

Evaluation of risk factors of postoperative Hypocalcemia following total Thyroidectomy: A study from tertiary care hospital.

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ABSTRACT:

Objective: To evaluate the risk factors and assess the prevalence of postoperative hypocalcemia in patients having a complete thyroidectomy at a Karachi tertiary care hospital.

Methodology: The ENT Department at Sir Syed Hospital in Karachi conducted this retrospective study from March 2022 to February 2025, over a span of three years. A total of 108 patients who underwent complete thyroidectomies had their medical records reviewed. The collected data included postoperative biochemical outcomes, details of the surgery, diagnoses, and demographic characteristics. Hypocalcemia was defined as total serum calcium levels below 8.0 mg/dl within 48 hours post-surgery. The statistical analysis employed multivariate logistic regression and chi-square tests to determine independent variables.

Results: The incidence of postoperative hypocalcemia was noted in 37 patients, representing 34.3% of the total 108 patients. Factors significantly linked to hypocalcemia included female gender ($p=0.032$), central neck dissection ($p=0.01$), Hashimoto's thyroiditis ($p=0.004$), and unintentional parathyroidectomy ($p<0.001$). The multivariate analysis identified the following independent predictors: Hashimoto's thyroiditis (OR: 3.1, 95% CI: 1.3-7.5), central neck dissection (OR: 2.8, 95% CI: 1.2-6.7), and excision of the parathyroid gland (OR: 5.2, 95% CI: 2.1-12.9)

Conclusion: Following a total thyroidectomy, postoperative hypocalcemia is a common consequence. The risk can be decreased by preserving the parathyroid glands, minimizing central dissection, and meticulously identifying thyroiditis.

Keywords: Hypocalcemia, total thyroidectomy, parathyroidectomy, central neck dissection, thyroiditis.

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Introduction:

A total thyroidectomy is a widely performed surgical procedure for various benign and malignant thyroid conditions, such as autoimmune thyroiditis, multinodular goiter, Graves' disease, and thyroid cancer. Even with advancement in surgical methods and intraoperative monitoring, postoperative complications remain prevalent, with hypocalcemia being the most frequently encountered issue.^{1,2} Temporary or permanent hypoparathyroidism, often caused by devascularization, trauma, or the accidental removal of one or more parathyroid glands, leads to post-thyroidectomy hypocalcemia.^{3,4} Transient hypocalcemia, which can resolve within days to weeks, occurs in as many as 50% of cases, while permanent hypocalcemia, characterized by low calcium levels lasting beyond six months, is seen in about 1-5% of patients.^{2,5} Symptoms include severe muscular cramps, laryngospasm, and potentially life-threatening arrhythmias, along with mild paresthesia and perioral numbness.⁶ Various studies have assessed the predictors of hypocalcaemia following thyroidectomy. Risk

factors identified are female gender, younger age, vitamin D deficiency, autoimmune thyroiditis like Hashimoto's disease, extensive tissue removal, central compartment lymph node dissection, and inadvertent parathyroidectomy.⁷⁻⁹ The measurement of parathyroid hormone (PTH) after surgery, within 24 hours, has proven to be a significant predictor and is being utilized more frequently to inform calcium supplementation and discharge planning.^{10,11} In developing countries, including Pakistan, surgical variability, limited intraoperative tools (e.g., PTH monitoring, parathyroid fluorescence imaging), and delayed biochemical testing introduce context-specific challenges.¹² In South Asia, thyroid disorders are often identified at more advanced stages, which complicates both surgical dissection and postoperative care.¹³ Gathering local evidence is essential in light of these challenges. The objective of this research was to evaluate the prevalence and risk factors associated with postoperative hypocalcaemia following a total thyroidectomy at a tertiary hospital in Karachi. Our goal is to assist in the development of preventive measures, enhance early detection, and ultimately decrease morbidity among patients undergoing thyroid surgery.

Objective:

To determine the risk variables and assess the prevalence of postoperative hypocalcemia in patients having a complete thyroidectomy at a tertiary care hospital of Karachi.

Methodology:

This retrospective study was conducted in the ENT department of Sir Syed Hospital, a teaching facility that offers tertiary care in Karachi. The research spanned three years, from March 2022 to February 2025. The objective of the study was to evaluate the prevalence and risk factors asso-

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ciated with postoperative hypocalcemia in patients undergoing a complete thyroidectomy.

The study involved 108 adult patients who underwent complete thyroidectomies within the specified time period. Eligible participants were those aged 18 and older, possessing a complete set of perioperative records, and who had a total thyroidectomy due to either benign or malignant thyroid conditions. Patients were excluded if they had known parathyroid disorders, chronic kidney disease, prior thyroid or neck surgeries, or incomplete postoperative biochemical data.

Retrospective patient data was collected using operating notes and medical records. Age, sex, preoperative diagnosis, the existence of histologically proven autoimmune thyroiditis, gland size, the amount of surgery (including if central neck dissection was performed), and the expertise level of the surgeon (consultant vs. trainee) were all noted. Biochemical data were also gathered, including total blood calcium and parathyroid hormone (PTH) values 24-48 hours after surgery, as well as preoperative serum calcium and vitamin D levels. Regardless of symptomatology, postoperative hypocalcemia was defined as a blood calcium level <8.0 mg/dl 24 or 48 hours after surgery. Two groups of patients were identified: those who had hypocalcemia and those who did not. Histopathological confirmation of parathyroid tissue in the thyroidectomy material allowed for the identification of the unintentional parathyroidectomy.

The data was analysed using SPSS version 26.0 (IBM Corp., Armonk, NY). Continuous variables were compared using the mean \pm standard deviation with the Student's t-test. To compare the frequencies and percentages of categorical variables, the Chi-square test or Fisher's exact test was employed, as appropriate. Multivariate logistic regression was utilized to identify independent predictors of postoperative hypocalcemia, with odds ratios (ORs) and 95% confidence intervals (CIs) reported. A p-value of less than 0.05 was deemed statistically significant.

Results:

Out of the 108 patients who underwent complete thyroidectomies during the study period, 37 individuals (34.3%) experienced postoperative hypocalcemia. The average age of the cohort was 43.7 ± 11.8 years, with 65.7% of the participants being female. Female patients exhibited a significantly higher incidence of hypocalcemia, with 81.1% in the hypocalcemia group versus 57.7% in the normocalcemic group ($p=0.048$). Hashimoto's thyroiditis, as confirmed by histopathology, was identified in 29 patients and showed a significant correlation with hypocalcemia. Among these patients, 18 (62.1%) developed hypocalcemia, while only 19 (23.8%) of those without thyroiditis experienced the same condition ($p=0.002$). Central neck dissection was conducted on 30 patients, of which 16 (53.3%) developed hypocalcemia, compared to 21 (26.9%) of the 78 patients who did not undergo central dissection ($p=0.011$). Inadvertent parathyroidectomy, which was confirmed through histopathological examination, occurred in 18 patients and was significantly linked to hypocalcemia (66.7% vs. 25.3%, $p=0.002$). Furthermore, postoperative PTH levels were recorded for 59 patients. Among these, 23 patients exhibited PTH <10 pg/mL, with 91.3% of them experiencing hypocalcemia ($p=0.001$) as shown in table 1.

In the univariate logistic regression analysis, six factors demonstrated a p-value <0.25 and were chosen for multivariate analysis: female gender, Hashimoto's thyroiditis, central neck dissection, inadvertent parathyroidectomy, low postoperative PTH (<10 pg/mL), and the level of surgeon

Table 1: Demographic and Clinical Characteristics of Patients Undergoing Total Thyroidectomy (N=108).

Variable	Hypocalcaemia (n=37)	Normocalcaemia (n=71)	p-value
Age < 40 years	16 (43.24%)	30 (42.25%)	0.93
Age \geq 40 years	21 (56.76%)	41 (57.75%)	
Female	30 (81.08%)	41 (57.75%)	0.048*
Male	7 (18.92%)	30 (42.25%)	
Hashimoto's Thyroiditis	18 (48.65%)	11 (15.49%)	0.002*
No Hashimoto's	19 (51.35%)	60 (84.51%)	
Central Neck Dissection	16 (43.24%)	14 (19.72%)	0.011*
No Central Neck Dissection	21 (56.76%)	57 (80.28%)	
Inadvertent Parathyroidectomy	12 (32.43%)	6 (8.45%)	0.002*
No Inadvertent Parathyroidectomy	25 (67.57%)	65 (91.55%)	
Post-op PTH <10 pg/mL**	21 (56.76%)	2 (2.82%)	0.001*
Post-op PTH ≥ 10 pg/mL**	2 (5.41%)	34 (47.89%)	

*Statistically significant, **PTH values were available for 59 patients only. experience. The odds ratios (ORs) for these factors varied from 1.6 to 9.8 as shown in table 2.

Table No 2: Univariate Logistic Regression Analysis of Risk Factors for Postoperative Hypocalcemia Following Total Thyroidectomy (N=108)

Variable	OR	95% CI	p-value
Female gender	2.2	1.01-4.91	0.048
Age < 40 years	1.3	0.62-2.79	0.47
Hashimoto's thyroiditis	3.9	1.66-9.31	0.002
Central neck dissection	3.1	1.29-7.55	0.011
Inadvertent Parathyroidectomy	4.7	1.77-12.62	0.002
Post-op PTH <10 pg/mL (n=59)	9.8	2.47-38.92	0.001
Vitamin D deficiency	1.4	0.61-3.14	0.42
Surgeon level (trainee vs consultant)	1.6	0.70-3.77	0.25

Three distinct predictors of postoperative hypocalcemia were identified through the multivariate logistic regression model. Hypocalcemia (adjusted OR [aOR]: 3.1, 95% CI: 1.18-8.32, $p=0.022$), central neck dissection (aOR: 2.9, 95% CI: 1.11-7.55, $p=0.030$), and unintentional parathyroidectomy (aOR: 5.2, 95% CI: 1.86-14.52, $p=0.002$) were all significantly associated with Hashimoto's thyroiditis. The female gender (aOR: 1.7, $p=0.23$) and surgeon experience (aOR: 1.3, $p=0.59$) did not show independent predictive value after adjustment. While postoperative PTH <10 pg/mL neared statistical significance (aOR: 3.9, 95% CI: 0.98-15.41, $p=0.054$), it failed to reach the standard significance threshold in the multivariate analysis as shown in table 3.

Table 3: Multivariate Logistic Regression Identifying Independent Predictors of Postoperative Hypocalcemia After Total Thyroidectomy (N=108)

Variable	Adjusted OR (aOR)	95% CI	p-value
Hashimoto's thyroiditis	3.1	1.18-8.32	0.022*
Central neck dissection	2.9	1.11-7.55	0.030*
Inadvertent parathyroidectomy	5.2	1.86-14.52	0.002*
Female gender	1.7	0.71-4.28	0.23
Post-op PTH < 10 pg/mL	3.9	0.98-15.41	0.054
Surgeon experience	1.3	0.49-3.52	0.59

Statistically significant

These results highlight the significance of intraoperative preservation of parathyroid glands, surgical extent, and autoimmune thyroid disease in predicting early postoperative hypocalcemia.

Discussion:

In this retrospective study involving 108 patients who underwent complete thyroidectomies, the incidence of postoperative hypocalcemia was found to be 34.2%. This statistic underscores the continued importance of anticipating and managing this complication, aligning with the global prevalence reported in existing literature (20-50%).^{1,2} Both transient and permanent hypocalcemia can greatly affect postoperative recovery and the overall quality of life for patients, particularly in high-volume surgical centers. Among the various factors assessed, postoperative PTH levels below 10 pg/mL stood out as the most significant independent predictor of hypocalcemia. This finding aligns with current research suggesting that early postoperative PTH serves as a dependable measure of parathyroid gland function and calcium balance.^{8,9} Kim et al. reported that PTH levels measured 6-24 hours post-surgery demonstrated strong predictive capabilities for both biochemical and clinical hypocalcemia, allowing healthcare providers to initiate vitamin D and calcium supplementation in a focused manner.¹⁰ It has also been shown that in patients undergoing total thyroidectomy and central neck dissection, reduced PTH levels were independently associated with both temporary and chronic hypoparathyroidism.¹¹

Another important aspect highlighted in our research was central neck dissection (CND). CND is frequently carried out in cases of thyroid cancer; however, this procedure raises the risk of injuring or disrupting the blood supply to the parathyroid glands due to their shared anatomical structures. In our findings, CND was observed in more than 56% of hypocalcaemia instances and was still independently linked to hypocalcaemia even after controlling for other factors. Comparable results were noted by Privitera et al., who reported a threefold increase in hypocalcaemia rates among patients who underwent CND.⁵ Surgeons need to weigh the oncological advantages of clearing the central compartment against the possible effects on parathyroid function. Hashimoto's thyroiditis, an autoimmune inflammatory condition, was another notable

factor, particularly in univariate analysis. The chronic lymphocytic infiltration and fibrosis that accompany Hashimoto's thyroiditis can make parathyroid gland identification and preservation more difficult.⁶ Casalino et al. and Qin et al. have noted that dense fibrosis, tissue adherence, and altered anatomical planes in Hashimoto's disease contribute to surgical difficulty and increased risk of inadvertent parathyroidectomy or devascularization.^{6,7} Although it did not retain significance in our multivariate model, its presence should raise intraoperative awareness. Unintentional parathyroidectomy, which has been histologically confirmed in a significant number of patients with hypocalcaemia, is an avoidable yet frequently encountered problem. In our research, 24.3% of patients suffering from hypocalcaemia showed signs of parathyroid tissue excision. Wang et al. observed comparable results in a Chinese cohort and highlighted the importance of precise surgical methods to minimize the risk of accidental gland removal and the resulting hypocalcaemia.⁹ Individuals under 40 years of age showed a higher risk of hypocalcaemia in univariate analysis; however, this association lost significance after adjustments were made. The existing literature regarding age as a risk factor presents conflicting views. Some researchers propose that younger patients might exhibit more reactive parathyroid physiology, while others argue that age could act as a surrogate for various confounding factors, including the prevalence of autoimmune diseases.^{12,13} Additional studies that incorporate stratified age analyses could provide further insights into this relationship. While gender did not emerge as a significant predictor in our cohort, earlier studies have produced varied outcomes, with some indicating an increased risk in females attributed to hormonal effects on calcium metabolism or variations in body composition.¹⁴

The strengths of our research lie in its well-defined criteria, consistent surgical techniques across a single institution, and thorough postoperative biochemical assessments. Nonetheless, it is important to recognize the limitations. The retrospective nature of the study inherently restricts the ability to establish causality. Additionally, information regarding vitamin D levels—a recognized factor influencing calcium balance—was not accessible. Griffin et al. have demonstrated that a deficiency in vitamin D can lead to symptomatic hypocalcaemia following thyroidectomy, even when PTH levels are sufficient.³

Our findings strongly support the routine measurement of PTH within 24 hours post-surgery. This approach, combined with attention to our research strongly advocates for the routine assessment of PTH within 24 hours following surgery. This method, when paired with careful consideration of CND and the status of Hashimoto's thyroiditis, can assist in risk stratification and facilitate early supplementation. Surgeons should strive to meticulously preserve the parathyroid glands and refrain from unnecessary CND unless it is oncologically justified.

Future multicentre trials that include vitamin D, magnesium, and long-term monitoring for permanent hypocalcaemia will be essential. Furthermore, investigating the potential benefits of intraoperative parathyroid auto fluorescence or auto transplantation may enhance patient outcomes.

Conclusion:

In order to identify at-risk individuals, our study emphasizes the significance of careful dissection, parathyroid gland preservation, and timely biochemical monitoring. When not oncologically warranted, surgeons should avoid needless CND and carefully maintain parathyroid glands.

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Authors' contribution

Saima Parween Shaikh	Conceive, Study design, Manuscript writing
Ghulam Shabir Mahar	Literature Review, Data collection and analysis
Abdul Waheed	Critical review and editing for Final version