ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCES,DEPARTMENT OF SURGERY,UNIT OF ENDOCRINE AND BREAST SURGERY

PREVALENCE AND ASSOCIATED FACTORS OF POST-THYROIDECTOMY HYPOCALCEMIA IN PATIENTS WHO UNDERWENT THYROIDECTOMY IN TIKUR ANBESSA SPECIALIZED HOSPITAL :A RETROSPECTIVE STUDY

By Berari Bayou, MD,Endocrine and Breast Surgery Fellow

July,2025

Addis Ababa, Ethiopia

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By Berari Bayou, MD, Endocrine and Breast Surgery Fellow

Advisors:1.Girmaye Tamrat, MD, General, Endocrine and Breast surgeon

2. Hiwot Yeshitila , MD, General, Endocrine and Breast surgeon

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Approval sheet

Submitted by:

Berari Bayou, MD, Endocrine and Breast Surgery Fellow

Signature _____ Date_____

Approved by:

Major Advisors

1.Dr. Girmaye Tamrat

Signature _____ Date_____

2.Dr. Hiwot Yeshitila

Signature _____ Date_____

3. Department Head

Signature _____ Date_____

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TABLE OF CONTENTS

List of Tables

List of Figures

Abbreviations and acronyms

AOR=Adjusted Odds Ratio

ATC=Anaplastic thyroid cancer

CCND=central compartment neck dissection

cT= Completion thyroidectomy

FTC=Follicular thyroid cancer

iPTH=Intact serum parathyroid hormone

MRND=Modified radical neck dissection

MTC=Medullary Thyroid cancer

PT =parathyroid

PTC=papillary thyroid cancer

POD1= postoperative day 1

SMNG=Simple multinodular Goiter

SPHMMC=Saint Paul Hospital Millenium Medical college

TASH=Tikur Anbessa Specialized Hospital

TMNG=Toxic multinodular goiter

TT=Total thyroidectomy

Abstract

Background: Thyroid disease is a common disorder of endocrine system globally. Thyroidectomy is one of the most common surgeries performed worldwide. Post-thyroidectomy hypocalcemia is one of the most dreaded complications following thyroidectomy, which can lead to considerable morbidity and deleterious effect in the quality of life of affected patients. Despite advancements in surgical techniques and perioperative care, the incidence of hypocalcemia remains a considerable challenge. It primarily occurs due to inadvertent damage or removal of the parathyroid glands during surgery, leading to a transient or permanent decrease in serum calcium levels.There is inadequate information regarding the prevalence and associated factors of post-thyroidectomy hypocalcemia in the study area and this study is intended to investigate it.

Objective: To determine the prevalence of Post-thyroidectomy hypocalcemia and associated factors among patients who underwent total and completion thyroidectomy with or without central/lateral neck dissections in Tikur Anbessa Specialized Hospital (TASH), from January 2021 to June 2024.

Methods and Materials: A retrospective study design was employed to conduct this study. Secondary data was collected from patient medical record by using structured checklist checked for its completeness, entered, edited, cleaned and analyzed by SPSS version 25. The study period was from May 2025 to June 2025.

Result: The result showed the overall prevalence of post-thyroidectomy hypocalcemia was 32.6% with prevalence of post-thyroidectomy transient hypocalcemia 25.7%, and permanent hypocalcemia 6.9%. The study revealed that the rate of post-thyroidectomy hypocalcemia varied with type of thyroidectomy and pathologic diagnosis. The rate was higher (39.3%) for TT with CND and/or MRND than TT and completion thyroidectomy alone,which was 31.0% and 31.3% respectively. This study also showed that patients with intraoperative identification of 4 PT glands were at higher risk of developing post-thyroidectomy hypocalcemia than those patients in which PT gland identification was not achieved with AOR=2.93(1.28,6.71)(p=0.011). This study showed that out of 28 patients who stayed in the hospital for >3 days to week,19(67.9%) were those with post-thyroidectomy hypocalcemia and out of 11 patients who stayed in the hospital for >1 week,9(81.8%) were those with post-thyroidectomy

hypocalcemia,showing that post-thyroidectomy hypocalcemia is associated with prolonged hospitalization.

There was no statistically significant association between post-thyroidectomy hypocalcemia and age, sex,type of thyroid disease, or pathologic diagnosis in this study.

Conclusion and Recommendation:

This study highlighted that post-thyroidectomy hypocalcemia is prevalent among 32.6% of patients who underwent total and completion thyroidectomy with or without central and/or lateral neck dissections.

The study also showed excessive dissection during thyroidectomy to identify PT glands may compromise their blood supply and may predispose patients to postoperative hypocalcemia.

Post-thyroidectomy hypocalcemia was associated with prolonged postoperative hospital stay in this study.

The study also revealed the effect of calcium and vitamin D supplementation on the reduction of transient post-thyroidectomy hypocalcemia.

Therefore,routine supplementation of calcium and vitamin D for patients after total thyroidectomy and completion thyroidectomy should be encouraged practice in endocrine and breast surgery unit. The unit has to make measurement of postoperative serum calcium and preoperative vitamin D a routine practice. Additionally the unit has to stick to the practice of capsular dissection technique with minimal manipulation around PT glands during thyroidectomy. The hospital administration has to equip the laboratories in the hospital with biochemical tests such as serum vitamin D,serum calcium and iPTH. Finally,for strong and reliable results,undergoing prospective multicenter study with larger sample size is recommended.

Key words: post-thyroidectomy hypocalcemia, total thyroidectomy, serum calcium

1. INTRODUCTION

1.1. Background

Thyroid disease is a common disorder of the endocrine system globally(1,2). It is also a common problem in Ethiopia and other developing nations(1). Thyroidectomy (partial or total) is one of the most common operations performed worldwide(2).Total thyroidectomy is defined as the removal of the entire thyroid gland in a single session;while completion thyroidectomy is defined as undergoing lobectomy or removal of reminant thyroid tissue in patients who had previously undergone lobectomy or subtotal thyroidectomy(3).

There are several indications for thyroidectomy including single or multinodular goiter with compression symptoms,suspected or confirmed malignancy,presence of complex thyroid cyst,thyrotoxicosis and cosmetic reasons(2,4).

Thyroidectomy is a safe procedure but it is associated with concerning complications like hematoma, airway obstruction,injury to recurrent laryngeal and superior laryngeal nerves and hypoparathyroidism. Hypocalcemia is one of the most common complications of thyroid surgery(4,5). Inadvertent removal or devascularisation of parathyroid glands is the main underlying mechanism; although factors like hungry bone syndrome where there is acute and rapid shift of calcium from the circulation in to bones in patients with thyrotoxicosis may also contribute to it in the early post-operative period(6). In patients at risk for post-thyroidectomy hypocalcemia the decline in serum calcium and the symptoms usually do not occur until 24 to 48 hrs after surgery(7).

Hypocalcemia is classically described as serum calcium less than the lower limit of normal for the given assay(7).According to the American Association of Clinical Endocrinologists(AACE) and American College of Endocrinology(ACE),the biochemical definition of hypocalcemia is when the total serum calcium is less than 8.5 mg/dl or ionized calcium less than 1.15 mmol/L;the distinction between temporary and permanent was made at 12 months(6).In some studies the normal serum calcium ranges from 8-11 mg/dl and the level < 8 mg/dl is taken as hypocalcemia(5).Temporary hypocalcemia is defined by different authors as a post-thyroidectomy decrease in calcium (Ca), lasting for 6 to 12 months; permanent hypocalcemia is a post-thyroidectomy decrease in Ca lasting for more than 12 months(8).But some define

permanent hypocalcemia when it doesn't return to normal within six months or requiring supplement of calcium and/or Vitamin D for 6 or more months(9).

Hypocalcemia can be asymptomatic,when serum calcium level is mildly reduced , or symptomatic with classic manifestations like Chvostek's and Trousseau's signs, muscle spasms ,cramps, and peripheral or perioral paresthaesia. Patients may also develop neurologic symptoms like seizure and confusion when not treated adequately(9). Post-thyroidectomy hypocalcemia is asociated with prolonged hospitalization as it requires calcium and vitamin D supplementation and monitoring until the serum calcium level is normalized(9).

1.2. Statement of the problem

Post-thyroidectomy hypocalcemia is one of the most dreaded complication following total thyroidectomy,which can lead to considerable morbidity and deleterious effect in the quality of life of affected patients(7). Despite advancements in surgical techniques and perioperative care,the incidence of hypocalcemia remains a considerable challenge,with varying rates reported in literature(6). It primarily occurs due to inadvertent damage or removal of the parathyroid glands during surgery,leading to a transient or permanent decrease in serum calcium levels(10).

The lack of standardized protocols for the identification ,and management of post-thyroidectomy hypocalcemia further complicates the situation,resulting in inconsistent clinical outcomes. Moreover,there is insufficient understanding of associated risk factors.This research aims to investigate the prevalence and associated contributing factors for hypocalcemia in patients who underwent total and completion thyroidectomy ,assess current clinical practices,and propose strategies to reduce this complication.

1.3. Significance of the study

The prevalence of post-thyroidectomy hypocalcemia varies among different literatures but many studies reveal it occurs in significant number of patients after total and completion thyroidectomy, mainly following injury to blood supply of parathyroid glands or inadvertent removal of the parathyroid glands. Understanding the prevalence and associated risk factors of post-thyroidectomy hypocalcemia is important to develop monitoring protocols,preventive measures and management strategies to reduce complications and improve patient outcomes.

This study aims to contribute to the existing body of knowledge and assist in improving clinical outcomes of patients undergoing total and completion thyroidectomy.

The study will help identifying patients at risk for post-thyroidectomy hypocalcemia and could lead to plan for preoperative counseling and postoperative early detection protocols.

The study may also give recommendation on the surgical techniques that preserve the function of parathyroid glands and decrease the incidence of post-thyroidectomy hypocalcemia.

Knowing the magnitude of post-thyroidectomy hypocalcemia from this study may also help for health care systems in more efficient allocation of resources in management of postoperative hypocalcemia.

In addition,this study will help as a baseline for future studies.

2. LITERATURE REVIEW

2.1. Prevalence of post-thyroidectomy hypocalcemia

According to retrospective study done in Saudi Arabia tertiary center, the prevalence of post-thyroidectomy hypocalcemia among patients who had undergone total thyroidectomy was 67.4% based on the level of serum calcium on the second post operative day. The majority of patients were asymptomatic and symptomatic hypocalcemia comprising 20.7%(11) . Prospective observational study done in India by analysis of 806 patients who had total thyroidectomy showed overall incidence of hypocalcemia being 23.6% and permanent hypocalcemia being 1.61%(12).

A retrospective study done in Saudi Arabia's King Salman Armed Forces Hospital showed 63.7% and 1.6% of patients who have undergone thyroidectomies developed post operative temporary and permanent hypocalcemia respectively(2).

A cross sectional study conducted in Yemen on patients who underwent total or completion thyroidectomy revealed the incidence of postoperative hypocalcemia within 24 hrs of surgery being 54%(13).

A systematic and narrative review of 63 observational studies by McMurran et al.showed the median incidence of 27.5% transient biochemical hypocalcemia and 2.2% permanent hypocalcemia,with permanent hypocalcemia being common in patients who have undergone concomitant neck dissection(14).

In a study conducted in Saint Paul Hospital Millenium Medical College(SPHMMC),Addis Ababa,Ethiopia the prevalence of post thyroidectomy symptomatic hypocalcemia was found to be 9.5% and permanent hypocalcemia was 6.1%(1).

2.2 **Factors associated with post-thyroidectomy hypocalcemia**

2.2.1. Demographic factors

Multiple studies on patients who had thyroidectomy showed female sex is associated with increased risk of post-thyroidectomy hypocalcemia(4,15,16). However the study done in South India showed that age or gender doesn't influence the incidence of postoperative hypocalcemia(5).Another prospective multicenter study by Eismontas et al. didn't show increased risk of post-thyroidectomy hypocalcemia with age or gender(8).

2.2.2.Disease and surgical related factors

A literature review by Paduraru et al.in Romania showed risk of post-thyroidectomy hypocalcemia is increased with total thyroidectomy(TT),intervention for recurrent goiter and lymph node dissection accompanied with thyroid removal(4). A systematic review and metanalysis by Chen et al. also showed an increased risk of postoperative hypocalcemia after thyroidectomy in patients with thyroid malignancies,retrosternal goiter and those who had inadvertent parathyroidectomy, TT,CCND and MRND. In contrast the same study didn't show Graves disease as associated risk factor for post-thyroidectomy hypocalcemia(15).But the study done in tertiary care Hospital in South India indicates that thyroidectomy for Grave's disease is significantly associated with hypocalcemia(5).

Routine identification of parathyroid glands at time of surgery is associated with conflicting results. Some studies found higher rates of hypocalcemia while the others found decreased risk of hypocalcemia(6).

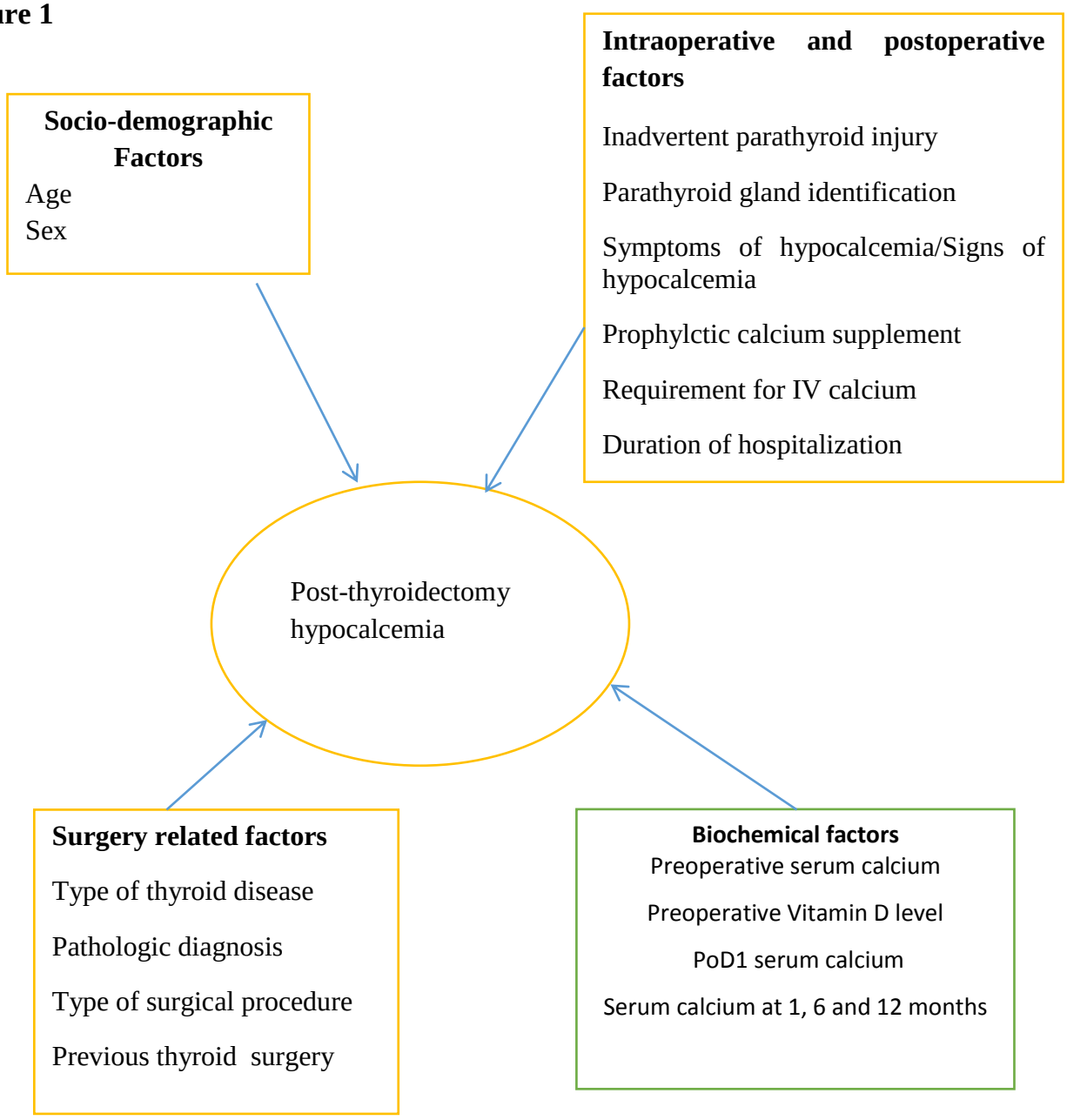
High volume surgeons have decreased rate of post-thyroidectomy hypocalcemia when compared to low volume surgeons(6).

2.2.3.Biochemical factors

The level of postoperative PTH and serum calcium are more predictive of post-thyroidectomy hypocalcemia(4).Another study also shows decreased total and ionized calcium pre-operatively and parathyroid hormone on day one following surgery are significant predictors of postoperative hypocalcemia(8).

2.3 Conceptual framework

Figure 1



3. OBJECTIVES

3.1. General objective

To determine the prevalence and associated factors of post-thyroidectomy hypocalcemia in patients who underwent thyroidectomy in TASH

3.2. Specific objective

- To determine the prevalence of post-thyroidectomy hypocalcemia
- To identify factors associated with post-thyroidectomy hypocalcemia

4. METHODS AND MATERIALS

4.1. Study area and period

This study was conducted in Tikur Anbessa Specialized Hospital(TASH) which is the largest tertiary care hospital in Ethiopia from May 2025 to June 2025. TASH was opened in 1964. It became the largest referral hospital in the country with 700 beds and a University teaching Hospital since 1998.The Tikur Anbessa Specialized Hospital is now the main teaching hospital for both clinical and preclinical training of most disciplines,for residents under specialty training and fellows under sub-specialty training. It is also an institution where specialized clinical services that are not available in most of other public or private institutions are rendered to the whole nation.

Department of surgery is among the giant departments in the college of health sciences and comprising multiple units and Endocrine and Breast Surgery Unit is one of the recently established units..

Endocrine and Breast surgery unit mainly focuses on thyroid, parathyroid,adrenal surgery and breast surgery.The are five endocrine and breast surgeons actively involved in the unit currently.

Thyroidectomy is the most commonly performed surgical procedure in the unit of Endocrine and Breast Surgery.In Endocrine and Breast Surgery Unit,the standard surgical approach for malignant thyroid conditions is typically a total thyroidectomy ,performed with or without central and/or lateral neck dissection. For benign thyroid diseases,the preferred procedures are either a total thyroidectomy or a hemithyroidectomy depending on the extent of diseases.Procedures such as near-total thyroidectomy,sub-total thyroidectomy ,and Dunhill's operation are generally discouraged as their potential benefits in reducing complications are not consistently guaranteed. Completion thyroidectomy is performed for recurrent diseases or for previously partial thyroidectomy of both benign and malignant thyroid diseases. The surgical technique performed in the unit while performing thyroidectomy is capsular dissection, minimizing excessive dissection to preserve parathyroid glands. Hence the complications related to this specific procedure requires due attention to prevent, identify and mitigate the most dreaded complications, namely hypocalcemia and recurrent laryngeal nerve injury.

4.2. Study design

An institution-based retrospective study design was conducted to determine the prevalence of post-thyroidectomy hypocalcemia and associated factors in patients who underwent thyroidectomy in TASH from January 2021-June 2024.

4.3. Population

4.3.1. Source population

Patients who underwent thyroidectomy for benign and malignant thyroid diseases in Tikur Anbessa Specialized Hospital from January 2021-June 2024 .

4.3.2. Study population

Patients who underwent total and completion thyroidectomy with or without lymph node dissection for malignant and benign thyroid diseases from January 2021-June 2024 in TASH

4.3.3. Study Period

The study period was from May 2025 to June 2025.

4.4. Eligibility criteria

4.4.1 Inclusion criteria

All Patients aged 14 and above who underwent total and completion thyroidectomy with or without lymph node dissection in Tikur Anbessa Specialized Hospital for malignant and benign thyroid diseases and with postoperative serum calcium determined at least once.

4.4.2 Exclusion criteria

Patients who had lobectomy or hemithyroidectomy or subtotal thyroidectomy

Patients with preoperative diagnosis of hypocalcemia,with documented biochemical or clinical evidences

Patients who were operated at other hospitals and referred to TASH for redo-surgery but with clinical or biochemical diagnosis of hypocalcemia or on treatment for hypocalcemia

Patients with absent operation note in the chart or electronic medical record and/or no followup

4.5. Sample size determination and sampling technique

4.5.1. Sample size determination

Sample size was calculated based on a single population proportion formula by using the following assumption

$Z\alpha/2$ = critical value for normal distribution at 95% confidence interval which equals to 1.96 (z value at alpha =0.05), p = 9.5% which is the prevalence of symptomatic hypocalcemia at the first followup visit in the previous study done in Ethiopia,SPHMMC(1) . d = an absolute precision (margin of error) =5% and Incomplete chart rate is = 10%, Where: n = required sample size

$$n=(Z\alpha/2)^2 p(1-p)/d^2$$

n=(1.96*1.96)*0.095*(1-0.095)/(0.05*0.05)

n=132

10% for incomplete chart=13.2=13

nf(final sample size)=132+13=**145**

4.5.2. Sampling techniques

There were total of 150 cases who underwent total and completion thyroidectomy with or without central and/or lateral neck dissections from January 2021-June 2024 and 144 out of them fulfilled the inclusion criteria and all of them were included in the study.

4.6. Study variables

4.6.1. Dependent variable

Post-thyroidectomy hpocalcemia(transient and permanent)

4.6.2. Independent variables

Age
Sex
Type of thyroid disease

Type of surgical procedure
Pathologic diagnosis
Inadvertent injury to parathyroid gland and their number
Identification of parathyroid glands and their number
Vitamin D status
First 24-48 hrs serum calcium level
1 month to 6 weeks postoperative serum calcium
6 months postoperative serum calcium
Clinical symptoms of hypocalcemia
Clinical signs of hypocalcemia
Postoperative calcium prophylaxis
Intravenous calcium requirement
Postoperative hospital stay

4.7. Operational definition

Hypocalcaemia = corrected total serum calcium level below 8 mg/dl or ionized serum calcium level below 1.1 mmol/L or below the lower normal range of specific laboratory value

Transient hypocalcemia=when hypocalcemia is corrected in less than 12 months after thyroidectomy with normalized serum calcium level or disappeared clinical symptoms without calcium and vitamin D supplementation

Permanent hypocalcaemia = persistent hypocalcaemia after 12 months of thyroidectomy and/or requiring calcium and vitamin D for correction of serum calcium or for control of symptoms of hypocalcemia

Symptomatic hypocalcemia=patients presenting with any of the classic manifestations like Chvostek's and Trousseau's signs, muscle spasms ,cramps, and peripheral or perioral paresthaesia

Asymptomatic hypocalcemia=patients with reduced serum calcium level but with absent symptoms and signs of hypocalcemia

Vitamin D status: Low=below the lower normal range,normal=within normal range of a laboratory value

4.8. Data collection tool and procedure

The list and medical record number of the charts of patients was obtained from the logbook of the operation room. Data about the included variables was collected using the chart and medical electronic file of the patients who underwent total and completion thyroidectomy with or without central/lateral neck dissection. Information that was collected from the records include age, gender,type of thyroid disease, type of surgical procedure, frequency of surgery, intraoperative information about parathyroid gland, preoperative Vitamin D status, serum calcium level at 24hrs to 48 hrs postoperative period,1month to 6wks,6 month and beyond, symptoms and signs of hypocalcemia, requirement for calcium and vitamin D and duration, and histopathological result of resected thyroid gland. Data was collected by trained surgical residents by reviewing the charts of the patients using a pretested and validated data extraction checklist and it was supervised by the principal investigator. The data was entered into a computer and was analyzed using SPSS 25 version.

4.9 Data quality assurance

The data extraction checklist prepared in English language was used for data collection. Two days training was given to data collectors on the data collection tool and data collection procedure. The checklist was pre-tested. Data collectors were supervised by the principal investigator closely and completeness of data extraction checklist was checked on daily basis. It was edited, coded, entered to SPSS version 25, cleaned and analyzed.

4.10 Data processing and analysis

Data was entered in to SPSS version 25. Descriptive and summary statistics were performed to describe the study population and presented using tables and graphs. Factors associated with postthyroidectomy hypocalcemia were identified by using a binary logistic regression model after checking the necessary assumptions of the model. Variables with a p-value of < 0.25 in the bivariable analysis were transferred to multivariable regression analysis. Those variables with p-value < 0.05 in the multivariable regression analysis were considered as statistically significant. Odds ratio with the corresponding 95% confidence interval were used to measure the presence and strength of the association.

4.11 Ethical consideration

Ethical clearance was obtained from research and ethics committee of department of surgery, Addis Ababa University ,college of health sciences. Confidentiality of the patients' record was kept and no patient information was transferred to any other body.

4.12 Dissemination plan

The result of this study will be presented to the Addis Ababa university,College of health sciences,Department of surgery,Endocrine and Breast surgery unit.

The final paper ready for publication will be submitted to the department of surgery,will be published in a reputable journal and will be presented in conferences.

5. Results

5.1 Characteristics of study participants

A total of 144 patients who underwent total and completion thyroidectomy with or without central/lateral neck dissection were enrolled in this study. The mean and standard deviation of age distribution of the studied patients was 43 ± 13 years. Most patients, 120 (83.3%), were females.

Most of them,51 (35.4%) had a papillary thyroid cancer followed by toxic multinodular goiter,36(25.0%) as preoperative diagnosis. Histopathologic diagnosis from the resected specimen showed colloid goiter being the commonest with 65(45.1%) patients followed by 48(33.3%) papillary thyroid cancer and 9(6.3%) follicular thyroid cancer. In general, all thyroid cancers combined made 67(46.5%) cases. Almost more than half of patients, 83(57.6%) out of all had four parathyroid glands identified intraoperatively.

Total thyroidectomy alone was performed in 100(69.4%) patients and TT with central and/or lateral neck dissection was performed in 28(19.4%) patients while the rest,16(11.1%) had completion thyroidectomy . Parathyroid injury occurred in 4 (4.5%) patients. Postoperative hospital stay was 1 to 2 days for a significant percentage (105, 72.9%) of patients. Overall, 143(99.3%) patients received postoperative calcium supplementation. Low levels of preoperative vitamin D were seen in 8(5.6%) of patients,most patients ,134(93.1%) didn't have the measurement.

Table 5: Baseline characteristics of patients who underwent total and completion thyroidectomy in Tikur Anbessa Specialized Hospital (n=144).

Characteristics		Frequency	Percentage
Age of the respondent Mean(SD)		43(13)	
Sex of the respondent	Male	24	(16.7)
	Female	120	(83.3)
Type of thyroid disease(clinical diagnosis)	Graves' diseases	16	(11.1)
	Toxic multi nodular goiter	36	(25.0)
	SMNG with or without compressive symptoms	13	(9)
	Papillary thyroid Ca	51	(35.4)
	Follicular Thyroid Ca	9	(6.3)
	Medullary Thyroid Ca	3	(2.1)
	Anaplastic Thyroid Ca	2	(1.4)
	Follicular/Hurthle cell neoplasm	14	(9.7)

Occurrence of the disease	primary	126	(87.5)
	recurrent	18	(12.5)
Pathologic diagnosis of thyroid disease	Colloid goiter	65	(45.1)
	Hurthle cell/Follicular adenoma	8	(5.6)
	Thyroid cancer	67	(46.5)
	Thyroiditis	4	(2.8)
Type of surgical procedure	Total Thyroidectomy	128	(88.9)
	Completion total thyroidectomy	16	(11.1)
Number of parathyroid identified intraoperatively	1-3	21	(14.6)
	4	83	(57.6)
	Not reported or Not identified	40	(27.8)
Parathyroid injury	no	84	(95.5)
	yes	4	(4.5)
Postoperative calcium supplementation	Yes	143	(99.3)
	No	1	(.7)
Postoperative hospital stay	1 to 2 days	105	(72.9)
	3 days to 1 week	28	(19.4)
	> 1week	11	(7.6)
Vitamin D level	Low	8	(5.6)
	Normal range	2	(1.4)
	Not measured	134	(93.1)

5.2. Prevalence of Post-thyroidectomy hypocalcaemia

The prevalence of post-thyroidectomy hypocalcaemia in this study was 32.6%(n=47);while the prevalence of transient hypocalcaemia was 25.7%, and that of permanent hypocalcaemia was 6.9%.

Symptomatic hypocalcemia was found in 19(40.4%) of patients with post-thyroidectomy hypocalcemia, where 10(27.8%) patients with transient hypocalcemia, and 9(90.7%) patients with permanent hypocalcemia developed clinical symptoms and signs of hypocalcemia.

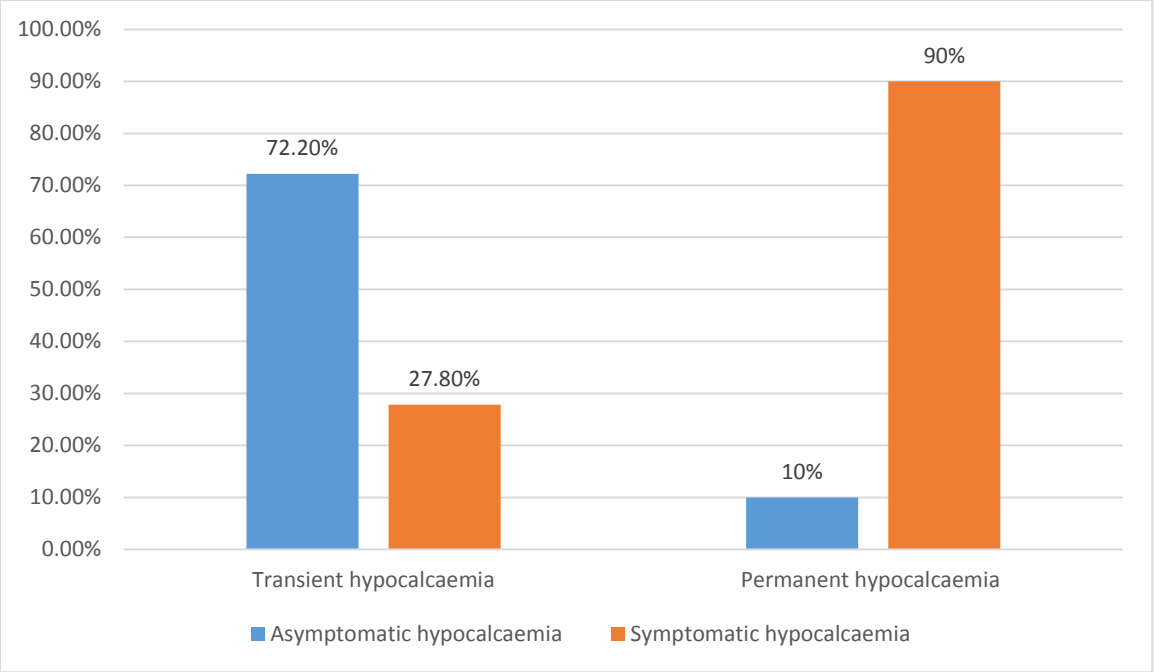


Figure *2*: The percentage of patients with symptomatic and asymptomatic hypocalcemia among transient and permanent hypocalcemia

Low levels of serum calcium were seen in 45(31.3%) and 36(25.0%) patients at 24 to 48 hours and 1 month to 6 weeks after surgery, respectively. The serum calcium became normalized within 1 - 3 months in 18 (48.6%) , 4-6 months in 11(29.7%), and 7-12 months in 8 (21.6%) patients with transient post-thyroidectomy hypocalcemia without calcium and/or vitamin D supplementation.

The most common symptoms of post-thyroidectomy hypocalcemia were perioral paresthesia and pain, muscle cramps, and fingertip paresthesia (n=17, 89.5%), whereas the most common signs were chvostek's and trosseu's sign (n=12, 63.2%).

Severe post-thyroidectomy hypocalcemia requiring intravenous calcium infusion was found in 16 out of 47(34.0%) patients, and the mean duration for calcium infusion was 3 ± 2 days.

Table 6: Post-thyroidectomy hypocalcemia among patients who underwent total and completion thyroidectomy with or without central and/or lateral neck dissection in Tikur Anbessa Specialized Hospital (n=144).

		Frequency	Percentage
Serum Calcium 24 to 48 hours after surgery	Low	45	(31.3)
	Normal	97	(67.4)
	not determined	2	(1.4)
Serum Calcium 1 month to 6 weeks	Low	36	(25.0)
	Normal	51	(35.4)
	Not determined	57	(39.6)
Symptoms of hypocalcemia in patients with low serum calcium	perioral paresthesia and pain, muscle cramps, finger tip paresthesia and numbness	17	(89.5)
	perioral paresthesia and pain, fingertip paresthesia and pain	2	(10.5)
Signs of hypocalcaemia in patients with low serum calcium	Chvostek's sign	7	(36.8)
	Both chvostek's and trosseu's sign	12	(63.2)
Requirement for IV calcium in patients with low serum calcium	Yes	16	(34.0)
	No	31	(66.0)
Duration for IV calcium in days in patients with low serum calcium: Mean($\pm$SD)		3($\pm$2)	
Time serum calcium level corrected for transient hypocalcemia patients without calcium and vit D supplementation	1 - 3 months	18	(48.6)
	4-6 months	11	(29.7)
	7-12 months	8	(21.6)

5.3. Factors associated with Post-thyroidectomy hypocalcemia

In the uni-variate analysis, patients who had PT glands identified intraoperatively had a higher risk of post-thyroidectomy hypocalcemia.

Post-thyroidectomy hypocalcemia was exhibited with a significant incidence in patients with parathyroid glands identified intraoperatively; 1-3 parathyroid in 11 cases (23.4%) and 4 in 18 (38.3%) cases .

Regarding postoperative hospital stay, patients with post-thyroidectomy hypocalcemia had a significantly longer postoperative hospital stay of 3 days to 1 week in 19(40.4%), and more than 1 week in 9 (19.1%) patients .

Six out 8 patients who had low preoperative vitamin D level developed transient hypocalcemia while 1 patient developed permanent hypocalcemia.

Out of 47 patients who developed post-thyroidectomy hypocalcemia,31 patients(66.0%) had a total thyroidectomy,11 patients(23.4%) underwent total thyroidectomy with central and/or lateral neck dissection and 5 patients(10.6%) experienced completion thyroidectomy. However,when considering the type of thyroidectomy procedures,the incidence of post-thyroidectomy hypocalcemia was higher in patients who underwent total thyroidectomy with central and/or lateral neck dissection,with 11 out of 28 patients(39.3%) experiencing hypocalcemia.This was compared to 31 out of 100 patients(31.0%) who had total thyroidectomy alone and 5 out of 16 patients(31.3%) who underwent completion thyroidectomy.

Among patients who developed post-thyroidectomy hypocalcemia,22(46.8%) had histopathologic diagnosis of thyroid cancer of all types,18(38.3%) had colloid goiter,5(10.6%) had follicular/hurthle cell adenoma and 2(4.3%) had thyroiditis.

Table 7: Relationship between post-thyroidectomy hypocalcaemia and baseline characteristics of patients (n=144)

		Post-thyroidectomy hypocalcaemia					
		Yes		No			
		n	%	n	%	X^2	p-value
Age of the respondent: Mean(SD)		41	11	43	14	2136*	.541
Sex of the respondent	Male	6	(12.8)	18	(18.6)	.764	.382
	Female	41	(87.2)	79	(81.4)		
Type of thyroid disease(clinical diagnosis)	Graves' diseases	5	(10.6)	11	(11.3)	8.869	.262
	Toxic multi nodular goiter	12	(25.5)	24	(24.7)		
	SMNG with or without compressive symptoms	3	(6.4)	10	(10.3)		
	Papillary thyroid Ca	16	(34)	35	(36.1)		
	Follicular Thyroid Ca	1	(2.1)	8	(8.2)		
	Medullary Thyroid Ca	2	(4.3)	1	(1)		
	Anaplastic	2	(4.3)	0	(0.0)		

	Thyroid Ca						
	Follicular/Hurthle cell neoplasm	6	(12.8)	8	(8.2)		
Occurrence of the disease	Primary	42	(89.4)	84	(86.6)	.221	.638
	recurrent	5	(10.6)	13	(13.4)		
Pathologic diagnosis of thyroid disease	Colloid goiter	18	(38.3)	47	(48.5)	4.518	.211
	Hurthle cell/Follicular adenoma	5	(10.6)	3	(3.1)		
	Thyroid cancer	22	(46.8)	45	(46.4)		
	Thyroiditis	2	(4.3)	2	(2.1)		
Type of surgical procedure	Total Thyroidectomy	42	(89.4)	86	(88.7)	.016	.900
	Completion total thyroidectomy	5	(10.6)	11	(11.3)		
Number of parathyroid identified intraoperatively	1	1	(2.1)	1	(1.0)	11.053	.026
	2	8	(17)	7	(7.2)		
	3	2	(4.3)	2	(2.1)		
	4	18	(38.3)	65	(67)		
	Not reported or Not identified	18	(38.3)	22	(22.7)		
Postoperative hospital stay	1 to 2 days	19	(40.4)	86	(88.7)	37.998	.000*
	3 days to 1 week	19	(40.4)	9	(9.3)		
	> 1week	9	(19.1)	2	(2.1)		

Table 8: Bivariate logistic regression analysis of factors associated with post-thyroidectomy hypocalcaemia.

		Post-thyroidectomy hypocalcaemia				COR(95% CI)	
		Yes		No			p-value
		n	%	n	%		
Sex	Male	6	(12.8)	18	(18.6)	1.557(0.57,4.22)	0.38
	Female	41	(87.2)	79	(81.4)	1	
Age	18-29	5	(10.6)	17	(17.5)	1.40(0.43,4.53)	0.57
	30-39	20	(42.6)	25	(25.8)	0.515(0.21,1.21)	0.128
	40-49	8	(17.0)	21	(21.6)	1.08(0.38,3.01)	0.88
	>=50	14	(29.8)	34	(35.1)	1	
Pathologic diagnosis of thyroid disease	Colloid goiter	18	(38.3)	47	(48.5)	2.611(0.342, 19.958)	.355
	Hurthle cell/Follicular adenoma	5	(10.6)	3	(3.1)	0.60(0.053, 6.79)	.68

	Thyroid cancer	22	(46.8)	45	(46.4)	2.04(0.27, 15.50)	.48
	Thyroiditis	2	(4.3)	2	(2.1)	1	
Number of parathyroid identified intraoperatively	1	1	(2.1)	1	(1.0)	0.81(0.04,14.01)	0.89
	2	8	(17)	7	(7.2)	.71(.21, 2.35)	.58
	3	2	(4.3)	2	(2.1)	.81(.10, 6.39)	.84
	4	18	(38.3)	65	(67)	2.95(1.31, 6.66)	0.009
	Not reported or Not identified	18	(38.3)	22	(22.7)	1	

In the bi-variable regression analysis of factors associated with post-thyroidectomy hypocalcaemia, variables with a p-value of 0.25 or less identified as candidate variables in the multivariable logistic regression analysis, including age category of the patients and number of parathyroid identified intraoperatively. Multivariate binary logistic regression analysis revealed that number of parathyroid glands identified intraoperatively was associated with post-thyroidectomy hypocalcaemia at a p-value of 0.05 or less.

The association was that patients with 4 parathyroid glands identified intraoperatively developed post-thyroidectomy in 3 fold higher than those in whom parathyroid glands were not achieved to identify (p-value=0.011)

Table 5:Multivariate logistic regression analysis of factors associated with post-thyroidectomy hypocalcaemia

		Post-thyroidectomy hypocalcaemia				COR(95% CI)	AOR(95% CI)
		Yes		No			
		n	%	n	%		
Age	18-29	5	(10.6)	17	(17.5)	1.40(0.43,4.53)	1.29(0.37,4.39)
	30-39	20	(42.6)	25	(25.8)	0.515(0.21,1.21)	0.48(0.19,1.18)
	40-49	8	(17.0)	21	(21.6)	1.08(0.38,3.01)	1.07(0.36,3.13)
	>=50	14	(29.8)	34	(35.1)	1	1
Number of parathyroid identified intraoperatively	1	1	(2.1)	1	(1.0)	0.81(0.04,14.01)	0.95(0.05,17.34)
	2	8	(17)	7	(7.2)	.71(.21, 2.35)	0.66(0.19,2.23)
	3	2	(4.3)	2	(2.1)	.81(.10, 6.39)	0.77(0.09,6.33)
	4	18	(38.3)	65	(67)	2.95(1.31, 6.66)	2.93(1.28,6.71)*
	Not reported or Not identified	18	(38.3)	22	(22.7)	1	1

6. Discussion

This study assessed the prevalence of post-thyroidectomy hypocalcemia and its associated factors in patients who underwent total and completion thyroidectomy with or without central/lateral neck dissections in Tikur Anbessa Specialized Hospital, from January 2021 to June 2024. The result showed the prevalence of overall post-thyroidectomy hypocalcemia being 32.6%; and the prevalence of post-thyroidectomy transient and permanent hypocalcemia 25.7% and 6.9% respectively.

The prevalence of post-thyroidectomy hypocalcaemia observed in the present study was comparable to that reported in a study conducted in Vietnam which was 23.6% and 6.5% for transient and permanent hypocalcemia respectively(6).It was also comparable with a study done in India,where transient and permanent hypocalcemia was 24% and 6% respectively(19). However, the prevalence of transient post-thyroidectomy hypocalcemia observed in the current study was lower than reported in a study conducted in Yemen(54%) (13) and Saudi Arabia (63.4.%)(2). This could be due to difference in serum calcium cut off points used to define hypocalcemia. In addition, the higher rate of patients in our study received oral calcium with vitamin D for at least one month after surgery which could decreased the incidence of transient hypocalcemia,which was also supported by other studies(4,23,25). This could also be due to improved surgical techniques attributed to availability of endocrine and breast surgeons and fellows,despite large proportion of cases are of thyroid cancer. The lower rate of transient hypocalcemia could also be due to incomplete follow up with serum calcium as it was shown in 57 patients(39.6%), serum calcium was not measured at 1month to 6 weeks period after surgery in our study.

The prevalence of permanent hypocalcemia from this study was also comparable to the study done in SPHMMC,Addis Ababa(6.1%) and slightly higher than other studies in Ethiopia and met-analysis in Africa (5.6%) and most guidelines (1,20,22). This could be due to larger proportion of thyroid cancer patients (46.5%) and more complex cases operated in the institution where this study was done.It could also be due to exclusion of less extensive thyroid surgeries like hemithyroidectomy and lobectomy from the study where the risk of hypocalcemia is low and their absence decreases the denominator. In addition other confounding factors like vitamin D deficiency might be a cause for such finding as the relation between low vitamin D status and hypocalcemia is well established. It was confirmed in studies that adult vitamin D deficiency is prevalent in low and middle income

countries in general(26), and Africa in particular,which is 17.3%,34.18%,58.54% for cut off <30,50 and 75 nmol/L respectively(27)

The finding of this study showed that age and gender were not associated with post-thyroidectomy hypocalcemia. This finding was in line with findings in other studies (5,29). Female gender appears to be a predisposing factor for the post-thyroidectomy hypocalcemia development in multiple studies which is not statistically defined in this study (4,15,16).

As for the type of surgical procedure, post-thyroidectomy hypocalcemia observed among higher proportion of patients undergoing total thyroidectomy with central and/or lateral neck dissection,which is performed for patients with thyroid cancers, than those who had total thyroidectomy and completion thyroidectomy alone, suggesting that extent of surgery significantly affects parathyroid gland injury. This is in agreement with the findings of a study conducted in Vietnam where extensive thyroid surgery and increased operative duration, have demonstrated a significant correlation with post-thyroidectomy hypocalcemia compared with less extensive thyroid procedures (6).

Regarding the number of parathyroid glands identified intraoperatively, this study showed that patients with intraoperative identification of 4 PT glands were at higher risk of developing post-thyroidectomy hypocalcemia than those patiens in which PT gland identification was not achieved with AOR=2.93(1.28,6.71)(p=0.011). This result is consistent with the findings in other studies(8,24,28). This could be due to excessive dissection to identify PT glands may have compromised their blood supply.

Furthermore,this study showed that out of 28 patients who stayed in the hospital for >3 days to week,19(67.9%) were those with post-thyroidectomy hypocalcemia and out of 11 patients who stayed in the hospital for >1 week,9(81.8%) were those with post-thyroidectomy hypocalcemia

. This finding is consistent with findings of a study conducted in Europe, where patients with postoperative hypocalcemia had a longer hospitalization (9). This could be explained by the fact that postoperative hypocalcemia may mandate for parenteral calcium supplementation which could lead to prolonged hospital stays.This could occur in patients who develop symptomatic hypocalcemia lately during discharge after surgery.

7. Conclusions

This study highlighted that post-thyroidectomy hypocalcemia is prevalent among 32.6% of patients who underwent total and completion thyroidectomy with or without central and/or lateral neck dissection

In addition the study showed that excessive dissection to identify PT glands may compromise their blood supply and may predispose patients to postoperative hypocalcemia. The study also showed that post-thyroidectomy hypocalcemia was associated with prolonged postoperative hospital stay.

However, there was no significant clinical relationship between post-thyroidectomy hypocalcemia and age or sex.

8. Recommendations

Because routine supplementation of calcium with vitamin D postoperatively in patients who underwent total thyroidectomy with or without central and/or lateral neck dissections has decreased the occurrence of transient hypocalcemia,it is recommended for the unit to continue this practice. In addition,preoperative and postoperative serum calcium measurement should be routine practice to identify patients at high risk for hypocalcemia and treat accordingly. It is also better to determine preoperative vitamin D level for patients undergoing thyroidectomy.

In addition,the unit has to employ capsular dissection technique during thyroidectomy and avoiding excessive dissection to identify parathyroid glands to not disrupt their blood supply.

It is also recommended to the hospital administrative body to avail the biochemical tests such as serum vitamin D ,serum calcium and iPTH measurements in the laboratory department of the hospital.

Finally,to derive strong and generalizing results, it is recommended to undergo prospective multicenter study in the future.

9.Limitations of the study

This study was conducted in a single institution and it was a retrospective study with secondary data used which could lead to missing information.In addition, the sample size used in this study was small.In this study the surgeons experience and the relation of hypocalcemia to other post-thyroidectomy complications were not studied. Lastly, post operative PTH measurement was not done.

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Annex

Data extraction checklist

Part I. Demographic factors

No	Question	Response	Remark
101	Age (in years)	_____Years	
102	Sex	1. Male 2. Female	

Part II.Type of thyroid disease,clinical diagnosis(select one)

No	Question	Response	Remark
1	Graves' disease		
2	Toxic MNG		
3	SMNG with or without compressive symptoms		
4	Retrosternal goiter		
5	Papillary thyroid ca		
6	Follicular thyroid ca		
7	Medullary thyroid ca		
8	Anaplastic thyroid ca		
9	Recurrent thyroid disease		
10	Thyroiditis		
11	Follicular neoplasm		

Part III. Occurrence of the disease

1. Primary(first appearance)
2. recurrence

Part IV.Pathologic Diagnosis of Thyroid disease(select one)

No	Question	Response	Remark
1	Colloid goiter		
2	Huirthle cell/follicular adenoma		
3	Papillary thyroid ca		
4	Follicular thyroid ca		
5	Medullary thyroid ca		
6	poorly differentiated thyroid ca		
7	Anaplastic thyroid ca		
8	Hurthle cell carcinoma		
9	Thyroiditis		

Part V.Type of surgical procedure(select one)

No	Question	Response	Remark
1	Total thyroidectomy		
2	Total thyroidectomy+CCND		
3	Total thyroidectomy+CCND+Unilateral (Rt/Lt)MRLND		
4	Total thyroidectomy+CCND+Bilateral MRLND		
5	Total thyroidectomy+MRND(Uni/Bil-lateral)		
6	Completion total thyroidectomy		

Part VI.Intraoperative findings

No	Question	Response	Remark
1	Number of parathyroids identified and preserved	1. One 2. Two 3. Three 4. Four 5. Not reported or not identified	
2	Inadvertent injury of parathyroid gland and number	1. One 2. Two 3. Three 4. Four 5. None 6. Not reported or documented	

Part VII.Postoperative course

No	Question	response	Remark
1	Postoperative prophylactic calcium supplementation	1.Yes 2.NO	
2	Postoperative hospital stay	1. 1 to 2 days 2.3 days to 1 week 3.>1week	
3	Requirement for IV calcium in patients with low serum calcium	1.Yes 2.No 3.not applicable for patients with normal calcium	
4	Duration for iv calcium in days for pts with low serum calcium	---------	

Part VIII.serum calcium level (total /ionized serum calcium)

No	Question	Response	Remark
701	1st 24-48hrs after surgery	1. Low 2. Normal 3. Not determined	
702	1 month to 6 weeks postop	1. Low 2. Normal 3. Not determined	

Part IX.Post-thyroidectomy hypocalcemia

1	Transient hypocalcemia	1. Yes 2. No	
2	Permanent hypocalcemia	1. Yes 2. No	

Part X.Time serum calcium level corrected(in months)(for patients with transient hypocalcemia)

No	Question		Remark
1. 1 to 3 months 2. 4 to 6 months 3. 7 to 12 months 4. Not applicable(for patients with normal serum calcium throughout and for patients with permanent hypocalcemia)			

Part XI.preoperative Vitamin D status

No	Question	Response	Remark
901	Vitamin D	1. Low 2. Normal 3. Not determined	

Part X .Symptoms and signs of hypocalcemia(for patients with transient or permanent hypocalcemia)

No	Question	Response	Remark
1	Symptoms for hypocalcemia	1. Perioral paresthesia and pain 2. Finger tip paresthesia and numbness 3. Muscle cramps 4. Perioral paresthesia and	

		pain,finger tip paresthesia and pain,muscle cramps 5. Perioral paresthesia and pain ,finger tip paresthesia and pain 6. No symptoms(asymptomatic) 7. Not applicable(patient is not hypocalcemic)	
2	Signs for hypocalcemia	1. chvostek's sign 2. Trousseu's sign 3. Both chvostek's and Trousseu's sign 4. None 5. Not applicable(patient is not hypocalcemic)	