HYPOCALCAEMIA AFTER THYROID SURGERY PREDICTION, PREVENTION AND MANAGEMENT

Thesis

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INTRODUCTION

Thyroidectomy is one of the most common operations done today. The complications following thyroidectomy are well known, some of these can be fatal, others are quite disturbing particularly in their permanent form. The extent of resection, exposure of the recurrent laryngeal nerve, parathyroid gland identification, lack of surgical experience are all among risk factors which contribute for morbidity after thyroidectomy ***(Herman et al., 2002).***

Hypocalcaemia is a common complication following thyroidectomy. Although permanent hypocalcaemia is rare, it can pose significant problems. The symptoms are often distressing especially when severe; many patients require prolonged treatment and follow up before calcium levls revert to normal. It was noticed that the incidence of biochemical and clinical Post-operative hypocalcaemia was relatively high despite efforts to identify and preserve as many parathyroid glands as possible ***(See and Soo, 1997).***

The pathogenesis of transient hypoclacemia after thyroid surgery is not fully understood. The incidence of hypocalcaemia is relatively much common after total thyroidectomy (6.9% to 25%) than after subtotal thyroidectomy or hemithyroidectomy (1.6% to 9.1%). Permanent hypocalcaemia, which could be defined as hypocalcaemia lasting two months or more after thyroid surgery, is due to vascular necrosis and/or accidental removal of the parathyroid glands ***(Conn et al., 2006).***

Tetnay, tingling around the mouth and in the distal extremities are commonly seen with hypocalcaemia. The appearance of these symptoms is thought to be related to the degree of speed of decrease in calcium levels after thyroidectomy ***(Uruno et al., 2006).***

The etiology of post thyroidectomy hypocalcaemia is still a debatable topic. Many factors such as excision, devascularization and of parathyroid glands are involved. Moreover, the influence of surgical experience on the incidence of post thyroidectomy hypocalcaemia may be relevant. The importance of preserving the parathyroid glands and their blood supply is still not properly evaluated ***(Soon et al., 2005).***

Temporary hyplcalcaemia may be contributed to calcitonin release due to operative manipulation of the thyroid gland, reactive hypoparathyroidism due to relative hypercalcemia in thyrotoxic patients ***(See and Soo, 1997).***

AIM OF THE WORK

The aim of this study is to discuss causes of post thyroidectomy hypocalcaemia, its management and methods of prevention.

SURGICAL ANATOMY AND EMBRYOLOGY OF THE THYROID GLAND AND ITS RELATED STRUCTURES

If morbidity during and following thyroid surgery is to be minimized or avoided, and if high rates of success are to be achieved in restoring normocalcaemia in patients undergoing thyroid surgery, the surgeons must have detailed knowledge of the anatomy and embryology of the thyroid and parathyroid glands. The surgeon must be fully prepared to apply that knowledge during the course of operations on those organs ***(Scott-Conner, 2001).***

Embryology of the thyroid gland

The thyroid, earliest glandular structure to appear, is recognizable in 4mms embryo by the end of the third week as a bulge on the floor of the foregut. This thyroid diverticulum is an endodermal pocket protruding between the first and second pharyngeal arches. This area is later evaginated to form median bud which appears during the later half of the fourth week and from which the thyroid gland develops ***(Mann et al., 1995).***

It extends from the foreman caecum ventrally between the first and second pharyngeal arches then caudally in front of the remaining arches as far back as the commencement of the trachea. From its distal extremity the bilobed thyroid gland grows out, a portion of the distal extremity often remains as the pyramidal lobe. The thyroglossal duct passes ventral to the hyoid bone and it may

form a recurrent loop behind it. This is a common site of thyroglossal cyst. The duct may, however, occasionally passes behind or more rarely through the hyoid bone ***(Undelsman, 2001).***

The developing gland, at first an irregular plate, develops two lateral wings connected by the isthmus. Follicles appear during the second month of gestation and increase through the fourth month. Colloid formation and uptake of radioactive iodine begin at about the eleventh week ***(Krukoski, 2000).***

The ultimobranchial body which arises from a diverticulum of the fourth or fifth pharyngeal pouch of each side, amalgamates with corresponding lateral lobe. Parafollicular C-cells are derived from the neural crest and reach the thyroid via the ultimobranchial body ***(Mann et al., 1995).***

Recently, consideration has been given to the possibility that some C-cells are of endodermal rather than neural crest origin ***(Krukowski, 2000).***

Surgical anatomy of the thyroid gland and its related structures

Surgeons attempting operations on the thyroid gland must be well informed of the anatomy of the neck, including the thyroid gland, its blood supply and its nerve supply as well as the adjacent structures, the trachea, the larynx, the oesophagus and the

parathyroid glands. It is presented in a topographic manner describing the anatomy as it is encountered in thyroidectomy ***(Henry, 2005).***

Thyroid gland

Is situated in the lower part of the neck. It consists of two symmetrical lobes united by an isthmus that lies in front of the second, third and fourth tracheal rings. The lobes lie on either side the larynx or trachea, extending from the oblique line of the thyroid cartilage to the sixth tracheal ring. It weights 25 gram in addition to its own capsule; the gland is enclosed by an envelope of pre pretracheal fascia ***(Skandalakis et al., 1995).***

The lobes

Each lateral lobe is pear shaped, and appears approximately triangular on cross section with lateral, medial and posterior surfaces ***(Fig.1).*** The lateral surface is under cover of sternohyoid and sternothyroid muscles. The medial surface lies against the lateral side of the larynx and upper trachea, with the lower pharynx and upper esophagus immediately. This surface is related to cricothyroid muscle of the larynx, as well as to the external and recurrent laryngeal nerves. The posterior surface overlaps the medial part of the carotid sheath. The parathyroid glands usually lie in contact with this surface between it and fascial sheath ***(Bellantone et al., 2002).***

The Isthmus

It joins the anterior surfaces of the lower parts of both lobes and is firmly adherent to the second, third and fourth tracheal rings. Its measurement is 1.25 cm transversely and vertically. A small portion of the gland substance often projects upwards from the isthmus, usually to the left of the midline, as the pyramidal lobe. It represents a development of glandular tissue from the caudal end of the thyroglossal duct. It is attached to the inferior border of the hyoid bone by fibrous tissue and muscle fibers. It is named levator glandulae thyroid and is innervated by a branch of the external laryngeal nerve ***(Henry, 2005).***

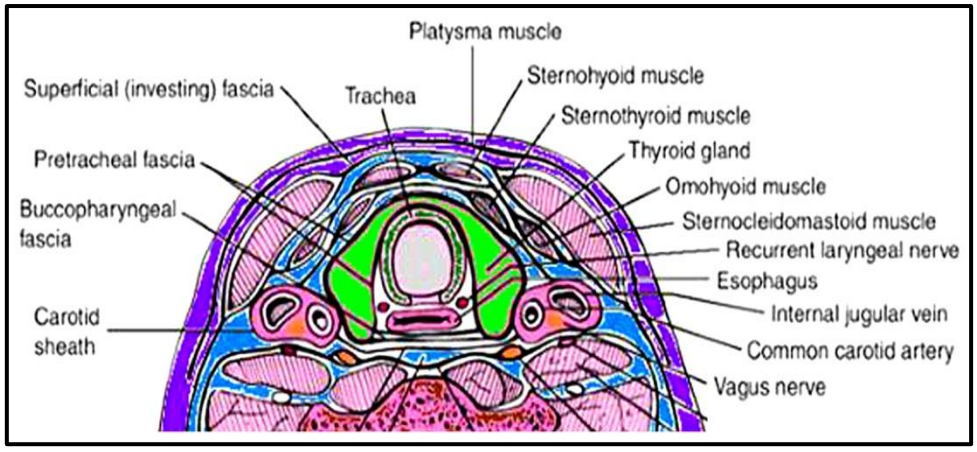

Fig. (1): Cross sectional anatomy of the neck at the level of mid thyroid gland ***(Bellantone et al., 2002).***

The Capsule

The thyroid gland has a connective tissue capsule which is continuous with the septa that make up the stroma of the organ. This is the true capsule of the thyroid ***(Bliss et al., 2000).*** Outside

the true capsule lies a layer of fascia derived from pretracheal fascia and is known as the false or surgical capsule. Anteriorly and laterally this fascia is well developed, while posteriorly it is thin and loose, permitting enlargement of the thyroid gland posteriorly. There is a thickening of the fascia that fixes the back of each lobe to the cricoid cartilage. This thickening is called the suspensory ligament of Berry ***(Skandalakis et al., 1995).***

The two ligaments, right and left, form a sling anchoring the gland to the larynx. They increase in size in large goitres, thus preventing the gland from falling away from the larynx the recurrent laryngeal nerve is in immediate contact with the back of the ligament. The numerous blood vessels of the thyroid gland pierce both the true and false capsules and then ramify to form a dense plexus of thin-walled vessels immediately beneath the inner or true capsule ***(Decker and DuPlessis, 1996).***

Only the arterial and venous trunks traverse the space between the two capsules. The surgeon, in dealing with the thyroid, secures these main trunks between the capsules, exercising the utmost care not to wound the true capsule because of the numerous fragile vessels which lie just under it ***(Decker and DuPlessis, 1996).***

The blood supply of the thyroid gland

The superior and inferior thyroid arteries constitute the main arterial supply. Occasionally, a branch from the aorta or innominate

artery, the lowest thyroid artery (arteria thyroideama) and the inferior thyroid veins (venae thyroidea ima) ***(Conn et al., 2006).***

The veins

The superficial jugular veins lie beneath the platysma. The external jugular veins are lateral and cross over the sternocleidomastoid muscle. The anterior jugular veins immediately over line the sternohyoid muscles. A plexus of communicating veins may be present between the external and anterior jugular veins ***(Russell et al., 2004).***

The deep thyroid veins leave the gland in relationship to the thyroid arteries mainly at the superior and inferior poles and the lateral aspect of the gland, they are less constant than the arteries in number, position, and size. The deep veins may be a serious threat during thyroid surgery because they are numerous and may be torn easily with ensuing hemorrhage ***(Skandalakis et al., 1995).***

The superior thyroid vein leaves the gland at the superior pole just anterior and lateral to the superior thyroid artery. It empties into the internal jugular vein ***(Van Herrden, 2006).***

The lateral or middle veins vary in number, they pass directly from the lateral border of the lobes and enter into the internal jugular vein. During thyroidectomy, they must be divided to permit access to the lateral compartment (fig. 2).