Section: General Surgery



Original Research Article

RELATIONSHIP BETWEEN PREOPERATIVE PARATHYROID HORMONE RESERVE AND POST-THYROIDECTOMY HYPOCALCAEMIA

Sathish Kumar Jayaraj[1], Gowtham Pandian Jeyachandrapandi[2], Suren Kandasamy[3]

[1]Assistant Professor, Department of General Surgery, Government Medical College Dindigul, Tamil Nadu, India.
[2]Assistant Professor, Department of General Surgery, Government Medical College Dindigul, Tamil Nadu, India.
[3]Assistant Professor, Department of General Surgery, Government Medical College Dindigul, Tamil Nadu, India.

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Corresponding Author:
Dr. Sathish Kumar Jayaraj,
Email: doctorsathish01@gmail.com

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ABSTRACT

Background: Hypocalcaemia is a recognised complication of total and completion thyroidectomy. Early postoperative PTH helps identify patients at risk, but the relevance of baseline PTH remains less clear. **Objective:** To examine the relationship between preoperative intact parathyroid hormone (PTH) concentration and biochemical hypocalcaemia within 48 hours after thyroidectomy. **Materials and Methods:** The study included adults who underwent total, near-total, or completion thyroidectomy at Government Medical College, Dindigul, from January to December 2025. The primary outcome is corrected serum calcium below 8.5 mg/dL within 48 hours of surgery. **Results:** In a cohort of 120 records, 35 (29.2%) met the criterion for biochemical hypocalcaemia. Rates differed across baseline PTH groups. Hypocalcaemia rates were 44.7%, 26.7%, and 16.2% in patients with preoperative PTH levels below 30, 30–50, and above 50 pg/mL, respectively ($p = 0.022$). Patients with early postoperative PTH below 15 pg/mL had a higher rate of hypocalcaemia than those with PTH ≥15 pg/mL (69.0% vs. 7.7%; $p < 0.001$). **Conclusion:** Preoperative PTH reflects baseline parathyroid hormone secretion but does not directly measure functional parathyroid reserve. Early postoperative PTH and corrected serum calcium are important for assessing hypocalcaemia after thyroidectomy.

INTRODUCTION

Hypocalcaemia is a common biochemical complication after total or completion thyroidectomy. Reported rates differ with the definition used, the timing of blood sampling and whether asymptomatic cases are included.[1] Disruption of the parathyroid glands or their blood supply can impair PTH secretion. The American Thyroid Association has outlined strategies for the recognition, prevention and management of postoperative hypoparathyroidism.[2] Risk also varies with the indication for surgery and the extent of dissection. A prospective multicentre study identified patient-related and operative predictors of postoperative hypocalcaemia.[3]

Intact PTH has a short circulating half-life, so its concentration may decline before a fall in serum calcium becomes apparent. This has prompted the use of perioperative PTH testing for postoperative risk assessment.[4] An individual-patient analysis of observational studies found that early postoperative PTH can help predict subsequent hypocalcaemia.[5] A systematic review also identified several clinical and surgical risk factors, including disturbances in calcium metabolism and the extent of thyroid surgery.[6]

The reduction in PTH after surgery has been associated with transient hypocalcaemia following total thyroidectomy.[7] Both the absolute postoperative PTH concentration and its change from baseline have been examined as predictors after total or completion thyroidectomy.[8] Preoperative PTH is affected by calcium concentration, vitamin D status, kidney function and magnesium balance. Thus, baseline PTH may be altered even when the capacity of the parathyroid glands to withstand surgical injury is unknown.[9]

This study examined the association between preoperative intact PTH concentration and biochemical hypocalcaemia within 48 hours after thyroidectomy at Government Medical College, Dindigul, during 2025. Here, the term "PTH reserve"

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denotes the preoperative hormone concentration; it does not refer to a dynamic functional test.

Aim: To assess whether preoperative intact PTH concentration is associated with biochemical hypocalcaemia after thyroidectomy.

Objectives

- Determine the frequency of biochemical and symptomatic hypocalcaemia in the first 48 hours.
- Compare baseline PTH concentrations between patients with and without postoperative hypocalcaemia.
- Examine hypocalcaemia across descriptive preoperative PTH categories and with PTH analysed as a continuous variable.
- Assess the contribution of early postoperative PTH, preoperative calcium, vitamin D, and operative characteristics.
- Describe calcium replacement and inpatient monitoring among patients with postoperative hypocalcaemia.

MATERIALS AND METHODS

Study design and setting

A single-centre retrospective study was conducted among patients who underwent thyroidectomy at Government Medical College, Dindigul, Tamil Nadu, India, between 1 January and 31 December 2025. Data were collected from hospital records and inpatient case sheets.

Study population

The inclusion criteria were age 18 years or older, total, near-total or completion thyroidectomy during the study period, a preoperative intact PTH result and a corrected calcium measurement within 48 hours after surgery. The exclusion criteria were lobectomy alone, pre-existing hypoparathyroidism or hyperparathyroidism, and long-term dialysis. Records lacking essential biochemical results are treated as incomplete; missing values are not imputed.

Preoperative data

Clinical variables include age, sex, thyroid diagnosis, previous thyroid surgery, procedure type, central neck dissection, parathyroid autotransplantation and preoperative intact PTH. Biochemical variables include calcium, albumin, creatinine, magnesium and 25-hydroxyvitamin D when recorded. Laboratory reports provide assay information and reference intervals.

Definition of preoperative PTH reserve

Preoperative intact PTH (pg/mL) is the principal exposure variable. For descriptive comparisons, PTH is grouped as below 30, 30-50 and above 50 pg/mL; these are analytical categories, not validated clinical thresholds. PTH is also considered as a continuous measure. When paired measurements are available, percentage PTH reduction is calculated as 100 × (preoperative PTH − postoperative PTH) / preoperative PTH.

Postoperative assessment and outcomes

The primary outcome is any corrected serum calcium value below 8.5 mg/dL within 48 hours after surgery. When appropriate, corrected calcium is calculated as measured calcium (mg/dL) + 0.8 × [4.0 − albumin (g/dL)]. Secondary outcomes are symptomatic hypocalcaemia, corrected calcium below 7.5 mg/dL, intravenous calcium administration and postoperative PTH below 15 pg/mL. The timing of blood sampling, prophylactic supplementation and treatment before sampling are also recorded.

Statistical analysis

Continuous variables are expressed as mean with standard deviation or median with interquartile range, according to distribution; categorical variables are reported as number and percentage. Group comparisons use an independent-samples test or a non-parametric alternative for continuous data, and the chi-square or Fisher exact test for categorical data. Preoperative PTH categories were compared by chi-square test; postoperative corrected calcium defined hypocalcaemia, and clinical variables were summarised. Associations are expressed as odds ratios with 95% confidence intervals. Statistical significance is set at $p < 0.05$.

RESULTS

Baseline characteristics

Table 1 presents a mean age of 46.8 ± 12.4 years, with 98 females (81.7%) and 22 males (18.3%). The procedure distribution includes 105 total thyroidectomies (87.5%) and 15 completion thyroidectomies (12.5%). The mean preoperative intact PTH level is 44.8 ± 18.5 pg/mL, and the mean corrected calcium level is 9.18 ± 0.41 mg/dL.

Early postoperative calcium status

Biochemical hypocalcaemia is recorded in 35 of 120 cases (29.2%); 85 (70.8%) have no hypocalcaemia. Fourteen (11.7%) are symptomatic, six (5.0%) have corrected calcium below 7.5 mg/dL, and four (3.3%) receive intravenous calcium. Some patients experienced more than one outcome (Table 2; Figures 1 and 4).

Preoperative PTH strata

Hypocalcaemia occurs in 17 of 38 cases (44.7%) with baseline PTH below 30 pg/mL, 12 of 45 (26.7%) with PTH of 30-50 pg/mL and six of 37 (16.2%) with PTH above 50 pg/mL. For these tabulated counts, the Pearson chi-square test gives $p = 0.022$ (Table 3; Figure 2).

Early postoperative PTH

Among the 42 records with early postoperative PTH below 15 pg/mL, 29 (69.0%) have hypocalcaemia; the corresponding figure is six of 78 (7.7%) when PTH is at least 15 pg/mL. Sensitivity and specificity calculated from these counts are 82.9% and 84.7%, respectively, with Fisher exact $p < 0.001$ (Table 4; Figure 3).

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Table 1: Baseline characteristics and operative profile (n = 120)

Variable	Value
Age, mean ± SD (years)	46.8 ± 12.4
Age <40 years, n (%)	28 (23.3)
Age 40–59 years, n (%)	70 (58.3)
Age ≥60 years, n (%)	22 (18.3)
Female, n (%)	98 (81.7)
Male, n (%)	22 (18.3)
Benign thyroid indication, n (%)	86 (71.7)
Malignant thyroid indication, n (%)	34 (28.3)
Total thyroidectomy, n (%)	105 (87.5)
Completion thyroidectomy, n (%)	15 (12.5)
Central neck dissection, n (%)	28 (23.3)
Preoperative corrected calcium (mg/dL)	9.18 ± 0.41
Preoperative intact PTH (pg/mL)	44.8 ± 18.5
Preoperative vitamin D (ng/mL)	24.9 ± 8.8

Values are shown as mean ± SD or n (%); PTH, parathyroid hormone.

Table 2: Early postoperative biochemical and clinical outcomes (n = 120)

Outcome	Number / value
Biochemical hypocalcaemia (<8.5 mg/dL)	35 (29.2%)
No biochemical hypocalcaemia	85 (70.8%)
Symptomatic hypocalcaemia	14 (11.7%)
Corrected calcium <7.5 mg/dL	6 (5.0%)
Intravenous calcium administered	4 (3.3%)
Postoperative intact PTH <15 pg/mL	42 (35.0%)
Postoperative corrected calcium (mg/dL)	8.49 ± 0.64
Postoperative intact PTH (pg/mL)	21.3 ± 11.5

Outcome categories may overlap; the group total is 120.

Table 3: Preoperative PTH and biochemical hypocalcaemia

PTH (pg/mL)	Total	Hypocalcaemia	Normal calcium	Rate (%)
<30	38	17	21	44.7
30–50	45	12	33	26.7
>50	37	6	31	16.2
Total	120	35	85	29.2

Pearson chi-square p = 0.022.

Table 4: Early postoperative PTH and biochemical hypocalcaemia

Postoperative PTH	Hypocalcaemia	Normal calcium	Total
<15 pg/mL	29	13	42
≥15 pg/mL	6	72	78
Total	35	85	120

Fisher exact p < 0.001; sensitivity 82.9%, specificity 84.7%, positive predictive value 69.0%, negative predictive value 92.3%.

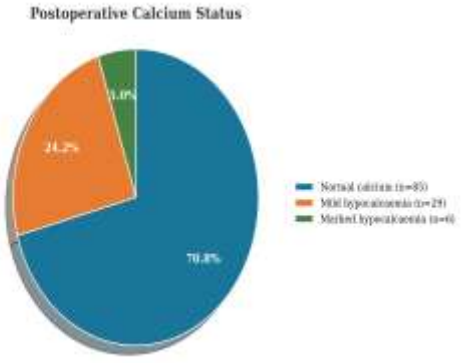


Figure 1: Distribution of early postoperative calcium status

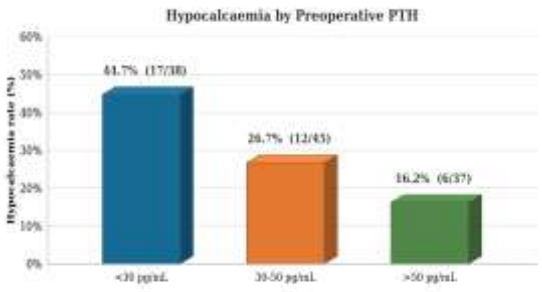


Figure 2: Biochemical hypocalcaemia according to preoperative PTH category

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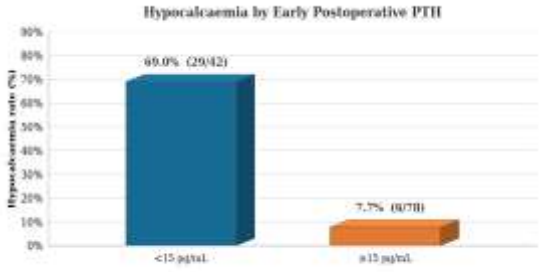


Figure 3: Biochemical hypocalcaemia according to early postoperative PTH

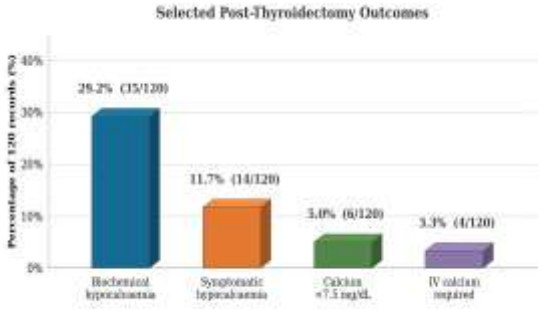


Figure 4: Selected early postoperative outcomes after thyroidectomy

DISCUSSION

Preoperative intact PTH measures circulating hormone before surgery rather than the glands' capacity to tolerate surgical dissection. Vitamin D deficiency and changes in calcium regulation can influence its concentration. Conversely, a normal preoperative PTH value does not rule out hypocalcaemia when parathyroid tissue or its blood supply is damaged during thyroidectomy.

PTH measured soon after thyroidectomy is more closely linked to the immediate effect of surgery. In a prospective cohort, the predictive value of early postoperative PTH depended partly on when the blood sample was obtained.[10]

Prospective research has also reported a role for perioperative PTH in detecting transient hypocalcaemia after thyroidectomy.[11] Postoperative PTH reflects parathyroid function, while serum calcium indicates the biochemical effect.

Thakur and colleagues found postoperative serum PTH useful for identifying hypocalcaemia risk following total thyroidectomy.[12]

Dugani and colleagues examined PTH, vitamin D and calcium following total or near-total thyroidectomy, highlighting the relevance of preoperative biochemical measurements.[13]

Hypocalcaemia detected during the first two postoperative days must be distinguished from persistent postsurgical hypoparathyroidism. The 2022 International Task Force guidance defines chronic postsurgical hypoparathyroidism by persistence beyond 12 months.[14]

A 2024 study associated lower baseline PTH, thyroiditis and parathyroid autotransplantation with reduced intraoperative PTH.[15] Preoperative and intraoperative PTH therefore describe different points in the course of thyroid surgery.

Blood-sampling times and calcium given before sample collection can affect interpretation of postoperative results. The indication for surgery, central neck dissection, kidney function and vitamin D status may also influence the relationship between preoperative PTH and hypocalcaemia.

CONCLUSION

Preoperative intact PTH provides a baseline measurement, but it is not a direct test of functional parathyroid reserve. Early postoperative PTH and corrected serum calcium remain important in assessing the risk and severity of hypocalcaemia after thyroidectomy. Vitamin D, preoperative calcium and operative factors also warrant consideration.

Declarations

Ethical statement

Ec approval was obtained.

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Conflict of Interest

The authors declare no conflict of interest.

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