Histological, Histochemical and Immunofluorescent Studies of The Thyroid Gland In Major Thyroid Disorders

Thesis

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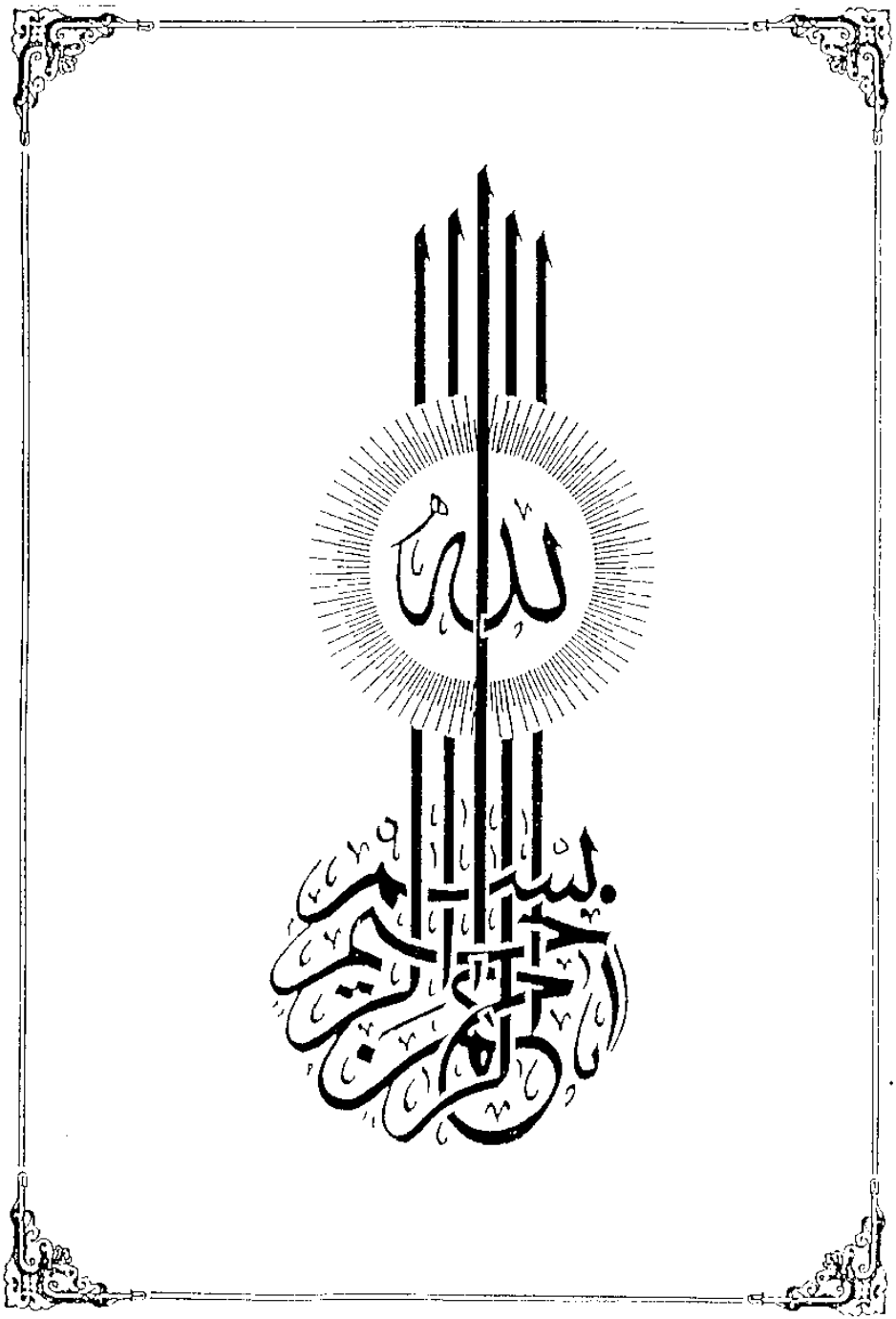

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Contents

Introduction

Introduction and Aim of the work

In the last few years the relationship between disorders of the thyroid gland and autoimmunity has become a question of common interest. Detection of thyroid antibodies is of great value in diagnosis, assesment of therapeutic effect and appropriate prognosis in thyroid disease.

A number of laboratory methods are used for the investigation of immune disorders. The immunofluorescent techniques developed by Coons et al., (1942) Coons and Kaplan (1950) have found wide application in this field. When these methods are used to test for circulating autoantibodies, the serum under examination is layered on to a normal tissue section as an antigen and autoantibodies become attached to various parts of the tissue e.g. antinuclear antibody becomes fixed to the cell nuclei.

Aim of the work

The aim of the present work is to study the histological, histochemical and immunological aspects of thyroid gland in a variety of major thyroid disorders and to correlate these aspects to the functional state of the thyroid gland.

The immunofluorescent aspect in this study will provide a trial to segregate different thyroid disorders of autoimmune origin.

Thyroid Gland

Anatomy of the thyroid gland

The thyroid gland is one of the largest endocrine organs, it weighs about 15-20 grams and extends from the 5th or the 6th tracheal ring inferiorly to the side of the thyroid cartilage superiorly.

The thyroid gland lying deep to the infrahyoid muscles is made up of two lobes of highly vascular glandular tissue joined together by an isthmus which lies over the second and third cartilagenous rings of the trachea.

Each lobe is conical in shape and measures about 2.5 cm in both thickhness and width and its largest diameter is approximately 4 cm.

Occasionally a pyramidal lobe is seen as a finger like projection extending from the isthmus upwards towards the hyoid bone to which it may be attached by a narrow strip of muscle, the levator glandulae thyroidae. A similar non muscular structure, the remnant of the thyroglossal duct may appear in this location indicating the embryonic path along which the thyroid gland has developed. Two pairs of parathyroid glands are embedded in its posterior surface. (Romanes, 1971).

Blood supply

The thyroid gland receives ample blood supply from

two main arteries, the external carotid and the subclavian.

The superior thyroid artery is usually the first branch of the external carotid. It passes inferiorly along the lateral edge of the thyrohyoid muscle, gives off branches and reaches the superior pole of the lateral lobe of the thyroid gland where it divides.
The inferior thyroid artery arises from the subclavian artery . An occasional small artery (Thyroidea ima) may arise from the brachiocephalic trunk or the left common carotid or the aortic arch.

The venous drainage is mainly through three pairs of veins : The superior and middle thyroid veins ending in the internal jugular vein and the inferior thyroid veins ending in the innominate vein of the same side or both join the left innominate. The thyroid blood flow ranges from 4 to 6 ml/min/gm which if compared to renal blood flow (3ml/min/gm) is considered a very well vascularization. (Hiatt and Gartener, 1982).

Lymph drainage

The gland is drained by two sets of lymph vessels ascending and descending. Each consists of medial and lateral channels.

The ascending vessels include a medial channel draining into the prelaryngeal gland and a lateral channel to the deep cervical glands. The descending vessels go medially to the pretracheal gland and laterally to the gland of the recurrent chain. (Du Plessis, 1975).

Nerve supply

The thyroid gland is supplied by branches from the cervical ganglia of the sympathetic trunk and from the cardiac and laryngeal branches of the vagus, therefore it is innervated by both adrenergic and cholinergic nervous system (Hiatt and Gartner, 1982).

Histology of the thyroid gland

The gland is covered by two capsules; the outer one is continuous with and is part of the pretracheal fascia , which in term is part of the deep cervical fascia. The inner capsule is regarded as the true capsule of the gland ; it consists of fibroelastic connective tissue and sends septa into the gland providing internal support and carrying blood vessles, lymphatics and nerves into its substance. These septa divide the gland into incomplete lobules.

Follicles

Thyroid follicles are both the structural and

functional units of the thyroid gland. A follicle consists of a layer of simple epithelium enclosing a cavity, the follicular cavity, which usually is filled with a gel-like material, the colloid.

In the normal thyroid gland the follicles vary from being irregularly rounded to tubular in shape measuring from 0.05 to 0.5 mm in diameter.

There are about 30 million follicles in the human thyroid gland packed together in a delicate reticular network that contains an extensive capillary bed.

Each follicle is surrounded by a basement membrane. There are apertures in these basement membranes allowing communications between adjacent follicles.

Follicular cells :

There are two kinds of epithelial cells in the thyroid follicles, the follicles cell proper and C cell.

Principal thyroid cells (follicular cells) are generally cuboidal in the normal gland having a height of 14-15 u, they have their apical ends facing towards the follicular cavity an their bases rest on a thin basement membrane.

The intercellular boundaries are distinct and fairly obvious under the light microscope. The principal cells become low cuboidal or even squamous in the relatively inactive gland. They enlarge and become tall columnar cells during periods of increased activity. (Doniach, 1967).

The nucleus is rounded and near the base of the cell, with the golgi apparatus lying between it and the lumen. In squanous follicular cells the nucleus is flat, in columnar cells it is spherical and relatively large. Mitochondria are scattered throughout the cell, vary in number with the activity of the cell.

The cytoplasm of the follicular cell is highly basophilic this basophilia increases with the activity of the cell, the cytoplasm also contains lipid droplets and PAS positive droplets (colloid resorption droplets).

An additional type of cell is occasionally seen in the follicle the colloid cell of langendorff; they are slender cells with darkly staining cytoplasm that often appears to be filled with colloid and they have pycnotic nuclei. They are degenerating cells. (Greep and Weiss, 1977).

Parafollicular cells :

In addition to the principal cells, there are the prarafollicular cells which are found singly or in small groups both within the follicle and within the interfollicular connective tissue. Those within the follicle are wedged between the principal cells and the basal lamima, they do not extend to the colloid cavity. The parafollicular cells are generally larger than the principal cell, and they have a lighter staining cytoplasm. They form thyrocalcitonin, a hormone that lowers blood calcium. These cells are rich in both mitochondria and glycerophosphate dehydrogenase.

At least 3 types of rounded bodies occur in the follicular cells most often above the nucleus :

1- pinocytosed colloid droplets (phagosomes)
2- lysosomes (which can be demonstrated by staining for acid phosphatase).
3- bodies arising from the fusion of the two previous type (phagolysosomes).

The thyroid colloid :

The cavity of the thyroid follicle is filled with a semifluid or gel-like substance, the thyroid colloid.

A number of large vacuoles may be seen in the colloid particularly at the junction of the colloid with the apical ends of the cells. These are due to shrinkage of colloid during preparation of the section. Neverthless, these vocuoles tend to occur more frequently in follicles with heightened activity. In colloid resroption, the colloid aslo becomes less dense and takes a lighter, more irregular stain. Thyroid colloid varies in its chemical composition as well as in its physical propereties. It is composed chiefly of nucleoproteins, thyroglobulin and proteolytic enzymes. It may also contain desquamated cells (Copenhaver et al., 1971). Thyroglobulin is an iodinated glycoprotein in which iodine and tyrosine are important constituents of a macromolecular complex.Both the amount of thyroglobulin in the colloid and the degree of iodination may vary. In sections stained by HX and E the colloid appears as a structureless acidophilic material.

The colloid is intensely PAS positive as are the intracellular colloid droplets. This reaction is not abolished by previous digestion with amylase. Although thyroglobulin contains sialic acid, glucoseamine, galactose, mannose and fucose it does not give the metachromatic reaction with basic thiazin dye that is characteristic of many acid mucopoly saccharides. (Greep and WEISS, 1977).