

# Analysis of Risk Factors and Outcomes of Postoperative Complications of Thyroidectomy

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**ABSTRACT**

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Thyroidectomy is associated with one or more risk factors and postoperative complications like hoarseness, hypocalcemia etc. The objective of this study was to perform an analysis of risk factors and outcomes of postoperative complications of thyroidectomy. This study was conducted between the period of January 2020 to March 2021 in Al Jumhory Teaching Hospital at the City of Mosul-Iraq. Patients with abnormal preoperative blood Parathyroid hormone (PTH), Parathyroid adenoma, and low Calcium levels were excluded from the study. The study included 291 patients who were undergone thyroidectomy due to benign or malignant thyrotoxicosis. Patients were investigated for physical examination, thyroid ultrasonography, imaging, and fine-needle aspiration biopsies during the preoperative period. Hypocalcemia was compared with the previous thyroidectomy. Data were analysed through Statistical Package for Social Sciences (SPSS) version 25. A p-value less than 0.05 was considered significant in all statistical evaluations. A total of 236 (81%) female, and 55 (18.7%) were male patients in the study with the mean age of  $45.02 \pm 13.5$  years. When examined in terms of preoperative thyroid functions, 182 (62.7%) of the patients were euthyroid, while hyperthyroidism was the most common dysfunction in the 109 (34.4%) patients of the study groups. According to the clinic pathological diagnoses, Non-neoplastic Lesions (NNL) is the most common benign thyroid disease with a rate of (59%) and malignancy (41%). According to the findings of this study, the preoperative diagnosis of toxic hyperthyroidism and the PTH being close to the upper limit in the preoperative period were the major factors responsible for hypocalcemia and other complications.



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## 1. INTRODUCTION

Recent decades have seen an increasing trend towards more radical surgery in benign thyroid surgery, i.e. total or hemithyroidectomy instead of subtotal resection [1]. Hoarseness is one of the most common complications following an operative procedure of the thyroid gland. The recurrent laryngeal nerve (RLN)

can be damaged by retraction as well as by thermal injury or dissection [2]. Hypocalcemia is a recognized complication following thyroid surgery. Its reported incidence has varied dramatically, ranging from 5 to 75% [3]. The relationship between patient factors and postoperative complications is complex and influenced by intrinsic disease factors, patient comorbidities, and operative management. The risk of complications in the patients with total thyroidectomy and associated factors are needed to be investigated for better patient benefit [4]. The study was conducted with the objective to perform an analysis of risk factors and outcomes of postoperative complications of thyroidectomy.

## 2. METHODS

This prospective study was conducted between the period of January 2020 to March 2021. The study was conducted in Al Jumhory Teaching Hospital at the City of Mosul-Iraq. All procedures performed in studies involving human participants followed the ethical standards of the institutional and national research committee and the 1964 Helsinki declaration and its later amendments, including informed consent and confidentiality of all personal information. Also, the Ethics committee of Mosul University has approved the research with ethical N0: IRB.Mosul:2547. Written and verbal consent of patients was obtained before participating in the study. Patients with abnormal preoperative blood Parathyroid hormone (PTH), Parathyroid adenoma, and low Calcium levels were excluded from the study. The study included 291 patients who were undergone (during the study) thyroidectomy due to benign or malignant thyrotoxicosis. Patients were investigated for physical examination, thyroid ultrasonography, imaging, and fine-needle aspiration biopsies during the preoperative period. In addition to average blood values, serum PTH, total/ionized calcium and thyroid function tests were investigated. The perioperative evaluation and frozen section results after the operation were also evaluated. Hypocalcemia was compared with the levels before the thyroidectomy. In the patients suffering from thyroid disorder, the types of goiter multinodular goiter (MNG), nodular goiter (NG), toxic diffuse goiter (TDG), toxic multi-nodular goiter (TMNG), recurrent goiter (NG), and thyroid malignant (TM), need the surgery. The categories of surgery performed in the study groups were of three types: subtotal Thyroidectomy (TT) in group 1, Hemi-thyroidectomy (lobectomy) in group 2, and Completion Thyroidectomy in group 3. These categories of surgery (as defined by classical surgical technique) were performed on the patients, considering the preoperative findings of the thyroid gland, perioperative evaluation and post operative frozen section results. The total extracapsular resection was performed in the cases. The complete thyroidectomy performance will leave. In that time, the parathyroid gland and thyroidectomy glands will be secure.

After surgery, the histological diagnosis was made on all patients. Blood samples were taken from the patients to monitor serum PTH, ionized, and total calcium levels at 24 hours. For the patients showing hypocalcemia (about 8 mg/dL) the calcium replacement therapy was commenced with intravenous calcium. The calcium was administered early to patients with severe symptoms, along with oral vitamin D as maintenance therapy. Patients, who developed signs and symptoms of hypocalcaemia, were followed up for monthly serum PTH and calcium levels until their clinical findings normalized and then the treatment was discontinued. Patients with clinical and laboratory findings of hypoparathyroidism were followed up until one year after surgery. PTH was measured by Roche Elecsys 2010 device with the "Electrochemiluminescence immunoassay (ECLIA) method," and average values as (1.6-6.9 pmol/L). Total calcium level was measured by the "Spectrophotometric method" in the "Abbott Aero set" device. Additionally, Ionized calcium was investigated with the (Na/K/Ca/Ph) analyzer ion-selective method. Studied level for total calcium accept as (8.4-10.6 mg/dl) and (4.2-5.2 mg/dl) for ionized calcium. Data were uploaded to Statistical Package for Social Sciences (SPSS) version 25 for analysis. A p-value less than 0.05 was considered significant in all statistical evaluations.

### 3. RESULTS

This study included 291 patients who were submitted to thyroidectomy due to benign or malignant thyrotoxicosis. The mean age of the patients was (45.02±13.5) years. Most of the patients were female with a total of 236 (81%) female and 55 (18.7%) male patients. When examined in terms of preoperative thyroid functions, 182 (62.7%) of the patients were euthyroid, while hyperthyroidism was the most common dysfunction among the 109 (34.4%) patients of the study groups (Table 1). According to the clinical diagnoses, Non-neoplastic Lesions (NNL) is the most common benign thyroid disease with a rate of (59%) and malignancy at a rate of (41%) (Table 2). The incidence of hypocalcemia on the postoperative 1st day and correlated with some of the variables (age, gender, Type of Thyroid Surgery, Type of lesion, Phosphorus level, PTH level) was elucidated in Table 4.

**Table 1.** Distribution of patients underwent to thyroidectomy by age, gender, and types of surgery

Age (45.02±13.5)	Subtotal Thyroidectomy		Hemi-thyroidectomy (lobectomy)		Completion Thyroidectomy		Total
	Male	Female	Male	Female	Male	Female	
20-30	4 (7.5%)	15(28.3)	3(5.7)	13(24.5%)	3(5.7%)	15(28.3%)	53 (18.2%)
31-40	6 (10%)	13(21.6%)	4(6.7%)	18 (30%)	3(5)	16(26.7%)	60 (20.6%)
41-50	3 (4.7)	17(26.6%)	5(7.8%)	17(26.5%)	4(6.3%)	18 (28.1%)	64(22%)
51-60	5 (7.3%)	18 (26.5%)	3(4.4)	20(29.4%)	3(4.4)	19(28%)	68\ (23.3%)
<60	2 (4.4%)	12(26.1%)	4 (8.7%)	15(32.6%)	3(6.5%)	10(21.7%)	46 (15.9%)
<b>Total</b>	20(6.9%)	75 (25.7%)	19(6.5%)	83(28.5%)	16(5.6%)	78(26.8%)	291(100%)
<b>Hypothyroidism</b>	10 (3.5%)	45 (15.5%)	11 (3.7%)	55 (19%)	9 3.1%)	52 (17.8%)	182 (62.7%)
<b>Hyperthyroidism</b>	15 (5.2%)	34 (11.7%)	5 (1.7%)	26 (8.9%)	5 1.7%)	24 (8.2%)	109 (34.4%)

**Table 2.** Distribution of thyroidectomy biopsy according to histopathological diagnosis

Histopathological diagnosis	No	%
<b>Neoplastic Lesions (NL)</b>	119	<b>41</b>
• Malignant Lesions	35	<b>12</b>
• Papillary Carcinoma	26	9
• Medullary Carcinoma	9	3
• Benign Lesions	26	<b>9</b>
• Follicular Adenoma	14	5
• Hurthle Cell Adenoma	9	3
<b>Non-neoplastic Lesions (NNL)</b>	172	59
• Nodular Hyperplasia	119	41
• Lymphoid Hyperplasia	15	5
• Lymphocytic Thyroiditis	20	7
• Hashimoto's Thyroiditis	9	3
• De Quervain's Thyroiditis	9	3

**Table 3.** Distribution of operations performed according to neoplastic lesions

Neoplastic Lesions	Subtotal Thyroidectomy		Hemi-thyroidectomy (lobectomy)		Completion Thyroidectomy	
	N	%	N	%	N	%
<b>Malignant Lesions</b>	103	87	7	6	9	7
• Papillary Carcinoma	97	82	6	5	8	6
• Medullary Carcinoma	6	5	1	1	1	1
<b>Benign Lesions</b>	89	52	83	48	0	0
• Follicular Adenoma	62	36	71	41	0	0

• Hurthle Cell Adenoma	27	16	12	7	0	0
<b>Hyperplasia</b>	67	50	44	33	23	17
• Nodular Hyperplasia	62	46	33	25	23	17
• Lymphoid Hyperplasia	5	4	11	8	0	0
<b>Lymphocytic Thyroiditis</b>	41	77	12	23	0	0
• Lymphocytic Thyroiditis	29	54	7	12	0	0
• Hashimoto Thyroiditis	12	23	0	0	0	0
• De Quervain's Thyroiditis	0	0	5	11	0	0

**Table 4.** The incidence of hypocalcemia on the postoperative 1st day by some of the variables

Variables	Postoperative Day 1 Hypocalcemia (%)	Normal
<b>Age</b>	(45.02±13.5)	
20-30	3 (1%)	3 (1%)
31-40	44 (15%)	20 (7%)
41-50	47 ((16%)	15 (5%)
51-60	73 (25%)	7 (20%)
<60	47 (16%)	7 (20%)
<b>Gender</b>		
<b>Women</b>	189(80%)	47 20%)
<b>Men</b>	34 (62%)	21 (38%)
<b>Type of Thyroid Surgery</b>		
<b>Subtotal Thyroidectomy</b>	95 76 80	19 20
<b>Hemi-thyroidectomy (lobectomy)</b>	102 64 63	38 37
<b>Completion Thyroidectomy</b>	77(82%)	17(18%)
<b>Lesion type</b>		
<b>Neoplastic Lesions (Malignant Lesions)</b>	83 (70%)	36 (30%)
<b>Non-neoplastic Lesions (Benign Lesions)</b>	143(83%)	29(17%)
<b>Phosphorus</b>		
<b>High</b>	17(6%)	12 (4%)
<b>Normal</b>	209(72%)	29 10%)
<b>Low</b>	12(4%)	12(4%)
<b>PTH</b>		
<b>High</b>	29 (10%)	0
<b>Normal</b>	87 (30%)	0
<b>Low</b>	175 (60%)	0

#### 4. DISCUSSION

Thyroid disorders are considered as one of the essential endocrine problems. A thyroidectomy is a surgical procedure to remove all or part of the thyroid gland and is used to treat diseases of the thyroid gland, including thyroid cancer, hyperthyroidism (overactive thyroid gland), large goitres or thyroid nodules causing symptomatic obstruction such as swallowing or breathing difficulties, multi-nodular goiter etc. The thyroidectomy operations may cause various different complications and hypocalcemia [5]. The present hospital-based study aims to investigate the postoperative complications and associated of thyroidectomy. This study included 291 patients (with mean age 45.02±13.5 years) who were submitted to thyroidectomy due to benign or malignant thyrotoxicosis and the 81 % patients were female. high degree of occurrence of thyroid disorders in females over male patients is well supported by various previous studies.6 The study concluded that the female individuals aged between 30 to 75 years of age are found to be suffering from thyroid disorders essentially in higher proportion as compared to the male counterparts. The occurrence percentage may vary depending on the population and race of the subjects. Laboratory evaluation of

patients undergoing thyroid surgery were tested for thyroid stimulating hormone (TSH) along with calcium, phosphorus, and intact parathyroid hormone (parathyroid hormone; in cases of total or completion thyroidectomy). Free or total triiodothyronine may be ordered with a suppressed TSH. Thyroid function testing is ideally drawn before fine needle aspiration (FNA) to determine if the nodule is hyper-functional. Due to these complications, the patients' hospital stay is prolonged, and many biochemical tests are needed [7]. Patients were discharged from the hospital, and follow-up was conducted in the outpatient clinic after ten days and six weeks post-surgery. The cost was increased both in the hospital treatment and in the follow-up phase. It was reported in a previous study that cosmetic, metabolic, and hormonal disorders may develop secondary to patients' complications and decrease the patients' quality of life [8]. Primary outcomes was postoperative hypocalcaemia (present or absent, defined as PTH <15 ng/L at 4 h after surgery since patients were discharged postoperative day 1), which caused long-term morbidity. This is one of the major problems following thyroid surgery and it must be investigated cautiously. Many studies have focused on reasons of these complication such as anatomical, surgical technique, and hormonal factors [9], [10]. The surgical procedure methods affect postoperative hypocalcemia rates. The rate of hypocalcemia increased significantly in patients who underwent bilateral total thyroidectomy [11], [12].

In this study, out of the 291 patients who underwent thyroidectomy, 57% patients developed transient hypocalcemia. It was the most significant and major complication. The patients were categorized into three groups according to surgical procedure (Subtotal/ hemi/ completion thyroidectomy). However, this difference between the groups in terms of other complications discovered did not show a clear difference. In our opinion, the factor leading to this result is the insufficient number of patients in these groups. However, many studies supported this statistical result [13], [14]. In this study, early preoperative, and late postoperative complication was assessed by measuring PTH, Ca, and Phosphorus level, Patients with low-level PTH in preoperative were close to the upper rate of hypocalcemia. Early and late postoperative PTH values showed a significant decrease in all patients with hypocalcemia due to temporal parathyroid circulation, postoperative hypocalcemia and low level of PTH. —The result of the present study were well supported by the previous studies [15], [16]. Many studies have shown that the earliest predictor of post-thyroidectomy-induced hypocalcemia is intact PTH measurement. This method gives results in less than an hour but the cost factor is the serious concern [17]. The cumulative complications were found in 27% and hypocalcemia in 57% of these patients. According to our multivariate study, the hungry bone condition (caused by preoperative thyrotoxicosis) is one of the most common causes of hypocalcemia. Hypocalcemia and other consequences were found to be significantly correlated in the patients. And it was identified with toxic hyperthyroidism before surgery, was made euthyroid, and had surgery. This factor can show as a frequent cause [18], [19]. In addition, it may contribute to this in cases where the anatomy of the parathyroid gland cannot be thoroughly evaluated due to excessive adhesion and bleeding during surgery due to hyperthyroidism. Hypocalcemia complications are common after total thyroidectomy and particularly in parathyroid and thyroid gland surgery, thyroid reoperations, and thyroid malignancy surgeries that include neck lymph node dissections. It occurs due to the disruption of the circulation of the parathyroid glands or the accidental removal of the glands [20– 22]. The result showed that extra dissection for nerve visualization had a disruptive effect on parathyroid circulation. The directly relationship was not observed in the available literature. Many studies in the literature have also explained the reimplantation of glands with poor circulation. Some parathyroid glands are lacking, and they had 57 percent of hypocalcemia. The other two or fewer parathyroid glands had 43 percent of hypocalcemia. Parathyroid reimplantation is recommended almost routinely to prevent hypocalcemia during thyroidectomy [23- 25]. The inadvertently removed operation region can protect the parathyroid glands from hypocalcemia, especially irreversible hypocalcemia [17- 19].

The link between the number of parathyroid glands visible intra-operatively and hypocalcemia was not a significant difference in this study. In this way, severe hypocalcaemia observed after total thyroidectomy was significantly reduced [26], [27]. According to the findings of this study, the preoperative diagnosis of toxic hyperthyroidism revealed PTH close to the upper limit. This factor was considered as the most essential considerations leading to hypocalcaemia after thyroidectomy. Although PTH does not rapidly result in the diagnosis of patients with hypocalcaemia, it decreases in the early postoperative period. It shows a serum level compatible with the clinical course. Being a retrospective study some of the patients could not be reached to get the complete data. Some patients which did not turn up in the follow-up check-up, could not be investigated for the present study.

## 5. CONCLUSIONS

It was concluded that the preoperative diagnosis of toxic hyperthyroidism with PTH levels being close to the upper limit in the preoperative period was the most significant cause of hypocalcaemia post thyroidectomy.

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