passes under the infrahyoid muscle and enters the upper pole of the thyroid lobes. The inferior thyroid artery arises from the thyrocervical trunk, a branch of the subclavian. It ascends along the medial border of scalenus anterior muscle as far as the level of the 6th cervical vertebra, then turns medially behind the carotid sheath to reach the middle of the back of the thyroid, and runs along the gland for a short distance

before entering its substance. Sometimes an additional branch (a. thyreoidea ima) arises from the innominate artery or the arch of aorta which ascends upon the front of the trachea. The arteries are remarkable for their large size and frequent anastomosis.

The superior thyroid vein emerges from the upper pole of the lobe and runs backwards, across the carotid arteries to enter the internal jugular vein.

The middle thyroid vein emerges from the lower part of the lateral border of the lobe and passes across the common carotid artery to join the internal jugular vein.

The inferior thyroid veins emerge from the isthmus or lower medial part of the lobe, and descend in front of the trachea to end in the left innominate vein. (Warwick & Williams, 1976).

Associated nerves:-

The external laryngeal nerve, which is a terminal division of the superior laryngeal branch of the vagus, runs downwards on the inferior constrictor, to end by supplying the cricothyroid muscle. Near its termination it is in fairly close proximity to the superior thyroid artery, and is liable to injury when the latter is secured.

The recurrent laryngeal nerve supplies all the intrinsic muscles of the larynx. It arises from the vagus- on the right side as it crosses the subclavian artery, and on the left side as it crosses the aorta, and ascends into the neck in the groove between trachea and oesophagus. Just before it enters the larynx it lies against the posterior surface of the thyroid gland, within its sheath and closely related to the termination of the inferior thyroid artery; it is therefore liable to be injured during ligation of the vessel. (Rintoul, 1978).

The parathyroid glands:-

These are two pairs of reddish brown glands each about the size of a small pea and ellipsoid in shape. They are situated usually in relation to the posterior aspect of the thyroid glands.

The superior gland is fairly constant in position, lying behind the upper one third of the lobe and related to the lateral surface of the trachea. It is stated that it lies invariably between the true capsule of the gland and its fascial sheath. It may however, be placed relatively forwards, in which case it is liable to be accidentally removed in the operation of subtotal thyroidectomy.

The inferior gland is situated usually behind the lower part of the lobe, either above or below the inferior thyroid artery as it enters the thyroid substance. Considerable variations, however, exist. The gland may be found behind the oesophagus, either in the neck or in the posterior mediastinum, or it may lie in the retro-sternal space. Occasionally it may be situated in the thyroid substance. (**Warwick & Williams, 1976**).

PHYSIOLOGY OF THE THYROID GLAND

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The normal thyroid gland weighs about 30gm. It consists of two lobes joined by an isthmus and is closely attached to the anterior and lateral aspects of the upper part of the trachea. The gland has a very rich blood supply and its estimated blood flow of 4-6ml/g/min is even higher than that through the kidneys (**Fletcher, 1982**). It has a large lymphatic drainage through which part of the stored thyroglobulins may enter the systemic circulation. The thyroid is innervated by the sympathetic system which probably supplies only the blood vessels (**Ganong, 1977**).

Microscopically, the gland consists of numerous acini or follicles about 200 μ in diameter. The wall of the follicle is lined by a cuboidal epithelium whose height varies with the degree of glandular stimulation (**Karamanian, 1977**). Each follicle contains a clear viscid proteinaceous amber-coloured colloid which normally comprises the greater part of the thyroid mass. The colloid consists mainly of iodinated thyroglobulin. With increased glandular activity the follicle becomes smaller, the cells columnar in shape and the colloid less abundant. Electron microscopy reveals many filamentous microvilli

projecting from the apices of the acinar cells into the colloid. Iodination of protein may occur within the follicle or in the acinar cells.

Resorption of colloid into the apical region of the acinar cells by pinocytosis is the prelude to the release of thyroxine from thyroglobulin (Keele & Neil, 1971), (Ganong, 1977).

Between the follicles there are parafollicular or C cells. Embryologically, they are derived from the ultimobranchial bodies (formed from the hinder part of the pharyngeal entoderm) which fuses with the thyroid in mammals (Ganong, 1977).

The follicular cells synthesize the iodine-containing thyroid hormones, thyroxine triiodothyronine and small amounts of reverse triiodothyronines (3,3,5-triiodothyronine); the parafollicular cells produce calcitonin (thyrocalcitonin) (Ganong, 1977).

FORMATION AND SECRETION OF THYROID HORMONES:

The main thyroid hormone is L-thyroxine an iodine containing amino acid. Small amounts of the more active L-triiodothyronine are also secreted besides reverse triiodothyronine.

Iodine Metabolism:-

Iodine is an essential raw material for the synthesis of thyroid hormones. The normal daily intake of iodine in food and water is about 100 µgm (Murkin, 1982). All iodine is converted to iodide in the gut and this form is completely and rapidly absorbed into the blood and extracellular fluid. About one-third is taken by the thyroid and about two-thirds excreted by the kidneys. The thyroid contains about 5000 µgm of iodine (90 per cent of the total iodine content of the body), most of which is in the form of iodinated amino acids (Ingbar & Woebar, 1981).

Hormone Synthesis:-

The acinar cells have two important functions:

- 1- They synthesize the glycoprotein thyroglobulin, which is stored within the follicle as colloid.
- 2- They selectively take up and transport iodine from blood to colloid where hormonal synthesis occurs (Surks et al., 1973).

The Iodine Trap:-

The thyroid gland can concentrate the inorganic iodide. The ratio of the thyroid iodide to plasma iodide (T/Pratio) is 25-50/1 this is a process requiring energy,