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Early and Late Hypocalcemia after Thyroidectomy, Prospective Study

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ABSTRACT

Background: Thyroidectomy, the surgical removal of all or part of the thyroid gland, is commonly performed for both malignant and benign conditions. While generally safe, it carries risks such as hypocalcemia, often caused by parathyroid gland injury. Hypocalcemia, defined by low serum or ionized calcium levels, may present early or persist long-term. *Purpose:* To evaluate the incidence and characteristics of early and late hypocalcemia in patients undergoing thyroidectomy.
Methods: A prospective observational cross-sectional study was conducted at Al-Nasiriyah Teaching Hospital over one year (April 2024–April 2025) to assess the incidence and characteristics of early and late hypocalcemia following thyroidectomy. Eighty-five adult patients undergoing surgery for benign or malignant thyroid conditions were included based on defined inclusion and exclusion criteria. Data on demographics, clinical history, surgical details, and serial calcium levels were collected using a structured sheet. Standardized surgical techniques were applied, and hypocalcemia was categorized as early (≤72 hours) or late (>6 months).
Results: Among thyroidectomy patients in this study, the mean age was 44.79±12.27 years, with females comprising 80.0% of the cohort. Benign diagnoses were more common (60.0%), and near-total thyroidectomy was the predominant procedure (74.1%). Early hypocalcemia occurred in 29.4% of patients, while permanent hypocalcemia was rare (1.2%). Significant differences in serum calcium levels by surgery type were observed at 24 hours (p=0.009) and 7 days postoperatively (p=0.002), with bilateral lobectomy showing higher calcium levels. Early hypocalcemia (p=0.019), normalization time (p=0.013), permanent hypocalcemia (p=0.033), and vitamin D supplementation duration (p=0.004) were all significantly associated with the type of thyroidectomy performed.
Conclusions: Early postoperative hypocalcemia is a common but usually transient complication of thyroidectomy, with permanent cases being rare. The risk and duration of hypocalcemia are significantly influenced by the extent of thyroid resection. More extensive procedures were linked to increased calcium and vitamin D supplementation needs, highlighting the importance of careful surgical technique and early monitoring to reduce hypocalcemia-related complications.
Keywords: thyroidectomy, hypocalcemia, parathyroid glands, calcium supplementation, vitamin D

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INTRODUCTION

Thyroidectomy, the surgical removal of part or all of the thyroid gland, is

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commonly performed to treat thyroid cancer, benign nodules, goiters, and hyperthyroidism (1). Surgical approaches were chosen based on disease type, patient condition, and treatment goals. According to the American Association of Endocrine Surgeons (AAES), types of thyroidectomy include total, near-total, hemithyroidectomy, subtotal, completion, radical, minimally invasive thyroidectomy, and isthmusectomy (2-7).

Thyroidectomy is indicated for malignant conditions such as papillary, follicular, medullary, or anaplastic thyroid cancers. For hereditary syndromes such as MEN (8), benign indications include compressive nodules, substernal goiters, refractory hyperthyroidism, recurrent nodules, and severe thyroiditis (9).

However, thyroidectomy may be contraindicated in patients with uncontrolled cardiovascular or respiratory diseases, active infections, bleeding disorders, or contraindications to general anesthesia. Relative contraindications, such as unstable thyrotoxicosis, poor health status, and pregnancy, require careful management (10,11).

One of the most significant complications of thyroidectomy is hypocalcemia, primarily due to inadvertent injury or removal of parathyroid glands. Other complications include nerve injury, hemorrhage, thyrotoxic crisis, and voice changes (12).

The parathyroid glands maintain calcium homeostasis through the secretion of parathyroid hormone (PTH), which increases calcium levels by promoting bone resorption, renal reabsorption, and vitamin D. Hypocalcemia manifests as neuromuscular symptoms including cramps, paresthesia, seizures, and arrhythmias (13). PTH and calcitriol act synergistically to restore the calcium balance (14).

Hypocalcemia is defined as serum calcium <8.5 mg/dL or ionized calcium <4.5 mg/dL (15). It may occur early (within 48–72 h) or later owing to permanent parathyroid damage. The risk k factors include total thyroidectomy, vitamin D deficiency, and renal disease. Early detection through calcium and parathyroid hormone (PT) H monitoring is essential (16).

Globally, transient hypocalcemia affects 20–40% of patients, with permanent hypocalcemia affecting 1-10% of patients (17). Regional variability is influenced by surgical practice and preoperative care. Management includes calcium and vitamin D supplementation, with recombinant PTH reserved for refractory cases (18).

METHODS

This prospective observational crosssectional study was conducted at the General Surgery Department of AlNasiriyah Teaching Hospital over one year, from April 1, 2024, to April 1, 2025. This study aimed to evaluate the incidence and characteristics of early and late hypocalcemia after thyroidectomy. All surgeries were performed by experienced general surgeons, using standardized techniques tailored to the disease type and anatomical considerations.

A total of 85 patients undergoing thyroidectomy for benign or malignant thyroid conditions were included. The inclusion criteria were age ≥18 years, availability of complete clinical data, and preoperative and postoperative calcium measurements with at least 6 months of follow-up. Exclusion criteria included preexisting hypocalcemia, parathyroid disorders, reoperative or completion thyroidectomy, chronic kidney disease, or medications affecting calcium metabolism. Convenience sampling was also conducted.

Data were collected through a structured sheet encompassing demographics, comorbidities, preoperative thyroid function and calcium levels, intraoperative details (type of thyroidectomy, parathyroid, and nerve preservation), and postoperative monitoring (serial calcium levels, supplementation, and complications). Standard thyroidectomy approaches were used, including subtotal, near-total, and total thyroidectomy with isthmusectomy. The key surgical steps involved RLN identification, parathyroid gland preservation, and fascial dissection, with bipolar cautery and ligaclips for hemostasis.

Postoperative calcium monitoring was performed at 24 hours and 7 days, with classification into early (within 72 hours) and late hypocalcemia (>6 months).

Statistical Analysis

Statistical analysis was conducted using SPSS v26, applying descriptive statistics, Chi-square/Fisher's exact tests for categorical data, and ANOVA for continuous variables, with $p < 0.05$ considered significant.

Ethical Approval

Ethical approval was granted by the Scientific and Ethical Committee of the AlNasiriyah Teaching Hospital and ThiQar Health Directorate. Informed verbal consent was obtained, confidentiality was maintained, and the participants were free to withdraw at any time.

RESULTS

A total of 85 patients undergoing thyroidectomy were enrolled in this study at the AlNasiriyah Teaching Hospital. The mean age was 44.79 ± 12.27 years, with the majority (58.8%) in the middle-aged group (4065 years). Females were predominant (80.0%). Regarding comorbidities, 30.6% had hypertension, and 10.6% had diabetes mellitus. Diagnostically, 60.0% of cases were classified as benign, 17.6% as malignant, and 22.4% as suspected or indeterminate. The mean preoperative calcium level was 9.315 ± 0.781 mg/dL (*table 1*).

Neartotal thyroidectomy was the most common surgical procedure (74.1%), followed by bilateral lobectomy and subtotal thyroidectomy (12.9%) (*fig. 1*).

Postoperative monitoring revealed that two parathyroid glands were identified in most patients (61.2%). Early hypocalcemia occurred in 29.4% of patients, while permanent hypocalcemia was observed in only one case (1.2%).

Calcium supplementation was required in 29.4% of the patients, with variable durations. Vitamin D supplementation was administered in 23.5% of cases. The mean serum calcium level decreased from 9.01 mg /dL at 24 h postoperatively to 8.36 mg/dL at 7 days. Post operative complications were infrequent, with only 9.4% experiencing any, primarily neuromuscular symp toms (20.0%), including numbness and paresthesia (9.4%). The final histopathology confirmed that 63.5% of the lesions were benign and 36.5% malignant lesions (*table 2*).

Neartotal thyroidectomy is more common in middle-aged and male patients. Malignancy was predominantly treated with near-total thyroidectomy. However, the association between surgery type and demographic variables was not statistically significant (*table 3*).

Significant postoperative calcium differences were observed between the surgical types at 24 h (p = 0.009) and 7 days (p = 0.002), with bilateral lobectomy associated with higher calcium levels (*table 4*).

Early hypocalcemia was significantly associated with the surgery type (p = 0.019), and the normalization time also differed significantly (p = 0.013). Permanent hypocalcemia was more frequent after subtotal thyroidectomy (p = 0.033). Postoperative complications, although more common in the near-total group, showed no significant association with surgery type *table 5*.

Table 1 - Demographic characteristics of the study population.

Variables	No.	%
Age (Years)		
20-39	30	35.3
40-65	50	58.8
> 65	5	5.9
mean±SD	44.79±12.27	
Gender		
Male	17	20
Female	68	80
Hypertension		
No	59	69.4
Yes	26	30.6
Diabetes		
No	76	89.4
Yes	9	10.6
Preoperative Diagnosis		
Benign	51	60
Malignant	15	17.6
Suspected	19	22.4
Seum calcium (Mean±SD)	9.315±0.781	

DISCUSSION

This study provides significant insights into the incidence and predictors of post-thyroidectomy hypocalcemia, a common complication that affects patient recovery and long-term outcome.

Near-total thyroidectomy is the most frequently performed procedure, particularly in middle-aged patients. The preference for more extensive surgery in older individuals aligns with the findings of Dhir et al. (19), who reported a tendency to perform total thyroidectomy in older populations due to the increased complexity or size of thyroid disease. Additionally, males more often underwent near total l thyroidectomy, a trend also noted by Huang et al. (20), who suggested that male patients are more likely to present with more complex thyroid conditions. Comorbidities such as hypertension and diabetes

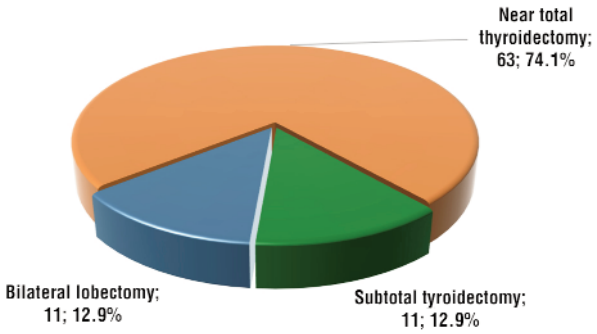

Figure 1 - Distribution of thyroidectomy types among the study population.

Table 2 - Postoperative parathyroid findings, hypocalcemia, and supplementation details.

Psot operation	No.	%
Number of Parathyroid Glands Identified		
1	10	11.8
2	52	61.2
3	23	27.1
Early Hypocalcaemia Diagnosis		
No	60	70.6
Yes	25	29.4
Type of Calcium Supplementation		
Oral	9	10.6
Both	16	18.8
Duration of Calcium Supplementation		
7 days	6	7.1
14 days	19	22.4
Timeframe for Normalization		
< 1 week	10	11.8
2 weeks	4	4.7
1-4 weeks	10	11.8
1-6 months	1	1.2
Permanent Hypocalcaemia Diagnosis		
No	84	98.8
Yes	1	1.2
Vitamin D Supplementation Needed		
No	65	76.5
Yes	20	23.5
Duration of Vit D Supplementation (Months)		
1 month	8	9.4
2 weeks	12	14.1
Mean serum calcium levels after 24 h.	9.01±0.92 mg/dl	
Mean serum calcium levels after 7 days	8.36±1.35 mg/dl	
Numbness and parasthesia		
No	77	90.6
Yes	8	9.4
Muscles cramps and parasthesia		
No	68	80.0
Yes	17	20.0
Histopathology		
Benign	54	63.5
Malignant	31	36.5

showed no significant impact, supporting earlier studies by Lee et al. (21) and Song et al. (22), which found that surgical planning is generally based more on thyroid-specific pathology than systemi pathology comorbid conditions.

Changes in perioperative calcium levels are the most critical finding. Although preoperative calcium levels were comparable across the surgical groups (p = 0.099), they emerged in the early and late postoperative periods. At both 24 h and 7 days post-surgery, serum calcium levels were significantly higher in the bilateral lobectomy group than in the near-total and subtotal groups. These results highlight the association between the extent of surgery and calcium homeostasis, consistent with the findings of Del Rio et al. (23) and Ozemir et al. (24), who reported higher rates of postoperative hypocalcemia following more extensive thyroid resections.

Similarly, ElSayed et al. (25) found a reduced incidence of hypoparathyroidism following subtotal procedures compared to total thyroidectomy, emphasizing the importance of limiting parathyroid manipulation. Furthermore, this study identified the early postoperative period (within 24-48 h) as the most critical window for detecting hypocalcemia, which supports the observations made by Hao et al. (26).

Regarding parathyroid gland preservation, most patients had two glands identified, with some near-total and subtotal cases showing only one gland. Although the number of glands identified was not significantly correlated,

Riordan et al. (27, and Luo et al. (28) noted that

Table 3 - Association between thyroidectomy type and demographic, clinical, and preoperative variables

	Thyroidectomy Type						P value
	bilateral lobectomy		near total thyroidectomy		subtotal thyroiectomy		
	No=11	%	No=63	%	No=11	%	
Age (Years)							
20-39	3	10	23	76.7	4	13.3	0.645
40-65	8	16	35	70	7	14	
> 65	0	0	5	100	0	0	
mean±SD	43.18±8.953		45.48±13.383		42.45±7.891		0.681
Gender							
Male	0	0	16	94.1	1	5.9	0.095
Female	11	16.2	47	69.1	10	14.7	
Hypertension							
No	5	8.5	45	76.3	9	15.3	0.143
Yes	6	23.1	18	69.2	2	7.7	
Diabetes							
No	11	14.5	56	73.7	9	11.8	0.37
Yes	0	0	7	77.8	2	22.2	
Preoperative Diagnosis							
Benign	6	11.8	37	72.5	8	15.7	0.163
Malignant	0	0	14	93.3	1	6.7	
Suspected	5	26.3	12	63.2	2	10.5	

Table 4 - Comparison of serum calcium levels by thyroidectomy type at preoperative, 24-hour, and 7-day intervals.

Serum calcium	Bilateral lobectomy	Near total thyroidectomy	Subtotal thyroiectomy	P value
	mean±SD	mean±SD	mean±SD	
Preoperative	9.482±0.945	9.367±0.79	8.855±0.284	0.099
24 h Post surgery	9.690±0.976	8.978±0.915	8.524±0.493	0.009
7 days post-surgery	9.661±1.522	8.181±1.292	8.080±0.73	0.002

Table 5 - Association between thyroidectomy type and postoperative calcium outcomes, supplementation, and parathyroid preservation.

	Thyroidectomy Type						P value
	bilateral lobectomy		near total thyroidectomy		subtotal thyroiectomy		
	No=11	%	No=63	%	No=11	%	
Early hypocalcemia							
No	11	18.3	44	73.3	5	8.3	0.019
Yes	0	0	19	76	6	24	
Timeframe for normalization							
Normal	11	18.3	44	73.3	5	8.3	0.013
< 1 week	0	0	9	90	1	10	
2 weeks	0	0	4	100	0	0	
1-4 weeks	0	0	6	60	4	40	
1-6 months	0	0	0	0	1	100	
Permanent hypocalcemia							
No	11	13.1	63	75	10	11.9	0.033
Yes	0	0	0	0	1	100	
Duration of Vit D supplementation (months)							
No Vit D needed	11	16.9	47	72.3	7	10.8	0.004
2 weeks	0	0	12	100	0	0	
1 month	0	0	4	50	4	50	
Numbness and parasthesia							
No	11	14.3	55	71.4	11	14.3	0.214
Yes	0	0	8	100	0	0	
Muscles cramps and parasthesia							
No	11	16.2	48	70.6	9	13.2	0.188
Yes	0	0	15	88.2	2	11.8	
Histopathology							
Benign	10	18.5%	36	66.7%	8	14.8%	0.079
Malignant	1	3.2%	27	87.1%	3	9.7%	

presere *in situ* glands are more important than identification alone for predicting postoperative function. A statistically significant association was observed between the surgery type and early hypocalcemia, with the majority of cases occurring after near-total thyroidectomy. This trend supports the findings of Benmiloud et al. (29) and Rao et al. (30). Although the type and duration of calcium supplementation were not significant, more extensive procedures required longer supplementation, consistent with the findings of Ahmad et al. (31). Vitamin D use was more frequent and prolonged in these groups, with the duration reaching significance, supporting the conclusions of Benmiloud et al. (29).

CONCLUSIONS

This study highlights the significant clinical implications of hypocalcemia following thyroidectomy. These findings confirm that hypocalcemia is a common complication in the early postoperative period, although it is typically transient and resolves with appropriate management. The extent of thyroid resection was found to be a critical determinant of both the incidence and duration of hypocalcemia, with more extensive procedures, particularly near-total and subtotal thyroidectomies, associated with a higher risk. Moreover, intraoperative identification of fewer parathyroid glands correlated with increased post-operative calcium disturbances, underscoring the importance of gland preservation during surgery.

Limitations

They included a small number of patients, missing PTH values, and a convenience sample, which limits the applicability of the results.

Author's Contributions

Nagham Sharhan; Conceptualization; Data Curation; Investigation; Methodology; Project administration, Software; Visualization; Writing – original draft, and writing – review and editing. Muhanad Al Ridha; conceptualization; supervision; validation; visualization; writing – original draft and writing – review and editing.

Conflicts of Interest

The authors declare no conflict of interest regarding this article.

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