

**Role of Intact Parathyroid Hormone Level as an Early
Predictor of Postoperative Hypocalcemia after Total
Thyroidectomy for Simple Multi-Nodular Goiter**

Thesis

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قالوا

لسبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم العظيم

صدق الله العظيم

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List of Contents

Title	Page No.
List of Tables	5
List of Figures.....	7
List of Abbreviations	10
Introduction	1
Aim of the Work	4
Review of Literature	
▪ Anatomy of Thyroid Gland	5
▪ Surgical Technique of Thyroidectomy.....	27
▪ Pathophysiology of Post Thyroidectomy Hypocalcaemia.....	52
▪ Role of Parathyroid Hormone Assay As Predictor of Post Thyroidectomy Hypocalcaemia	82
Patients and Methods.....	108
Results	115
Discussion.....	131
Summary	140
Conclusion	142
Recommendations	143
References	144
Arabic Summary	

List of Tables

Table No.	Title	Page No.
Table (1):	Types of thyroidectomy	27
Table (2):	Causes of increase and decrease of intestinal calcium absorption.....	55
Table (3):	Factors influencing renal Ca excretion.....	59
Table (4):	Typical Laboratory Test Results in Some Disorders Causing Hypocalcemia.....	71
Table (5):	Risk Factors for Hypoparathyroidism	77
Table (6):	Signs and symptoms of postsurgical hypoparathyroidism	84
Table (7):	Definitions of post thyroidectomy hypoparathyroidism	88
Table (8):	Recommendation for Parathyroid Autotransplantation.....	95
Table (9):	Demographic characters of study population.....	116
Table (10):	Comparison between Pre Operative and Post Operative regarding “Ca=Calcium, PO= phosphorus, Alb.= Albumin, Corrected Ca, PTH= parathyroid hormone”	117
Table (11):	Net number and percent of patients with low corrected calcium hypoparathyroidism and clinical hypocalcemia and the percent of PTH decline	119
Table (12):	Post-Operative Corrected Ca level and demographic description of study population.....	121
Table (13):	Post-Operative Clinical Hypocalcemia and demographic description of study population.....	121

List of Tables (cont...)

Table No.	Title	Page No.
Table (14):	Post-Operative Corrected Ca level in correlation to pre-operative individual variants.....	122
Table (15):	Post-Operative Corrected Ca level in correlation to post-operative individual variants.....	123
Table (16):	Between hypocalcemic and normocalcemic group variable PTH level and clinical hypocalcemia.....	124
Table (17):	Comparison between hypocalcemic and normocalcemic group regarding calcium and PTH level.....	125
Table (18):	Correlation between percent of decline of PTH and other predictive variants.....	126
Table (19):	ROC analysis of %PTH of decline and PTH24hr in predicting immediate postoperative significant hypocalcemia.....	130

List of Figures

Fig. No.	Title	Page No.
Figure (1):	Thyroid gland, site, anterior and lateral views.....	5
Figure (2):	Sternocleidomastoid and strap muscles	7
Figure (3):	Tubercle of Zukerkandl	9
Figure (4):	Vascular anatomy of the thyroid gland	15
Figure (5):	Vascular anatomy of the thyroid gland (thyroid ima artery is shown).....	18
Figure (6):	Posterior and lateral views of the recurrent laryngeal and the superior laryngeal nerves in the chest and neck as they course in the tracheoesophageal groove and innervate the larynx	20
Figure (7):	Variable relationship of the RLN and the branches of ITA	22
Figure (8):	Anatomical position of the superior and inferior parathyroid glands	24
Figure (9):	A. Capsular dissection ligating individual tertiary branches of the ITA while preserving the blood supply to both parathyroid glands. The dashed line indicates the plane of capsular dissection	26
Figure (10):	Position of patient illustration.....	32
Figure (11):	Landmarks and incision photo.....	33
Figure (12):	Flap dissection (superior part).....	35
Figure (13):	Completed flap dissection and retracted.....	35
Figure (14):	Division between the strap muscles.....	36

List of Figures (Cont...)

Fig. No.	Title	Page No.
Figure (15):	Division in the midline between the strap muscles, exposure of the trachea after isthmectomy.....	37
Figure (16):	Lateral dissection of the thyroid gland.....	38
Figure (17):	Lateral dissection of the thyroid gland continued exposing middle thyroid vein.....	39
Figure (18):	Dissection of the superior pole with ligation of the superior thyroidal artery	40
Figure (19):	Preservation of the inferior parathyroid gland (marked by <i>arrow</i>).....	42
Figure (20):	Preservation of the RLN	43
Figure (21):	Dissection of the ligament of Berry, recurrent laryngeal nerve <i>RLN</i>	44
Figure (22):	Contralateral lobectomy of the thyroid gland, saving <i>RLN</i> recurrent laryngeal nerve, <i>SP</i> superior parathyroid, <i>IP</i> inferior parathyroid.....	45
Figure (23):	Closure of wound.....	46
Figure (24):	Calcium content and distribution in an adult	53
Figure (25):	Schematic representation of cellular and paracellular pathways for Ca transport across intestinal epithelium.....	56
Figure (26):	Biochemical findings in hypoparathyroidism	90
Figure (27):	AACE recommendations for management of post operative hypocalcemia.....	103

List of Figures (Cont...)

Fig. No.	Title	Page No.
Figure (28):	Chart showing the mean value of pre and post-operative parathyroid.	117
Figure (29):	Chart showing the mean value of pre and post-operative corrected calcium.	118
Figure (30):	Chart showing the percent of patient presented with biochemical and clinical hypocalcemia among study population.	119
Figure (31):	Percent of cases experienced clinical hypocalcemia in correlation to their calcium serum level.	124
Figure (32):	Chart demonstrating the significant decline in post-operative PTH and its relation to low calcium level.	126
Figure (33):	A graph demonstrate the correlation between postoperative corrected calcium level and its positive correlation to percent of decline of PTH post operatively.	127
Figure (34):	A graph demonstrate the positive correlation between post operative net PTH level and percent of decline.	127
Figure (35):	Box and whisker plot demonstrate the percent of PTH decline and its variation measured postoperatively among normo and hypocalcemic groups.	128
Figure (36):	ROC analysis of iPTH24hr in predicting immediate postoperative significant hypocalcemia.	129
Figure (37):	ROC analysis of %PTH of decline in predicting immediate postoperative significant hypocalcemia.	130

List of Abbreviations

Abb.	Full term
<i>Ca</i>	<i>Calcium</i>
<i>CaSR</i>	<i>Calcium Sensing Receptor</i>
<i>CCA</i>	<i>Common Carotid Artery</i>
<i>EBSLN</i>	<i>External Branch of the Superior Laryngeal Nerve</i>
<i>ECA</i>	<i>External Carotid Artery</i>
<i>GFR</i>	<i>Glomerular Filtration Rate</i>
<i>IBSLN</i>	<i>Internal Branch of Superior Laryngeal Nerve</i>
<i>ICA</i>	<i>Internal Carotid Artery</i>
<i>IP</i>	<i>Inferior Parathyroid</i>
<i>iPTH</i>	<i>Intact Parathyroid Hormone</i>
<i>iPTH-24hr</i>	<i>Identify Parathyroid Hormone -24</i>
<i>ITA</i>	<i>The Inferior Thyroid Artery</i>
<i>LGT</i>	<i>Levator Glandulae Thyroideae</i>
<i>LMA</i>	<i>Laryngeal Mask Anesthesia</i>
<i>PTH</i>	<i>Parathyroid Hormone</i>
<i>RLN</i>	<i>The Recurrent Laryngeal Nerve</i>
<i>SCM</i>	<i>Sternocleidomastoid</i>
<i>SLN</i>	<i>Superior Laryngeal Nerve</i>
<i>SMNG</i>	<i>Simple Multi-nodular Goiter</i>
<i>SMNG</i>	<i>Simple Multi-nodular Goiter</i>
<i>SP</i>	<i>Superior Parathyroid</i>
<i>STA</i>	<i>Superior Thyroid Artery</i>
<i>TALH</i>	<i>The Loop of Henle</i>
<i>VDR</i>	<i>Vitamin D Receptor</i>

ABSTRACT

These results indicate that a low serum intact PTH level after thyroidectomy is an earlier predictor of hypocalcaemia than serum calcium levels alone.

Serum PTH 24-h after total thyroidectomy is a reliable predictor of hypocalcaemia and can allow safe early discharge of patients from hospital. Patients with a normal postoperative serum PTH and normal serum calcium the following morning will not develop hypocalcaemia and can be considered for discharge that day. Measuring %iPTH decline, where a decline $>72.3\%$ was precise for early diagnosis of hypocalcemia after total thyroidectomy too. Our study didn't find a difference, between combination of both tests and measuring iPTH24hr only, also did not increase the accuracy. Thus, calculation of the %iPTH decline might not be necessary. Only using a single measurement of iPTH24hr is more convenient and cost-effective in early diagnosis of immediate significant postoperative hypocalcemia.

Keywords: Internal Branch of Superior Laryngeal Nerve- Glomerular Filtration Rate - External Carotid Artery

INTRODUCTION

Thyroid surgery has a history of significant changes in the technique and the incidence of complications. Continuous developments in surgical techniques and better understanding of thyroid anatomy and pathology have increased the safety of thyroid surgery and reduced the incidence of complications. Nowadays, the rate of postoperative mortality is extremely low. The most common and potentially life-threatening complications in thyroid gland surgery are vocal cord palsy and hypocalcemia (*Khafagy and Abdelnaby, 2013*).

Preservation of the parathyroid glands during total thyroidectomy is a major concern for an endocrine surgeon, because there is no guarantee of normal postoperative parathyroid function, even if the procedure is performed for benign disease. It is especially difficult to keep the parathyroid glands intact if a tumor is large, infiltrative or if there are extensive lymph node metastasis. According to one systematic review, the median incidences of transient and permanent hypocalcemia were 27% and 1%, respectively, but at the worst, these rates were as high as 38% and 3%, respectively (*Park et al., 2016*).

Early postoperative calcium monitoring, although important, is a poor predictor of subsequent symptomatic hypocalcemia. Despite the fact that the slope of postoperative serum calcium levels correlates with the development of

symptomatic hypocalcemia, its utility is limited as the results are not available until 24–48 hours post-thyroidectomy. Other approaches to monitor and predict postoperative parathyroid function and subsequent hypocalcemia have been described in the literature. These include parathyroid hormone (PTH) assayed either intraoperatively or in the early postoperative period. These approaches are based on the fact that intact PTH (iPTH) has a short half-life of 1–4 minutes, thus allowing detection of its fall early in the perioperative period (*AIQahtani et al., 2014*).

The nadir for hypocalcemia typically occurs at around 24–48 hours postoperatively but may be as delayed as post-op day 4. Therefore, detecting patients requiring calcium replacement therapy with serial calcium measurements can take multiple blood tests over several days. Placing all patients on calcium therapy unnecessarily commits many patients to unnecessary treatment and puts them at risk for hypercalcemia. A clinical laboratory method for early prediction of postoperative hypocalcemia could, therefore, facilitate earlier implementation of treatment, and early discharge (≤ 24 hours) (*Le et al., 2014*).

In the context of escalating health care costs, a number of initiatives have focused on various ways to facilitate timely hospital discharge without compromising patient safety. The importance of a reliable measure to predict a person's relative risk for developing clinically significant hypocalcemia

following thyroidectomy should not be underestimated. Besides facilitating timely discharge in low-risk patients, classification of high-risk patients would also allow prompt prophylactic treatment. Unfortunately, the classification of patients into relative risk levels for subsequent hypocalcemia is not always straightforward. Because of its relatively shorter half-life, changes in parathyroid hormone (PTH) precede changes in calcium by hours. Intraoperative PTH has been less readily adopted for use during thyroidectomy. Among those who have used PTH as a guide for guiding management after thyroidectomy, differing reports exist regarding the sensitivity and specificity of PTH for accurately predicting hypocalcemia. Some studies even report seemingly contradictory results. There is no consensus about the best time to obtain PTH levels for accurately predicting a patient's risk for clinically significant hypocalcemia. It is also unclear whether the absolute value of PTH versus the percentage change from preoperative to intraoperative/postoperative levels is a better predictor for postoperative hypocalcemia (*David et al., 2015*).

AIM OF THE WORK

This is a prospective study to estimate the incidence of hypocalcemia and hypo-parathyroidism following total thyroidectomy for simple multi-nodular goiter (SMNG), and to determine which early clinical and biochemical characteristics could be considered as predictive factors. Also to identify PTH-24 (iPTH-24hr) as a simple predictor of early postoperative hypocalcemia.