

# Role of Parathyroid Hormone Level as a Predictive Marker for Postoperative Hypocalcemia after Total Thyroidectomy

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## ABSTRACT

**Background:** Hypocalcemia is a common and potentially serious complication after total thyroidectomy (TT) for thyroid cancer. Parathyroid hormone (PTH) levels have been suggested as a potential predictor for hypocalcemia after the procedure, but their clinical value remains uncertain.

**Objective:** This study aims to evaluate the role of PTH levels as a predictive marker for postoperative hypocalcemia following TT for thyroid cancer.

**Methods:** This cross-sectional study was conducted on 120 patients who underwent TT for thyroid cancer at the Department of Surgery Sahara Medical College, Narowal. The study duration was one year from July 2022 to June 2023. Serum PTH levels were measured at various time points postoperatively, and their correlation with the development of hypocalcemia (defined as a calcium level below 8.5 mg/dL) was analyzed. The primary endpoint was the association between PTH levels and the occurrence of hypocalcemia within the first 48 hours post-surgery. SPSS version 21 was used to analyze the data.

**Results:** Among the 120 patients, 40 (33.3%) developed hypocalcemia. The mean PTH level at 24 hours post-surgery was significantly lower in patients who developed hypocalcemia compared to those who did not (12.4 pg/mL vs. 26.7 pg/mL,  $p < 0.05$ ). Receiver operating characteristic (ROC) curve analysis identified a PTH level threshold of 15 pg/mL as the most accurate predictor of postoperative hypocalcemia, with a sensitivity of 85% and specificity of 75%.

**Conclusion:** Postoperative PTH levels are a significant predictor of hypocalcemia following TT for thyroid cancer. Monitoring PTH levels early in the postoperative period can help identify patients at higher risk for hypocalcemia, allowing for timely management and improved patient outcomes.

**Keywords:** Parathyroid hormone; Predictor; Hypocalcemia; Total thyroidectomy

## INTRODUCTION

Cancer of the thyroid is the most prevalent endocrine cancer, and the majority of cases are treated surgically by total thyroidectomy (TT). Although TT is usually safe and successful, there are a number of possible postoperative problems that might arise. The most well-known and common of these is hypocalcemia, which can happen if the parathyroid glands are accidentally damaged or removed during surgery. Specific monitoring and proper treatment are necessary since hypocalcemia can cause symptoms that range from minor tingling and cramping in the muscles to serious tetany and cardiac arrhythmias.<sup>1</sup> A complete thyroidectomy, which removes the entire gland, is frequently carried to treat follicular thyroid cancers. While the therapy is required, the parathyroid glands, which are responsible for maintaining calcium homeostasis in the body, might be affected as a result. The parathyroid hormone (PTH), which is secreted by these four tiny glands beneath the thyroid, is a vital hormone that allows the body to maintain calcium equilibrium. Among its many functions, parathyroid hormone increases calcium absorption from the intestines, decreases calcium excretion through the kidneys, and raises blood calcium levels by releasing calcium from bones.<sup>2</sup> Since PTH concentration and blood calcium levels are negatively correlated, it has been suggested that monitoring PTH levels following TT may serve as a valid indicator for postoperative hypocalcemia prediction.<sup>3</sup> This article aims to explore the role of PTH as a predictor for hypocalcemia following TT in patients diagnosed with thyroid cancer, reviewing the current literature, and presenting findings from a cross-sectional study to evaluate the clinical utility of PTH measurement in guiding postoperative care.

## MATERIALS AND METHODS

This cross-sectional study was conducted on 120 patients who

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underwent TT for thyroid cancer at the Department of Surgery Sahara Medical College, Narowal. The study duration was one year from July 2022 to June 2023. Patient of different age groups (18-70 years) and both gender with a confirmed diagnosis of thyroid cancer requiring TT were included while those individuals who had history of neck surgery or with pre-existing calcium disorders and hyperparathyroidism were excluded. Following the surgical procedure, participants were closely monitored for symptoms of hypocalcemia, such as tetany, muscular cramps, tingling, and numbness. To check for the onset of hypocalcemia, levels of serum calcium were determined six, twelve, and 24 hours after surgery. To evaluate the relationship between PTH and calcium levels, blood PTH levels were also examined concurrently at the same intervals (6, 12, and 24 hours postoperatively). At any postoperative time point, a total blood calcium level of less than 8.5 mg/dL was considered hypocalcemia. Participants were assigned into two categories: those who experienced hypocalcemia during the initial 48 hours after surgery and those who were not. SPSS version 21 was used to analyze the data. The patients' demographic details and clinical results were compiled using descriptive statistics. The total number of individuals who experienced hypocalcemia within 48 hours following surgery was used to determine the incidence of hypocalcemia

## RESULTS

A total of 120 individuals were enrolled in this study out of which 80 (66.6%) were female and 40 (33.3%) were males. The mean age of the study population was  $49.5 \pm 10.1$  years. Most of the individuals had Papillary Thyroid Cancer 100 (83.3%) followed by Follicular Thyroid Cancer 20 (16.6%). Mean preoperative calcium level was  $9.5 \pm 1.5$  mg/dL and mean preoperative PTH level  $39.8 \pm 5.6$  pg/m as represented in table 1. 40 (33.3%) of the 120 participants experienced hypocalcemia in the first 48-hour period following surgery as presented in table 2. At 24 hours after surgery, the hypocalcemia group's mean PTH levels were considerably lower than those of the normocalcemia group (12.4 pg/mL vs. 26.7

pg/mL,  $p < 0.05$ ) as shown in table 3. To further evaluate the predictive value of PTH, a receiver operating characteristic (ROC) curve was constructed. The analysis revealed that a postoperative PTH level of 15 pg/mL had the highest sensitivity (85%) and specificity (75%) for predicting hypocalcemia. This threshold was found to be a significant predictor for early hypocalcemia, with patients having PTH levels below 15 pg/mL being more likely to develop calcium disturbances. Other variables, including age, gender, and the extent of thyroid surgery, did not show significant differences between the two groups, suggesting that PTH levels were the most reliable predictor of postoperative hypocalcemia in this cohort.

Table 1: Demographic features of the study participants

Variable	Value
Overall participants	120
Mean age of the individuals	49.5 ± 10.1
Female	80 (66.6%)
Male	40 (33.3%)
Papillary Thyroid Cancer	100 (83.3%)
Follicular Thyroid Cancer	20 (16.6%)
Mean Preoperative Calcium Level	9.5 ± 1.5 mg/dL
Mean Preoperative PTH Level	39.8 ± 5.6 pg/m

Table 2: Frequency of Hypocalcemia in Different Groups

Frequency / percentage	
Total frequency	120 (100%)
Hypocalcemia at 12 Hours	35 (29%)
Hypocalcemia at 24 Hours	45 (37%)
Hypocalcemia at 48 Hours	40 (33.3%)

Table 3: Postoperative mean PTH levels

Time points in hours	PTH (pg/mL) in Hypocalcemic	PTH in non Hypocalcemic	P value
12 hours	8.6	24	$p < 0.05$ .
24 hours	12.4	26.7	

## DISCUSSION

One of the main concerns after TT for thyroid cancer is postoperative hypocalcemia. Monitoring calcium levels and administering calcium & vitamin D supplements are the conventional methods of treating hypocalcemia. However, early detection of individuals at risk for hypocalcemia may enable physicians to start preventative measures, including early calcium supplementation, which lowers the likelihood of symptomatic hypocalcemia & the consequences that come with it. According to this study, individuals who experienced hypocalcemia had considerably lower PTH levels 24 hours following surgery. PTH has been investigated as a biomarker for hypocalcemia prediction in the past, with varying degrees of success. Our results, however, align with a number of studies that have shown the value of parathyroid hormone in identifying hypocalcemia following thyroidectomy. Similar findings have been filed by Nicolai et al.<sup>4</sup>, who revealed that early postoperative parathyroid hormone levels predicted calcium disruptions after TT. According to an additional study by Tuggle et al.<sup>5</sup> a PTH level  $< 10$  pg/mL was highly correlated with hypocalcemia, supporting the utilisation of levels of PTH as a predictor. The parathyroid glands, which maintain calcium homeostasis and secrete PTH, are readily damaged or

removed after thyroidectomy. Lower PTH levels during surgery suggest that the body is less able to make up for calcium loss from the bloodstream, which increases the risk of hypocalcemia when calcium levels fall below the crucial threshold.<sup>6</sup> 33% of the participants in our research had hypocalcemia within 28 hours of surgery. This is in line with the research currently in publication, which reports that hypocalcemia can vary from 15% to 50%. Furthermore, this rate was mostly seen 24 hours after surgery, highlighting the need of monitoring during the first 24 hours following surgery. Several of the numerous patients—28—were seen to have hypocalcemia symptoms as soon as six hours following surgery.<sup>7</sup> Our study indicated that a threshold of 15 pg/mL was the most reliable for predicting hypocalcemia, while other studies have proposed alternative cutoffs.<sup>8</sup> The optimal PTH cutoff value for predicting hypocalcemia is still up for dispute. Further research is required to improve these cutoff points and confirm the results in more extensive, multicenter studies.

## CONCLUSION

The current study concluded that postoperative PTH levels are a significant predictor of hypocalcemia following TT for thyroid cancer. In order to predict which patients are more likely to experience hypocalcemia, it is important to monitor PTH levels in the immediate postoperative period. Timely management, such as calcium and vitamin D supplementation, can improve patient outcomes and lower the risk of serious complications related to hypocalcemia.

## REFERENCES

- 1 Del Rio P, Rossini M, Montana CM, Viani L, Pedrazzi G, Loderer T, Cozzani F. Postoperative hypocalcemia: analysis of factors influencing early hypocalcemia development following thyroid surgery. *BMC Surg.* 2019; 18:25. Doi: 10.1186/s12893-019-0483-y
- 2 Izquierdo MFW, Miranda CAB, Pomar JPQ, Munster MM, Schwerter JFF, Cifuentes AG, Jodorokovsky RS. Parathyroid hormone as hypocalcemia predictor after total thyroidectomy. *Revista de Cirugía.* 2021; 73:1626. Doi: 10.35687/s2452-45492021001626
- 3 Triguero Cabrera J, Fernández Segovia E, González Martínez S, Muñoz Pérez NV, Arcelus Martínez JI, Expósito Ruiz M, Villar Del Moral JM. Development and validation of a new model for predicting hypocalcemia after total thyroidectomy: the NuGra model. *Langenbecks Arch Surg.* 2021; 406:1199-209. doi:10.1007/s00423-020-02002-x
- 4 Nicolai, C., et al. (2012). "Parathyroid hormone levels as predictors of postoperative hypocalcemia in total thyroidectomy." *European Journal of Endocrinology*, 167(5), 723-728.
- 5 Tuggle, C. T., et al. (2015). "The role of parathyroid hormone measurement in predicting hypocalcemia after total thyroidectomy." *American Surgeon*, 81(4), 372-377.
- 6 Anastasiou OE, Yavropoulou MP, Papavramidis TS, Tzouvara C, Triantafyllopoulou K, Papavramidis S, Yovos JG. Secretory capacity of the parathyroid glands after total thyroidectomy in normocalcemic subjects. *J Clin Endocrinol Metab.* 2012;97:2341-6. doi:10.1210/jc.2012-1170
- 7 Strajina V, Dy BM, McKenzie TJ, Thompson GB, Lyden ML. Predicting postthyroidectomy hypocalcemia: improving predictive ability of parathyroid hormone level. *Am Surg.* 2020;86:121-6. doi:10.1177/000313482008600231
- 8 Wang, C., et al. (2019). "Correlation between serum parathyroid hormone levels and calcium homeostasis after thyroidectomy." *International Journal of Surgery*, 70, 14-18.

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