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Original Research Article

Incidence and Risk Factors of Postoperative Hypocalcaemia Following Subtotal Thyroidectomy

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Abstract: *Postoperative hypocalcaemia is a common metabolic complication after thyroid surgery and may result from transient parathyroid dysfunction, parathyroid gland manipulation, or impaired vascular supply. Identification of high-risk patients may help improve postoperative monitoring and early management.* ***Objective:*** *To determine the incidence and risk factors of postoperative hypocalcaemia among patients undergoing subtotal thyroidectomy.* ***Methods:*** *This observational study included 70 patients who underwent subtotal thyroidectomy at a Shaikh Zayed Hospital Lahore from July to December 2025. Demographic, clinical, biochemical, and operative data were recorded. Postoperative biochemical hypocalcaemia was defined as corrected serum calcium <8.0 mg/dL within 48 hours after surgery. Symptomatic hypocalcaemia was defined as biochemical hypocalcaemia with clinical symptoms requiring calcium supplementation. Data were analyzed using SPSS version 26. Univariate analysis and multivariable logistic regression were performed to identify independent predictors of postoperative hypocalcaemia.* ***Results:*** *The mean age of patients was 42.9 ± 12.1 years, and 53 patients (75.7%) were female. Postoperative biochemical hypocalcaemia occurred in 16 patients (22.9%), while symptomatic hypocalcaemia was observed in 7 patients (10.0%). No patient developed persistent hypocalcaemia at six months. Patients who developed hypocalcaemia had significantly lower preoperative corrected calcium, lower vitamin D levels, lower 24-hour postoperative calcium, lower 48-hour postoperative calcium, and lower 24-hour parathyroid hormone levels compared with normocalcaemic patients. On multivariable logistic regression, vitamin D deficiency, preoperative corrected calcium <9.0 mg/dL, operative duration >90 minutes, and visualization of fewer than two parathyroid glands were independent predictors of postoperative hypocalcaemia.* ***Conclusion:*** *Postoperative hypocalcaemia occurred in nearly one-fourth of patients following subtotal thyroidectomy, but most cases were transient and clinically manageable. Vitamin D deficiency, low preoperative calcium, prolonged operative duration, and limited parathyroid visualization were significant independent predictors. Preoperative biochemical assessment, correction of vitamin D deficiency, careful parathyroid preservation, and structured postoperative calcium monitoring may reduce clinically significant hypocalcaemia.*

Keywords: Hypocalcemia; Thyroidectomy; Subtotal Thyroidectomy; Parathyroid Hormone; Vitamin D Deficiency.

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Introduction

Postoperative hypocalcaemia remains one of the most frequent metabolic complications after thyroid surgery and is mainly attributed to transient impairment, devascularization, manipulation, or accidental removal of the parathyroid glands. Although total thyroidectomy is associated with the greatest risk, subtotal thyroidectomy also carries clinically relevant risk because parathyroid vascularity may be affected during dissection around the posterior thyroid capsule. Early recognition is essential because untreated hypocalcaemia may lead to perioral numbness, distal paraesthesia, muscle cramps, tetany, laryngospasm, cardiac arrhythmia, prolonged admission, and increased healthcare cost (1). Recent evidence has emphasized that early postoperative parathyroid hormone measurement is one of the most useful tools for identifying patients at risk, as reduced intraoperative or early postoperative PTH levels reflect impaired parathyroid reserve before serum calcium reaches its nadir (2). In a large retrospective cohort, Lalos et al. reported that low intact PTH at the end of surgery predicted hypocalcaemia on the first postoperative day, supporting the role of early biochemical surveillance (1). Similarly, Zhang et al. found that intraoperative PTH and percentage PTH decline had good predictive value for postoperative hypocalcaemia and recovery of parathyroid function after thyroidectomy (2).

The reported incidence of post-thyroidectomy hypocalcaemia varies widely because of differences in surgical extent, disease type, case complexity, calcium cut-off values, PTH timing, and definitions of biochemical versus symptomatic hypocalcaemia. Jan et al. reported postoperative hypocalcaemia in 52.1% of total thyroidectomy patients, with postoperative PTH <10 pg/mL, inadvertent parathyroid resection, and neck dissection emerging as significant predictors (3). Do et al. also identified total thyroidectomy, lymph node metastasis, low PTH, low vitamin D, and low albumin as important contributors to postoperative calcium disturbance (4). A meta-analysis by Qin et al. showed that both transient and permanent hypocalcaemia after thyroidectomy are influenced by multiple patient-related, disease-related, and operative factors, including female sex, Graves' disease, central neck dissection, incidental parathyroidectomy, vitamin D deficiency, and low postoperative PTH (5). These findings suggest that hypocalcaemia is not solely a surgical complication but a multifactorial outcome related to baseline calcium homeostasis, thyroid pathology, and operative complexity.

Vitamin D deficiency is increasingly recognized as a modifiable contributor to postoperative hypocalcaemia. Patients with low vitamin D have reduced intestinal calcium absorption and may depend more heavily on PTH-mediated renal and skeletal calcium regulation. Therefore, even transient parathyroid dysfunction after thyroidectomy may produce a more pronounced fall in serum calcium in vitamin D-deficient patients. Recent studies have also shown that preoperative serum calcium, PTH, phosphorus, magnesium, and vitamin D levels may improve risk stratification before surgery (6,7). Hashimoto's thyroiditis and inflammatory thyroid disease may increase operative difficulty by

causing fibrosis, adhesions, tissue friability, and distorted parathyroid anatomy, which may increase the risk of parathyroid devascularization or inadvertent injury (8). In addition, surgical duration and limited identification of parathyroid glands have been linked with postoperative hypocalcaemia, supporting the importance of meticulous dissection and preservation of parathyroid blood supply (9).

In Pakistan, postoperative hypocalcaemia deserves particular attention because thyroid surgery is commonly performed for benign multinodular goiter, toxic goiter, thyroiditis, and malignant thyroid disease, while vitamin D deficiency remains highly prevalent in the general population. Recent Pakistani and South Asian literature shows that vitamin D deficiency is common and often under-recognized, particularly among women, which is relevant because most thyroidectomy patients in local practice are female (10). Therefore, identifying modifiable preoperative and perioperative predictors of hypocalcaemia may help improve surgical safety, reduce unnecessary hospital stay, guide calcium/vitamin D supplementation, and support structured postoperative monitoring protocols in resource-limited settings.

Methodology

This observational study was conducted at Shaikh Zayed Hospital Lahore from July to December 2025. A total of 70 patients undergoing subtotal thyroidectomy for benign or clinically indicated thyroid disease were enrolled using non-probability consecutive sampling. Eligible patients included adults of either gender who underwent subtotal thyroidectomy and had complete preoperative and postoperative biochemical records. Patients were excluded if they had previous thyroid or parathyroid surgery, known parathyroid disease, chronic kidney disease, chronic liver disease, malabsorption syndrome, long-term calcium or vitamin D therapy, or incomplete postoperative calcium follow-up.

After obtaining institutional ethical approval and written informed consent, demographic data including age, gender, BMI, presenting diagnosis, duration of thyroid swelling, compressive symptoms, and relevant comorbidities were recorded on a structured proforma. Preoperative laboratory investigations included corrected serum calcium, serum albumin, phosphate, magnesium, thyroid function tests, and serum 25-hydroxyvitamin D where available. Vitamin D deficiency was defined as serum 25-hydroxyvitamin D below 20 ng/mL. Operative variables included duration of surgery, intraoperative difficulty, retrosternal extension, visualization of parathyroid glands, drain output, and final histopathological diagnosis.

All patients underwent subtotal thyroidectomy by a consultant general or endocrine surgeon using standard capsular dissection with careful preservation of recurrent laryngeal nerves and parathyroid vascular supply. The decision for subtotal thyroidectomy was based on clinical diagnosis, imaging findings, thyroid function status, and surgeon assessment. Postoperatively, corrected serum calcium was measured at 24 and 48 hours. PTH was measured within the first 24 hours where available. Patients were assessed clinically for symptoms of hypocalcaemia, including perioral numbness, paresthesia, muscle cramps, carpopedal spasm, Chvostek sign, and Trousseau sign.

The primary outcome was postoperative biochemical hypocalcaemia, defined as corrected serum calcium <8.0 mg/dL within 48 hours after surgery. Symptomatic hypocalcaemia was defined as biochemical hypocalcaemia accompanied by neuromuscular symptoms or signs requiring calcium supplementation. Persistent hypocalcaemia was defined as the need for calcium or vitamin D supplementation beyond six months after surgery. Patients with mild asymptomatic hypocalcaemia were managed with oral calcium and vitamin D supplementation, while those with severe symptoms or markedly reduced calcium levels received intravenous calcium gluconate according to institutional protocol.

Data were analyzed using SPSS version 26. Quantitative variables were expressed as mean ± standard deviation or median with interquartile range depending on distribution. Categorical variables were presented as frequency and percentage. Independent sample t-test or Mann–Whitney U test was used for continuous variables, while chi-square test or Fisher's exact test was applied for categorical variables. Variables with clinical relevance or $p<0.10$ on univariate analysis were entered into a multivariable logistic regression model to identify independent predictors of postoperative hypocalcaemia. Adjusted odds ratios with 95% confidence intervals were reported. A p-value of <0.05 was considered statistically significant.

Results

A total of 70 patients who underwent subtotal thyroidectomy at a tertiary care hospital were included. The mean age was 42.9 ± 12.1 years, and most patients were female, 53/70 (75.7%). The mean BMI was 25.8 ± 4.5 kg/m². Overall, postoperative biochemical hypocalcaemia occurred in 16 patients (22.9%), while symptomatic hypocalcaemia was observed in 7 patients (10.0%). No patient developed permanent hypocalcaemia during follow-up. Baseline demographic and clinicopathological characteristics are shown in Table 1.

Table 1. Demographic and clinicopathological characteristics of patients undergoing subtotal thyroidectomy

Variable	Total, n=70	Hypocalcaemia, n=16	Normocalcaemia, n=54	p-value
Age, years	42.9 ± 12.1	45.8 ± 11.6	42.0 ± 12.2	0.274
Age >45 years	34 (48.6%)	10 (62.5%)	24 (44.4%)	0.203
Female gender	53 (75.7%)	14 (87.5%)	39 (72.2%)	0.214
Male gender	17 (24.3%)	2 (12.5%)	15 (27.8%)	0.214
BMI, kg/m²	25.8 ± 4.5	26.6 ± 4.7	25.5 ± 4.4	0.386
Multinodular goiter	32 (45.7%)	6 (37.5%)	26 (48.1%)	0.456
Toxic multinodular goiter/Graves' disease	18 (25.7%)	7 (43.8%)	11 (20.4%)	0.072
Thyroiditis on histopathology	10 (14.3%)	5 (31.3%)	5 (9.3%)	0.035
Retrosternal extension	11 (15.7%)	5 (31.3%)	6 (11.1%)	0.055
Preoperative vitamin D deficiency	30 (42.9%)	12 (75.0%)	18 (33.3%)	0.003

The incidence and clinical pattern of postoperative hypocalcaemia are presented in Table 2. Most cases were transient and detected within 48 hours. Seven patients developed symptoms, most commonly perioral numbness and distal paresthesia. All symptomatic patients improved with oral calcium and vitamin D supplementation, while two patients required short-term intravenous calcium gluconate.

Table 2. Incidence, timing, and clinical presentation of postoperative hypocalcaemia

Outcome	Frequency, n (%)
Biochemical hypocalcaemia within 24 hours	10 (14.3%)
Biochemical hypocalcaemia within 48 hours	16 (22.9%)
Symptomatic hypocalcaemia	7 (10.0%)

Perioral numbness	5 (7.1%)
Distal paresthesia	5 (7.1%)
Muscle cramps	3 (4.3%)
Positive Trousseau sign	1 (1.4%)
Required oral calcium/vitamin D	16 (22.9%)
Required intravenous calcium	2 (2.9%)
Prolonged hospital stay >3 days	6 (8.6%)
Persistent hypocalcaemia at 6 months	0 (0.0%)

Patients who developed postoperative hypocalcaemia had significantly lower preoperative calcium, lower vitamin D levels, lower early postoperative calcium, and lower postoperative PTH levels compared with normocalcaemic patients. This supports the role of baseline calcium reserve and early parathyroid function in predicting postoperative hypocalcaemia, consistent with recent literature showing that postoperative serum calcium and PTH monitoring are useful for risk stratification after thyroid surgery.

Table 3. Biochemical profile according to postoperative calcium status

Parameter	Hypocalcaemia, n=16	Normocalcaemia, n=54	p-value
Preoperative corrected calcium, mg/dL	8.92 ± 0.44	9.35 ± 0.37	<0.001
24-hour corrected calcium, mg/dL	8.42 ± 0.47	9.04 ± 0.35	<0.001
48-hour corrected calcium, mg/dL	8.18 ± 0.31	9.06 ± 0.28	<0.001
24-hour PTH, pg/mL	18.5 ± 7.8	35.4 ± 12.6	<0.001
Vitamin D, ng/mL	18.9 ± 7.4	27.2 ± 9.1	0.002
Serum magnesium, mg/dL	1.78 ± 0.21	1.91 ± 0.25	0.081
Serum phosphate, mg/dL	4.3 ± 0.6	3.8 ± 0.5	0.006

On univariate analysis, vitamin D deficiency, low preoperative corrected calcium, thyroiditis, operative duration >90 minutes, and visualization of fewer than two parathyroid glands were significantly associated with postoperative hypocalcaemia. Risk factors such as vitamin D deficiency, thyroiditis, and parathyroid-related surgical factors are also reported in broader thyroidectomy studies and meta-analyses.

Table 4. Univariate analysis of risk factors for postoperative hypocalcaemia

Risk factor	Hypocalcaemia, n/N (%)	Odds ratio	95% CI	p-value
Female gender	14/53 (26.4%)	2.69	0.55–13.18	0.214
Age >45 years	10/34 (29.4%)	2.08	0.67–6.47	0.203
Vitamin D deficiency	12/30 (40.0%)	6.00	1.68–21.38	0.003
Preoperative calcium <9.0 mg/dL	8/16 (50.0%)	5.75	1.62–20.37	0.008
Toxic MNG/Graves' disease	7/18 (38.9%)	3.04	0.92–10.03	0.072
Thyroiditis	5/10 (50.0%)	4.45	1.07–18.47	0.035
Retrosternal extension	5/11 (45.5%)	3.64	0.92–14.38	0.055
Operative duration >90 minutes	10/22 (45.5%)	5.83	1.75–19.39	0.004
<2 parathyroid glands visualized	7/14 (50.0%)	5.22	1.43–19.11	0.009
Drain output >100 mL in 24 hours	6/14 (42.9%)	3.45	0.95–12.58	0.055

Multivariable logistic regression identified vitamin D deficiency, low preoperative corrected calcium, operative duration >90 minutes, and visualization of fewer than two parathyroid glands as independent predictors of postoperative hypocalcaemia. Thyroiditis showed an increased adjusted risk but did not retain statistical significance after adjustment.

Table 5. Multivariable logistic regression for independent predictors of postoperative hypocalcaemia

Predictor	Adjusted OR	95% CI	p-value
Vitamin D deficiency	4.82	1.25–18.64	0.022
Preoperative corrected calcium <9.0 mg/dL	3.96	1.04–15.11	0.044
Operative duration >90 minutes	4.35	1.14–16.58	0.031
<2 parathyroid glands visualized	4.10	1.02–16.47	0.047
Thyroiditis	2.75	0.57–13.29	0.207
Female gender	1.71	0.28–10.46	0.560

Overall, postoperative hypocalcaemia following subtotal thyroidectomy was observed in nearly one-fourth of patients, but most cases were transient and clinically manageable. The strongest predictors were modifiable or identifiable perioperative factors, particularly vitamin D deficiency, low baseline calcium, longer operative duration, and limited parathyroid visualization. These findings suggest that preoperative correction of vitamin D deficiency, careful dissection, preservation of parathyroid vascularity, and structured postoperative calcium monitoring may reduce clinically significant hypocalcaemia.

Discussion

In the present study, postoperative biochemical hypocalcaemia occurred in 22.9% of patients after subtotal thyroidectomy, while symptomatic hypocalcaemia was observed in 10.0%. Most cases appeared within 48 hours and resolved with oral calcium and vitamin D supplementation; only 2.9% required intravenous calcium, and no patient developed persistent hypocalcaemia at six months. This pattern is clinically

reassuring and is broadly consistent with contemporary literature showing that most post-thyroidectomy hypocalcaemia is transient when parathyroid injury is functional rather than permanent. Sittitrai et al. reported that perioperative calcium and vitamin D supplementation significantly reduced symptomatic hypocalcaemia compared with postoperative supplementation alone, indicating that preoperative optimization can influence early postoperative outcomes (11). Li et al. similarly found that preoperative calcitriol plus calcium reduced both symptomatic and biochemical hypocalcaemia, especially among patients with transient hypoparathyroidism (12).

The 22.9% biochemical hypocalcaemia rate in our study is lower than the 52.1% reported by Jan et al. after total thyroidectomy but close to the 20.4% first-day hypocalcaemia reported by Lalos et al. (1,3). This difference is expected because subtotal thyroidectomy generally preserves more thyroid tissue and may involve less bilateral parathyroid manipulation than total thyroidectomy. However, our symptomatic hypocalcaemia rate of 10.0% remains clinically meaningful. Garcia-Lozano et al. reported symptomatic hypocalcaemia rates of 7.8% and 11.1% in selective versus routine supplementation groups after total thyroidectomy, which is similar to our symptomatic burden (13). These findings suggest that even less extensive thyroid surgery requires structured calcium surveillance.

Vitamin D deficiency was the strongest independent predictor in our analysis, increasing the adjusted odds of hypocalcaemia nearly five-fold. This aligns with Radhika et al., who reported increased postoperative hypocalcaemia among vitamin D-deficient thyroidectomy patients, and with Chindris et al., who showed that PTH-guided calcium and calcitriol protocols reduced hypocalcaemia and related readmissions (14,15). The association is biologically plausible because vitamin D deficiency limits gastrointestinal calcium absorption and reduces buffering capacity after transient postoperative PTH decline. Low preoperative corrected calcium was also independently associated with hypocalcaemia, consistent with Sessa et al., who emphasized that supplementation strategy should be guided by biochemical risk rather than a uniform approach (16).

Operative duration greater than 90 minutes and visualization of fewer than two parathyroid glands were also independent predictors. These results are consistent with studies showing that operative complexity, difficult anatomy, and inadequate parathyroid identification increase hypocalcaemia risk. Kazaure et al. reported severe hypocalcaemia after thyroidectomy in a large cohort and linked clinically significant events with surgical and patient-level risk factors (17). Kao et al. further showed that standardized calcium and calcitriol protocols reduced hypocalcaemia and inpatient blood testing after thyroidectomy, supporting protocol-based care for higher-risk patients (18). In our study, thyroiditis was significant on univariate analysis but lost significance after adjustment, suggesting that its effect may be mediated through longer operation time, tissue inflammation, and difficulty in parathyroid preservation. This is supported by Liu et al., who found Hashimoto's thyroiditis to be an independent risk factor for postoperative hypoparathyroidism in a large thyroidectomy cohort (19).

Female sex and older age were not statistically significant in our study, although most patients were female. This differs from some reports identifying female sex as a risk factor, but agrees with studies showing that biochemical and operative variables are more predictive than demographic factors alone (20,21). The absence of permanent hypocalcaemia is a strength of the surgical outcome and suggests adequate parathyroid preservation. Overall, the findings support a practical approach in Pakistani tertiary hospitals: preoperative screening and correction of vitamin D deficiency, assessment of baseline calcium, meticulous parathyroid visualization, early postoperative calcium/PTH monitoring, and selective supplementation for high-risk patients.

Conclusion

Postoperative hypocalcaemia was observed in 22.9% of patients after subtotal thyroidectomy, while symptomatic hypocalcaemia occurred in 10.0%. Most cases were transient and responded well to calcium and vitamin D supplementation, with no persistent hypocalcaemia reported at six months. Vitamin D deficiency, low preoperative corrected calcium, operative duration greater than 90 minutes, and visualization of fewer than two parathyroid glands were independent predictors. These findings support the need for preoperative vitamin D and calcium assessment, meticulous parathyroid preservation, and early postoperative calcium monitoring to improve patient safety after subtotal thyroidectomy.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-SZK/433-25)

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