Retrospective Comparative Study Of The Incidence Of Hypocalcaemia In Total Thyroidectomy Between Ain-Shams University as a Referral Center And Damanhour Medical National Institute

THESIS

Submitted for fulfillment of M.Sc. Degree in General

Surgery By

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(M.B., Bch.)

Supervised by:

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*First and foremost, I would like to express my ultimate thanks to **Allah** for all the blessings in my life that made me the person I am today and for his compensation and rewarding. If it hadn't been for the strength and patience **Allah** gave me, this work wouldn't have seen light.*

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*I dedicate this thesis to all members of my **family**. A special feeling of gratitude to my loving **parents** for their endless love, support and encouragement. I give my deepest expression of love and appreciation for the encouragement that they gave and the sacrifices they made during my whole life. To my dearest **seniors specialy Dr.Mohamed Dorbok** who has been a source of encouragement and inspiration, a very special thanks for his practical and emotional support. To my beloved **brothers** who stood by me all through my life.*

Mohamed Ashraf El Shamy

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List of abbreviations

CaSR	Calcium sensing receptor
DIT	Diiodotyrosine
ELN	External laryngeal nerve
iCa++	Ionized calcium
ITA	Inferior thyroid artery
I−	Iodide
MIT	Monoiodotyrosine
NIS	Na+/ I− symporter
PTH	Parathyroid hormone
RLN	Recurrent laryngeal nerve
SLN	Superior laryngeal nerve
Tg	Thyroglobulin
T3	Triiodothyronine
T4	Tetraiodothyronine
TPO	thyroid peroxidase
TRH	Thyroid releasing hormone
TSH	Thyroid stimulating hormone
UV	Ultraviolet

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Introduction

Thyroid disease is a common condition with varied aetiology. Total thyroidectomy is one of modalities of treatment for thyroid disorders; in addition, it is one of the most performed surgical procedures. **(Docimo et al., 2017).**

One of the most common complications of thyroid surgery is postoperative hypocalcaemia which is defined as a serum calcium level below 8.5 mg/dl (2.1 to 2.6 mmol/L). **(Tulachan et al., 2019).**

The risk factors of this complication depends on the extent of surgery, the nature of the underlying disease and the experience of the operating surgeon, recurrent thyroid disease, large goitre, retrosternal extension and devascularisation, damage or inadvertent removal of the parathyroid glands with the thyroid specimen. **(Salman et al., 2018).**

Hypocalcaemia occurred significantly more often after total thyroidectomy than after unilateral thyroid lobectomy. Patients treated by thyroidectomy with concomitant neck dissection, which is indicated for thyroid cancer patients with lymph node metastasis, was the strongest risk factor for postoperative hypocalcaemia. **(Pesce et al., 2010).**

One of the most important factors is the reduction of functional parathyroid tissue which decreases the PTH concentration after thyroidectomy; Accidental parathyroidectomy and parathyroid autografting were found to be associated with a higher risk of hypocalcaemia; a PTH level below 10 pg/ml within the first 24 h after total thyroidectomy have a postoperative predictive value of 100% for postoperative hypocalcaemia. **(Schlottmann F et al., 2015)**.

The capsular dissection technique of mobilization ensures intact parathyroid glands with vascular pedicles; Lateral ligation of inferior thyroid arteries is a strong determinant of hypocalcaemia. **(Nair CG et al., 2013).**

Postoperative hypocalcaemia may be transient, resolving within a few months, or permanent, requiring lifelong oral calcium and vitamin D supplementation. In most patients it is transient and resolve spontaneously and only few patients develop permanent hypocalcaemia. **(Baldassarre et al., 2012).**

Postoperative hypocalcaemia usually manifests itself in the first 24 hours post operatively or within the 2 - 3 days after operation, however, very rarely the onset is delayed 2-3 weeks. **(Miki et al., 2009).**

Patients can complain of symptoms varying from perioral tingling and numbness to carpopedal spasms and tetany (symptomatic hypocalcaemia) or they can be asymptomatic (when only low calcium serum levels are found, defined as laboratory hypocalcaemia). Even if hypocalcaemia recovers in most patients within few months (transient hypoparathyroidism), the presence of symptoms is of concern, because it can prolong hospitalization or cause readmission. **(Docimo et al., 2017).**

Asymptomatic hypocalcaemia does not require calcium supplementation, while in patient with severe disturbances or symptoms of hypocalcaemia, intravenous supplementation should be implemented and patients should be released with oral calcium and vitamin D regimen until the hypoparathyroidism resolves. Intravenous calcium gluconate can be given 10-20 ml of 10% solution slowly until the symptoms disappear, then 50 ml of 10% calcium gluconate can be added to 500 ml of 5%

dextrose solution and administered by intravenous drip at a rate of 1ml/kg/h. **(Brunicardi et al., 2014).**

Routine oral calcium and vitamin D supplements have been proposed to prevent the development of symptomatic hypocalcaemia and to increase the likelihood of early hospital discharge after total thyroidectomy. **(Nair et al., 2017).**

Aim of Study

This retrospective study was proposed for Comparison of the incidence of development of hypocalcaemia after total thyroidectomy in patients who underwent total thyroidectomy in Ain-Shams University and Damanhour Medical National Institute.

Anatomy of thyroid gland

Embryology of thyroid gland

The development of thyroid gland begins by the 3rd week of gestation and ends by the 11th week. The primordium of the medial part of the gland appears during the 3rd week of gestation as an epithelial proliferation in the floor of the pharynx, this point of origin of the thyroid gland is later called the foramen cecum, immediately caudal to the tuberculum impar at the border of the 1st and 2nd pharyngeal pouches **(Arrangoiz, et al., 2018)**.

The lateral thyroid primordia originate from the 4th and 5th pharyngeal pouches; descend to join the medial primordium by the 5th week of gestation contributing to up to 30% of the weight of the gland **(Mohebati & Shaha, 2012)**.

The developing thyroid gland descends in the neck, anterior to the developing hyoid bone and laryngeal cartilages. For a short time, the thyroid gland connects to the tongue by thyroglossal duct. At first, the thyroid primordium is hollow but it soon becomes solid and divides into right and left lobes connected by the isthmus of the thyroid gland which lies anterior to the developing 2nd and 3rd tracheal rings. At the age of seven weeks, the thyroid assumes its definitive shape and reaches its final site in the neck. The thyroglossal duct, by this time, has normally degenerated and disappeared. The proximal opening of the thyroglossal duct persists as a small pit in the tongue, the foramen cecum **(Khatawkar & Awati, 2015).**

The developing thyroid gland becomes invested with neural crest cells as well as cells from ultimo-branchial bodies. These bodies form the para follicular cells, the C-cells which produce calcitonin **(Schoenwolf et al., 2015).**

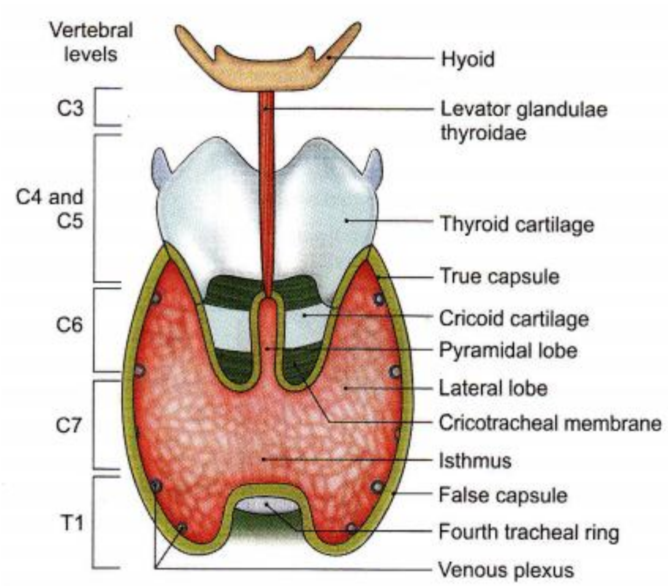
At the age of 10 to 12 weeks of gestation, follicles containing some colloid material are evident, few weeks later; the gland begins to synthetize non-iodinated thyroglobulin. Secretion of triiodotyrosin, one of the forms of thyroid hormone, is detectable by late in the 4th month **(Carlson, 2014)**.

Shape and site of thyroid gland

The thyroid gland is located posterior to the strap muscles in the muscular triangle, extending from the level of the fifth cervical vertebra down to the first thoracic vertebra. The shape of the thyroid gland varies from an H to a U shape and is formed by two lateral lobes with superior and inferior poles connected by a median isthmus, overlying the second to fourth tracheal rings **(Arrangoiz, et al., 2018)**.

Capsules of thyroid gland

The thyroid gland has a true capsule, which is a condensation of connective tissue of the gland and a false capsule derived from pretracheal fascia **(Garg et al., 2013).**



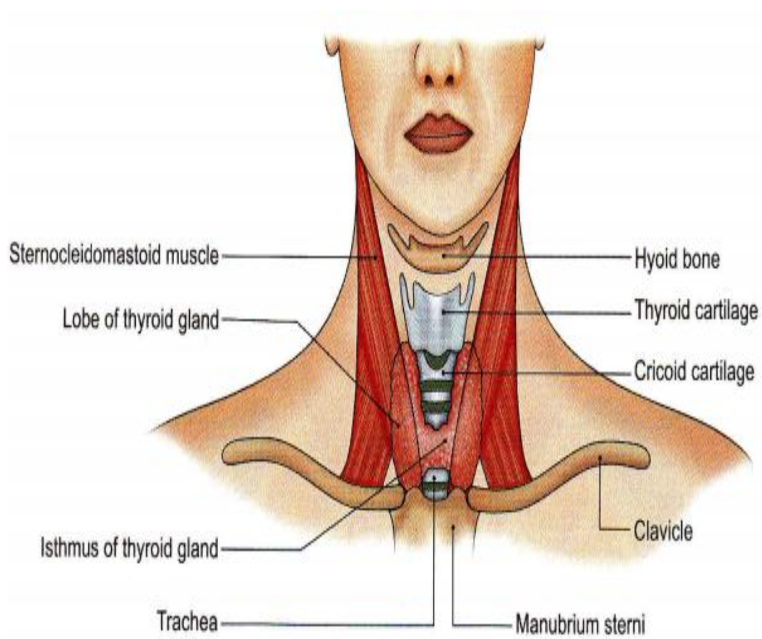


Fig. (1): Normal site of thyroid gland **(Garg et al., 2013).**

Arterial supply of thyroid gland

1) ***Superior thyroid artery:*** it is a branch from the external carotid artery, which divides at the upper pole of thyroid into anterior and posterior branches **(Khatawkar & Awati, 2015).**

2) ***Inferior thyroid artery:*** it is a branch from thyrocervical trunk of the first part of subclavian artery which divides into:

a) ***Inferior branch*** which supplies the lower part of gland and anastomosis with posterior branch of superior thyroid artery.

b) ***Ascending branch*** which supplies the parathyroid gland **(Drake et al., 2010).**

3) ***Thyroidea ima artery***: it arises from the brachiocephalic or arch of aorta, it may replace inferior thyroid artery and become major artery of the gland **(Mohebati & Shaha, 2012).**

4) ***Accessory thyroid arteries:*** it arises from the tracheal and esophageal arteries **(Garg et al., 2013).**

Venous drainage of thyroid gland

1) ***Superior thyroid vein***: it is located at the upper of pole of the lobe the gland and it drains into the internal jugular vein **(Paulsen & Waschke, 2011).**

2) ***Middle thyroid vein***: it is located at the middle of the lobe of the gland and it drains into the internal jugular vein **(Dionigi et al., 2010).**

3) ***Inferior thyroid veins***: it is located at the lower border of isthmus of the gland and it drains into the left brachiocephalic vein **(Khatawkar & Awati, 2015).**

4) ***Fourth thyroid vein (Kocher):*** it may emerge between middle and inferior veins and it drains into the internal jugular vein **(Garg et al., 2013).**

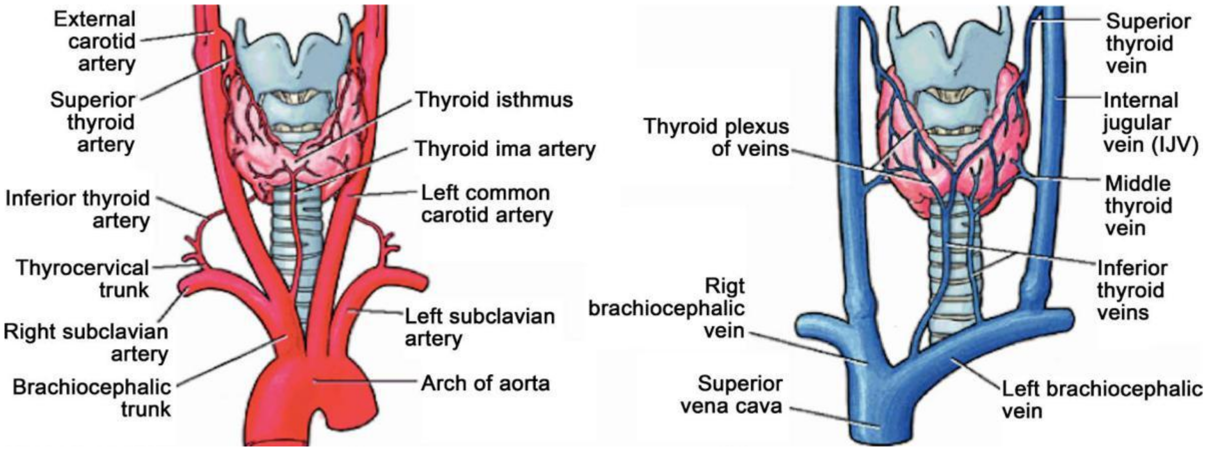


Fig. (2): Arterial supply of the thyroid gland and venous drainage of the thyroid gland. **(Arrangoiz, et al., 2018)**.

Lymphatic drainage of thyroid gland

The lateral part of the gland drains into upper and lower deep cervical lymph nodes, while the medial part drains into prelaryngeal and pretracheal lymph nodes **(Khatawkar & Awati, 2015).**

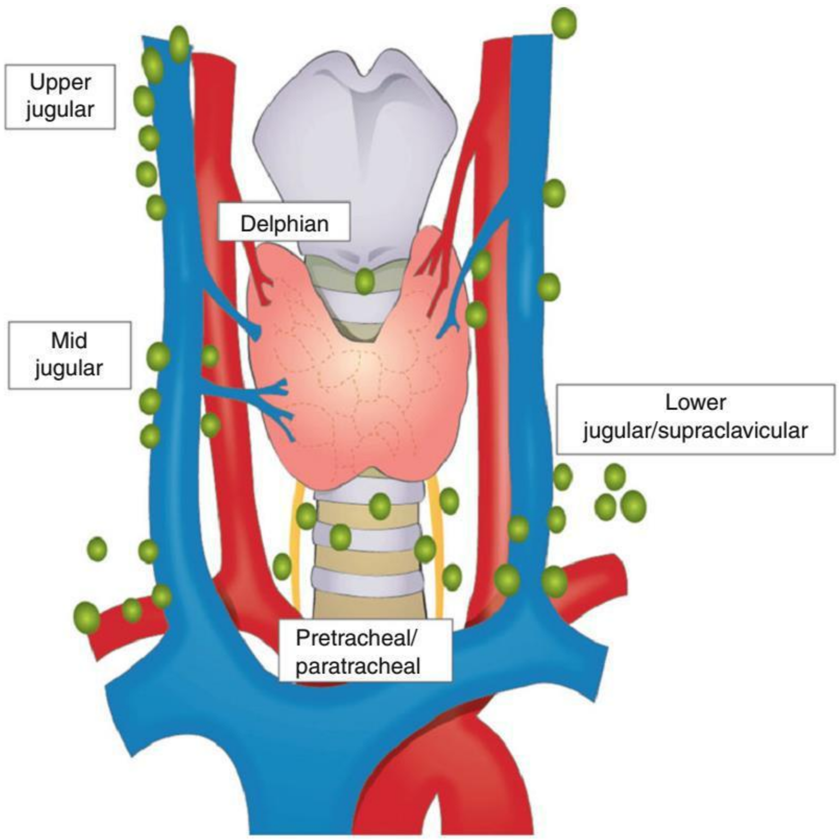


Fig. (3): Lymphatic drainage of thyroid gland **(Youn et al., 2014)**