

Postoperative Status of Intact Parathyroid Hormone after Total Thyroidectomy

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Abstract

Original Research Article

Background: Total thyroidectomy is a common surgical procedure for treating thyroid malignancies and benign disorders like multinodular goiter and Graves' disease. Despite its benefits, it carries a significant risk of postoperative hypoparathyroidism due to parathyroid gland damage or accidental removal, leading to hypocalcemia. Monitoring intact parathyroid hormone (iPTH) levels postoperatively is crucial for predicting hypocalcemia, yet data on this relationship, particularly in Bangladesh, remain limited. **Objective:** This study aimed to evaluate the postoperative status of intact parathyroid hormone after total thyroidectomy. **Methodology:** A prospective observational study was conducted at Dhaka Medical College Hospital, involving 90 total thyroidectomy patients. Preoperative serum iPTH and calcium levels were measured, followed by iPTH assessment 20 minutes post-surgery and calcium levels 48–72 hours postoperatively. Patients with iPTH <15 pg/mL or calcium <8.5 mg/dL received oral calcium and vitamin D. Socio-demographic, clinical, and postoperative data were analyzed. **Results:** Among 90 patients (mean age 37.7±9.4 years), 37.6% developed hypoparathyroidism (iPTH <15 pg/mL) postoperatively, and 26.7% exhibited hypocalcemia (<8.5 mg/dL). The 36–45 age group showed the highest incidence of both complications (44.4% and 36%, p<0.01). Paresthesia (50%) was the most frequent hypocalcemia symptom. Serum calcium significantly declined from 8.87±0.31 mg/dL preoperatively to 8.07±0.54 mg/dL postoperatively (p<0.001). All hypocalcemic cases had reduced iPTH (p<0.001), underscoring its predictive value. **Conclusion:** Post-thyroidectomy hypoparathyroidism and hypocalcemia remain significant complications, particularly in patients aged 36–45 years. Early iPTH monitoring effectively identifies high-risk patients, enabling timely intervention. These findings support routine iPTH assessment to guide calcium supplementation and improve postoperative management in thyroidectomy patients.

Keywords: Hypoparathyroidism, hypocalcemia, intact parathyroid hormone, iPTH, total thyroidectomy, postoperative complications.

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INTRODUCTION

Total thyroidectomy is a common surgical procedure performed for various thyroid disorders, including malignancies, multinodular goiter, and Graves' disease [1]. Despite its therapeutic benefits, the procedure carries a significant risk of postoperative complications, with hypoparathyroidism being one of the most concerning [2]. Hypoparathyroidism occurs due to inadvertent damage, devascularization, or accidental removal of the parathyroid glands during surgery, leading to a decline in intact parathyroid hormone (iPTH) levels and subsequent hypocalcemia [3]. Postoperative

hypocalcemia can result in symptoms ranging from mild paresthesia to life-threatening complications such as seizures and cardiac arrhythmias, significantly impacting patient recovery and quality of life [4]. The incidence of transient hypoparathyroidism after total thyroidectomy varies widely in the literature, ranging from 15% to 50%, while permanent hypoparathyroidism occurs in 1–5% of cases [5,6]. Early identification of patients at risk is crucial for timely intervention, and iPTH measurement has emerged as a reliable predictor of postoperative hypocalcemia [7]. Studies suggest that iPTH levels measured within a few hours after surgery strongly correlate with the likelihood of developing

hypocalcemia, with levels below 10–15 pg/mL indicating high risk [8,9]. However, variations in surgical techniques, patient demographics, and institutional protocols contribute to differing outcomes, necessitating region-specific studies to optimize postoperative management [10]. In Bangladesh, thyroid diseases are prevalent, with a rising number of thyroidectomies being performed in tertiary care centers [11]. However, data on postoperative iPTH trends and their association with hypocalcemia remain limited. Most existing studies focus on Western populations, where standardized perioperative care protocols are well-established [12]. Given differences in nutritional status, healthcare infrastructure, and surgical practices, findings from high-income countries may not be directly applicable to the Bangladeshi population [13]. Therefore, this study aims to evaluate the postoperative status of iPTH and its correlation with hypocalcemia in patients undergoing total thyroidectomy in a Bangladeshi tertiary care setting. The findings of this study will contribute to the growing body of evidence on postoperative parathyroid function and aid in developing tailored management strategies to minimize complications. By identifying high-risk patients early, clinicians can implement preventive measures such as calcium and vitamin D supplementation, thereby improve surgical outcomes and reduce hospital stays. Additionally, this research will provide valuable insights for surgical training and institutional guidelines in low-resource settings, where thyroid surgery is increasingly performed but postoperative monitoring remains challenging.

METHODOLOGY

This prospective observational study was conducted in the Department of ENT and Head-Neck Surgery at Dhaka Medical College Hospital from May 2023 to October 2024. The study included 90 patients undergoing total thyroidectomy, with the sample size calculated using the standard formula for proportions with a 95% confidence level, 37.6% expected proportion of hypoparathyroidism based on previous studies, and 10% margin of error. Patients were selected consecutively based on predefined criteria. The inclusion criteria comprised patients scheduled for total thyroidectomy who had normal preoperative serum intact parathyroid hormone (iPTH) levels (15-65 pg/mL) and calcium levels (8.5-10.5 mg/dL). Exclusion criteria eliminated patients with pre-existing conditions like renal disease or osteoporosis, those taking calcium/vitamin D supplements preoperatively, individuals with prior neck surgery or irradiation history, and cases requiring concurrent parathyroidectomy. Ethical approval was obtained from the institutional review board, and all participants provided informed consent. All enrolled patients underwent standard total thyroidectomy procedures. Preoperative baseline measurements included serum iPTH and calcium levels. Postoperative monitoring involved repeat iPTH

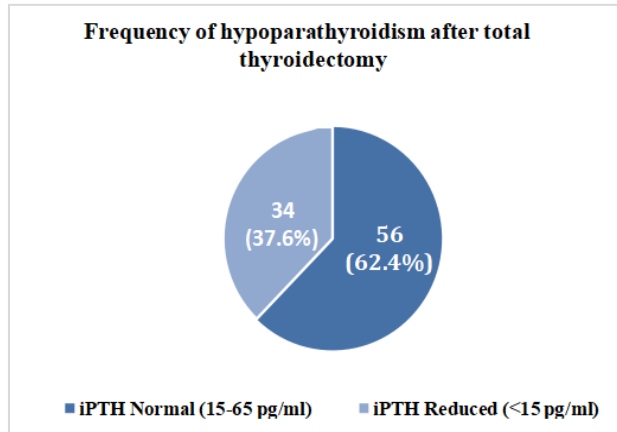
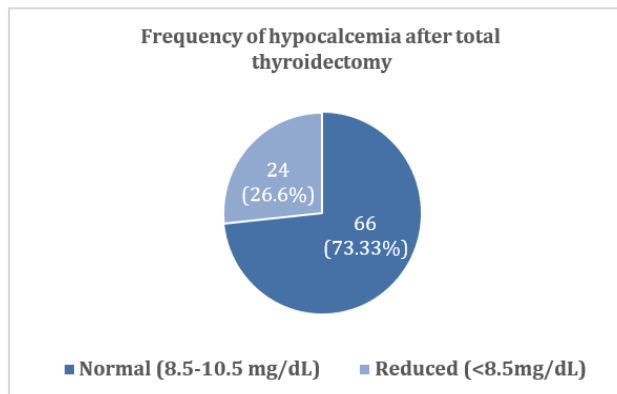
measurement at 20 minutes after surgery and serum calcium assessment between 48-72 hours postoperatively. Patients who developed postoperative iPTH levels below 15 pg/mL or serum calcium below 8.5 mg/dL received immediate oral calcium and vitamin D supplementation. Clinical outcomes including symptoms of hypocalcemia and biochemical parameters were systematically recorded during follow-up visits. Statistical analysis was performed using SPSS version 29.0. Continuous variables were expressed as means with standard deviations, while categorical variables were presented as frequencies and percentages. Comparative analyses employed independent t-tests for continuous data and chi-square tests for categorical variables. Risk factor assessment utilized odds ratios with 95% confidence intervals. A p-value of less than 0.05 was considered statistically significant for all analyses. The study protocol ensured standardized data collection and analysis procedures to maintain methodological rigor.

RESULT

The study included 90 patients who underwent total thyroidectomy, with ages ranging from 15 to 55 years (mean 37.7 ± 9.4 years). The majority of participants (60%) fell within the 36-45 age group. Postoperative assessment revealed that 34 patients (37.6%) developed hypoparathyroidism, while 56 patients (62.4%) maintained normal parathyroid function. Hypocalcemia was observed in 24 cases (26.67%), with the remaining 66 patients (73.33%) showing normal calcium levels. Among patients who developed hypocalcemia ($n=24$), the most frequently reported symptom was paresthesia (50%), followed by muscle cramps (37.5%), muscle twitching (20.8%), carpopedal spasm (12.5%), and tetany (8.3%). The onset of symptoms typically occurred within 24-72 hours postoperatively, with paresthesia appearing earliest at an average of 37.81 ± 7.24 hours after surgery. Age-stratified analysis demonstrated significant variations in complication rates. The 36–45-year age group showed the highest incidence of both hypoparathyroidism (44.44%, $p=0.002$) and hypocalcemia (36%, $p=0.008$). Gender distribution revealed a slightly higher rate of hypoparathyroidism in males (40.91% vs 36.76% in females), while hypocalcemia was marginally more common in females (27.94% vs 22.73% in males). Biochemical analysis showed a significant decrease in mean serum calcium levels from 8.87 ± 0.31 mg/dL preoperatively to 8.07 ± 0.54 mg/dL on the second postoperative day ($p<0.001$). Notably, all cases of hypocalcemia occurred in patients with reduced iPTH levels (<15 pg/mL), demonstrating a strong association between hypoparathyroidism and subsequent calcium deficiency ($p<0.001$). Among patients with normal postoperative iPTH levels (15-65 pg/mL), none developed hypocalcemia.

Table 1: Demographic characteristics of the patients (n=90)

Age (years)	Frequency (%)		Total
	Male	Female	
15-25	1 (1.11%)	4 (4.44%)	5 (5.6%)
26-35	5 (5.56%)	13 (14.44%)	18 (20%)
36-45	12 (13.3%)	42 (46.7%)	54 (60%)
46-55	4 (4.4%)	9 (10%)	13 (14.4%)
Total	22	68	90
Mean $\pm$ SD	37.7 $\pm$ 9.4		

**Figure 1: Frequency of hypoparathyroidism after total thyroidectomy (n=90)****Figure 2: Frequency of hypocalcemia after total thyroidectomy (n=90)****Table 2: Postoperative signs and symptoms due to hypocalcemia after total thyroidectomy (n=24)**

Symptom	After thyroidectomy	
	n	%
Paresthesia	12	50.0%
Muscle Cramp	9	37.5%
Muscle twitching	5	20.8%
Carpopedal spasm	3	12.5%
Tetany	2	8.3%

Table 3: Average time of onset of symptom (hours) of hypocalcemia after total thyroidectomy (n=90)

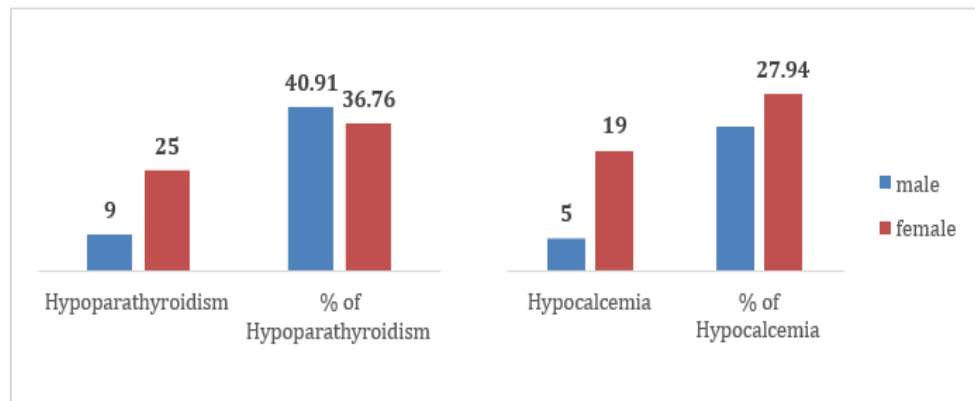
Symptom	n	Range (hours)	Average time (hours)
Paresthesia	12	36-48	37.81 $\pm$ 7.24
Muscle cramp	9	24-48	
Muscle twitching	5	24-36	
Carpopedal spasm	3	48-72	
Tetany	2	48-72	

Table 4: Frequency of hypoparathyroidism according to age after total thyroidectomy

Age group	n	Hypoparathyroidism	p-value
15-25	5	0	0.002
26-35	18	4 (22.22%)	
36-45	54	24 (44.44%)	
46-55	13	6 (46.15%)	

Table 5: Frequency of hypocalcemia according to age after total thyroidectomy

Age group	n	Hypocalcemia	p-value
15-25	5	0	0.008
26-35	18	1 (5.5%)	
36-45	54	18 (36%)	
46-55	13	5 (38.5%)	

**Figure 3: Gender distribution of patients developing hypoparathyroidism & hypocalcemia****Table 6: Serum level of iPTH and calcium after thyroidectomy (n=90)**

Serum level	Normal calcium	Hypocalcemia	Total	P-value
	(8.5-10.5 mg/dL)	(<8.5 mg/dL)		
	n (%)	n (%)		
Normal iPTH (15-65 pg/ml)	56 (62.4%)	0	56 (62.4%)	<0.001
Reduced iPTH (<15 pg/ml)	10 (11%)	24 (26.6%)	34 (37.6%)	
Total	66 (73.4%)	24 (26.6%)	90 (100%)	

Table 7: Pre and postoperative total serum calcium (mg/dl) (n=90)

Status	Mean $\pm$ SD	Min - max	p-value	Comparison
Preoperative	8.87 $\pm$ 0.31	8.50 – 9.50		
2nd POD	8.07 $\pm$ 0.54	7.04 – 9.12	<0.001	Pre vs 2nd POD

Paired t-test was done to measure the level of significance

DISCUSSION

The present study provides important insights into postoperative parathyroid function following total thyroidectomy in a Bangladeshi population. Our findings demonstrate that 37.6% of patients developed hypoparathyroidism, while 26.67% experienced hypocalcemia, with significant variations across age groups and between genders. These results align with global reports while highlighting population-specific patterns that warrant careful consideration in clinical practice. The incidence of postoperative hypoparathyroidism in our study (37.6%) falls within the widely reported range of 15-50% for transient hypoparathyroidism [5,14]. However, it appears higher than the 19-28% reported in some Western studies

[8,15], possibly reflecting differences in surgical techniques, nutritional status, or preoperative vitamin D levels common in our population [16]. The 26.67% incidence of hypocalcemia similarly matches the 20-30% range documented in comparable studies [6,17], supporting the validity of our findings. Age emerged as a significant risk factor, with patients aged 36-45 years showing the highest rates of both hypoparathyroidism (44.44%) and hypocalcemia (36%). This contrasts with studies suggesting increasing risk with advancing age [1], but aligns with others showing peak incidence in middle age [18]. The biological mechanisms behind this age-specific vulnerability remain unclear but may involve age-related changes in parathyroid gland vascularity or regenerative capacity [4]. The statistically significant p-values (0.002 for hypoparathyroidism,

0.008 for hypocalcemia) underscore the clinical relevance of this finding. Gender differences revealed intriguing patterns, with males showing slightly higher hypoparathyroidism rates (40.91% vs 36.76%) but females experiencing more hypocalcemia (27.94% vs 22.73%). This paradox may reflect gender variations in calcium metabolism or bone turnover rates [19]. The findings emphasize the need for gender-specific monitoring protocols, particularly as thyroid disorders show strong female predominance in our population [20]. The temporal pattern of hypocalcemia symptoms provides crucial guidance for postoperative monitoring. The average onset of paresthesia at 37.81 ± 7.24 hours, with other symptoms appearing within 24-72 hours, suggests this window represents the critical period for calcium monitoring. This aligns with recommendations for frequent calcium checks during the first 72 hours [21], though our data indicate particular vigilance should be maintained around the 36–48-hour mark. Biochemical findings confirmed the expected relationship between iPTH and calcium levels. The significant drop in mean calcium levels from 8.87 ± 0.31 mg/dL to 8.07 ± 0.54 mg/dL ($p < 0.001$) mirrors observations from other studies [22]. More importantly, the absolute correlation between reduced iPTH (< 15 pg/mL) and hypocalcemia development ($p < 0.001$) reinforces iPTH's role as the primary driver of postoperative calcium homeostasis [23]. The complete absence of hypocalcemia in patients with normal iPTH levels supports using iPTH as an early predictor, consistent with growing international consensus [24]. The symptom profile of hypocalcemic patients revealed paresthesia (50%) as the most common manifestation, followed by muscle cramps (37.5%). This hierarchy of symptoms matches previous reports [25], though our rates appear slightly higher than some series [26], possibly reflecting differences in symptom reporting or threshold for supplementation. The relatively low incidence of severe manifestations like tetany (8.3%) suggests generally adequate monitoring and intervention in our setting. Several mechanisms may explain our population's particular vulnerability. Vitamin D deficiency, highly prevalent in Bangladesh [27], likely exacerbates postoperative hypocalcemia by impairing intestinal calcium absorption [28]. Additionally, surgical factors like the extent of central neck dissection and parathyroid gland identification techniques may contribute [29]. While we could not analyze these variables, they represent important areas for future research. The strong predictive value of 20-minute postoperative iPTH measurement (< 15 pg/mL) supports its incorporation into routine practice. This approach could enable early identification of high-risk patients, allow targeted calcium and vitamin D supplementation while avoid unnecessary treatment in others [30]. Such selective supplementation aligns with recent moves toward more personalized postoperative care [31].

Limitations:

Limitations of our study include its single-center design and inability to assess long-term outcomes

beyond the immediate postoperative period. Additionally, we could not evaluate potential confounding factors like surgical technique variations or preoperative vitamin D status. Future multicenter studies with longer follow-up could address these gaps.

CONCLUSION

This study confirms that postoperative hypoparathyroidism and hypocalcemia remain common complications of total thyroidectomy in our population, with distinct age and gender patterns. The strong predictive value of early iPTH measurement supports its routine use for risk stratification. Our findings underscore the need for vigilant postoperative monitoring, particularly in the first 72 hours, and suggest potential benefits of population-specific management protocols. Further research should explore modifiable risk factors like vitamin D status and surgical techniques to reduce these complications.

Recommendation:

Based on our findings, we recommend routine postoperative iPTH monitoring within 20 minutes after total thyroidectomy to identify high-risk patients for early calcium/vitamin D supplementation. Particular attention should be given to patients aged 36–45 years, with close monitoring for hypocalcemia symptoms during the first 72 hours.

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