



Original Article

Changes in Serum Parathyroid Hormone and Timing of Biochemical and Clinical Manifestations After Thyroid Surgery

Haque MM¹, Anwar RT², Hassan MR³, Karim MR⁴, Islam MA⁵, Haque MM⁶

Abstract

Background: Postoperative parathyroid dysfunction frequently occurs after thyroid surgery. Because of its brief half-life, early postoperative serum parathyroid hormone (PTH) serves as a dependable indicator of postoperative calcium imbalance and occurs prior to alterations in serum calcium. Nonetheless, information from Bangladesh is scarce. This research assessed alterations in serum PTH levels and the onset of postoperative biochemical and clinical signs following thyroid surgery.

Methods: This prospective observational study, conducted prospectively, involved 120 patients who underwent thyroid surgery at Dhaka Medical College Hospital between January 2019 and June 2020. Serum PTH levels were measured preoperatively and 24 hours postoperatively, and patients were evaluated for postoperative hypoparathyroidism. Data analysis was performed using SPSS version 24.0, with $p < 0.05$ regarded as statistically significant. Approval for ethical considerations and informed consent were secured.

Results Of 120 patients, 17 (14.2%) experienced postoperative hypoparathyroidism, mainly in women, individuals aged 40–49 years, and those with papillary thyroid carcinoma. Mean serum PTH significantly declined following surgery (from 37.4 ± 10.9 to 22.8 ± 12.5 pg/ml, $p < 0.001$). Muscle cramps and paresthesia were the most frequently observed signs (41.2% each), with symptoms appearing within 24–48 hours after surgery.

Conclusion: Thyroid surgery led to a notable decrease in postoperative serum PTH, with 14.2% of patients experiencing hypoparathyroidism. Measuring PTH levels soon after surgery, alongside careful biochemical and clinical observation, aids in the prompt identification and treatment of postoperative hypoparathyroidism, which may lessen complications and enhance patient results.

Keywords: Parathyroid Hormone, Biochemical and Clinical Manifestations, Thyroid Surgery

1. Md Mahbobul Haque

Assistant Professor, Dept. of ENT, General Hospital, Faridpur, Bangladesh
Attachment -National Institute of ENT, Tejgaon, Dhaka, Bangladesh
Email: md.mahbobulhaque1986@gmail.com. Orcid Id: 0009-0004-8671-0974

2. Rahat Tanvir Anwar

Assistant Registrar, Department of Otolaryngology & Head Neck Surgery
National Institute of ENT, Tejgaon, Dhaka, Bangladesh.
Email: rahattanvirdmc66@gmail.com. Orcid Id: 0009-0005-7659-1710

3. Md. Rifat Hassan

Assistant Professor, Department of Otolaryngology & Head Neck Surgery
National Institute of ENT, Tejgaon, Dhaka, Bangladesh
Email: rifatraib905@gmail.com. Orcid Id: 0009-0004-6614-8021

4. Md. Rezaul Karim

Research Officer, Department of Otolaryngology & Head Neck Surgery
National Institute of ENT, Tejgaon, Dhaka, Bangladesh
Email: drrezaulkarim46@gmail.com. Orcid Id: 0009-0005-6173-618X

5. Md. Ashraful Islam

Assistant Registrar, Department of Otolaryngology & Head Neck Surgery
National Institute of ENT, Tejgaon, Dhaka, Bangladesh
Email: razib46somc@gmail.com. Orcid Id: 0009-0001-0387-8797

6. Muhammad Mozammel Haque

Assistant Professor, Department of ENT
National Institute of ENT, Tejgaon, Dhaka, Bangladesh.
Email Id: Orcid Id:

Introduction

Thyroid surgery is a common endocrine procedure performed for benign and malignant conditions such as multinodular goiter, Graves' disease, and thyroid cancer. Despite advances in surgical techniques and perioperative care, alterations in parathyroid hormone (PTH) levels remain one of the most common postoperative concerns following thyroidectomy [1].

Correspondence to: Md. Mahbobul Haque

Assistant Professor, Dept. of ENT, General Hospital, Faridpur, Bangladesh
Attachment -National Institute of ENT, Tejgaon, Dhaka, Bangladesh

Hypoparathyroidism is marked by decreased secretion of parathyroid hormone (PTH), resulting in hypocalcemia. Following total thyroidectomy, transient hypoparathyroidism is observed in roughly 24.1% of patients, while permanent hypoparathyroidism impacts around 1.2% [2,3].

Parathyroid hormone (PTH) is the main regulator of calcium balance. Because of its brief half-life (2–5 minutes), serum PTH decreases quickly following parathyroid damage, occurring before the decrease in serum calcium by 24–48 hours. Consequently, initial postoperative PTH assessment is a dependable indicator of postoperative calcium disorder and parathyroid impairment [4,5]. Measuring PTH levels early after surgery (1–6 hours) is an effective indicator of potential postoperative calcium issues and parathyroid problems before serum calcium levels drop, facilitating prompt calcium supplementation and allowing for safe early discharge of patients at low risk [6,7]. The decline of biochemical calcium often occurs before clinical manifestations, which consist of circumoral numbness, paresthesia, muscle cramps, carpopedal spasm, and, in serious instances, laryngospasm, seizures, or cardiac arrhythmias. Since symptom onset differs from patient to patient, clinical characteristics alone are not enough for timely diagnosis [8,9].

International research indicates that thyroidectomy leads to an initial decrease in serum PTH, succeeded by a later reduction in serum calcium, with postoperative calcium imbalance observed even in certain patients exhibiting normal early PTH levels. These results endorse the application of early PTH evaluation alongside continuous calcium tracking to identify parathyroid dysfunction after surgery [10,11]. Research in Bangladesh indicates that early postoperative serum PTH is a reliable predictor of calcium imbalance following total thyroidectomy, while postoperative parathyroid dysfunction occurs more frequently after extensive thyroid surgeries, emphasizing the importance of early biochemical observation [12,13].

Data from Bangladesh regarding postoperative alterations in serum parathyroid hormone (PTH) and the sequence of biochemical and clinical signs following thyroid surgery is scarce. Consequently, this research sought to assess variations in serum PTH and identify the timing of postoperative biochemical and clinical signs to enhance early identification and treatment of parathyroid dysfunction.

Methodology:

This prospective observational study was conducted in the Department of Otolaryngology–Head and Neck Surgery, Dhaka Medical College Hospital (DMCH), Dhaka, Bangladesh, from January 2019 to June 2020. A total of 120 consecutive patients undergoing thyroid surgery for benign or malignant thyroid diseases were enrolled using purposive sampling. Patients aged 18 years or older who

underwent hemithyroidectomy, subtotal thyroidectomy, near-total thyroidectomy, or total thyroidectomy and provided written informed consent were included in the study. Patients with pre-existing hypoparathyroidism, chronic kidney disease, known calcium or vitamin D metabolism disorders, previous thyroid or parathyroid surgery, concomitant parathyroid disease, or incomplete biochemical follow-up were excluded.

Baseline demographic and clinical data, including age, sex, and thyroid pathology, were recorded using a structured data collection form. Venous blood samples were collected preoperatively and within the first 24 hours after surgery for measurement of serum intact parathyroid hormone (PTH) using a chemiluminescent immunoassay. Histopathological diagnoses were obtained from postoperative pathology reports and categorized as multinodular goitre (MNG), papillary thyroid carcinoma (PTC), follicular thyroid carcinoma (FTC), Hashimoto's thyroiditis, or follicular adenoma (FA).

Patients underwent thyroid surgery, including hemithyroidectomy, subtotal thyroidectomy, near-total thyroidectomy, or total thyroidectomy. The type and extent of thyroid surgery were recorded for each patient. Patients were monitored clinically during the postoperative period for signs and symptoms of hypoparathyroidism, including muscle cramps, paresthesia, muscle twitching, carpopedal spasm, and tetany. The time of onset of the first clinical manifestation was recorded in hours after surgery. Postoperative hypoparathyroidism was defined as postoperative serum PTH below the laboratory reference range, with or without symptoms and/or calcium supplementation.

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 24.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequency and percentage. Preoperative and postoperative serum PTH levels were compared using the paired Student's t-test.

The study protocol was approved by the Institutional Review Board/Ethical Review Committee of Dhaka Medical College, and written informed consent was obtained from all participants before enrollment. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

Results:

Baseline Characteristics of the Study Population

Table 1 contrasts the fundamental demographic traits of patients based on the occurrence of postoperative hypoparathyroidism. Out of 120 participants, 17 (14.2%) patients developed postoperative hypoparathyroidism, whereas 103 (85.8%) did not experience it. Individuals aged

40–49 years represented the highest percentage in both the hypoparathyroidism (41.2%) and non-hypoparathyroidism (31.1%) cohorts. Women made up the majority in both groups, representing 94.1% of patients with hypoparathyroidism and 78.6% of those without. Generally, postoperative hypoparathyroidism was more commonly seen in female patients and individuals in their forties.

Table 1. Baseline demographic characteristics according to postoperative hypoparathyroidism (n=120)

Variables	Hypoparathyroidism Yes (n = 17), n (%)	No (n = 103), n (%)
Age group (years)		
10–19	1 (5.9)	4 (3.9)
20–29	1 (5.9)	13 (12.6)
30–39	5 (29.4)	28 (27.2)
40–49	7 (41.2)	32 (31.1)
50–59	2 (11.8)	18 (17.5)
≥60	1 (5.9)	8 (7.8)
Sex		
Male	1 (5.9)	22 (21.4)
Female	16 (94.1)	81 (78.6)

Distribution of Thyroid Pathology

Table 2 illustrates that papillary thyroid carcinoma (PTC) was the predominant pathology in patients with postoperative hypoparathyroidism (58.8%), succeeded by multinodular goitre (MNG) (35.3%) and follicular thyroid carcinoma (FTC) (5.9%). There were no instances reported in individuals with Hashimoto's thyroiditis or follicular adenoma. In patients without hypoparathyroidism, the main pathology was MNG (63.1%), with PTC following closely at 23.3%. In general, postoperative hypoparathyroidism occurred more often in patients with PTC.

Table 2: Distribution of Thyroid Pathology According to Postoperative Hypoparathyroidism (n = 120)

Thyroid pathology	Hypoparathyroidism Yes (n=17), n (%)	Hypoparathyroidism No (n=103), n(%)	Total (n = 120), n (%)
Multinodular goitre (MNG)	6 (35.3)	65 (63.1)	71 (59.2)
Papillary thyroid carcinoma (PTC)	10 (58.8)	24 (23.3)	34 (28.3)
Follicular thyroid carcinoma (FTC)	1 (5.9)	4 (3.9)	5 (4.2)
Hashimoto's thyroiditis	0 (0.0)	7 (6.8)	7 (5.8)
Follicular adenoma	0 (0.0)	3 (2.9)	3 (2.5)
Total	17 (100.0)	103 (100.0)	120 (100.0)

Changes in Serum Parathyroid Hormone Levels

Table 3 shows a significant reduction in serum parathyroid hormone (PTH) levels was observed following thyroid surgery. The mean preoperative serum PTH level was 37.4 ± 10.9 pg/ml, which decreased significantly to 22.8 ± 12.5 pg/ml postoperatively, corresponding to a mean reduction of 14.6 pg/ml ($p < 0.001$).

Table 3. Comparison of preoperative and postoperative serum parathyroid hormone levels (n=120)

Parameter	Preoperative (Mean $\pm$ SD)	Postoperative (Mean $\pm$ SD)	Mean Difference	p-value
PTH (pg/ml)	37.4 ± 10.9	22.8 ± 12.5	14.6	<0.001

Serum Parathyroid Hormone Levels According to Thyroid Pathology

Table 4 shows that postoperative serum PTH levels were lower than preoperative levels across all histopathological groups. The greatest numerical reduction was observed in Hashimoto's thyroiditis, followed by follicular adenoma, PTC, FTC, and MNG. The findings indicate an overall postoperative decline in PTH, although no statistical comparison between pathology groups was performed.

Table 4. Preoperative and postoperative serum parathyroid hormone levels according to thyroid pathology

Histopathology	n	Preoperative PTH (Mean $\pm$ SD)	Postoperative PTH (Mean $\pm$ SD)
Hashimoto's thyroiditis	7	40.8 ± 10.7	22.1 ± 11.6
Follicular adenoma (FA)	3	53.9 ± 5.2	36.5 ± 5.9
Multinodular goitre (MNG)	71	37.0 ± 10.2	23.8 ± 10.9
Papillary thyroid carcinoma (PTC)	34	36.1 ± 12.8	19.6 ± 14.8
Follicular thyroid carcinoma (FTC)	5	37.2 ± 7.9	21.9 ± 12.6
Total	120	—	—

Clinical Manifestations and Timing of Postoperative Hypoparathyroidism

Table 5 displays the clinical symptoms and onset timing of postoperative hypoparathyroidism in the 17 patients affected. The most prevalent symptoms were muscle cramps and paresthesia, both seen in 7 (41.2%) patients, followed by muscle twitching in 5 (29.4%), carpopedal spasm in 3 (17.6%), and tetany in 2 (11.8%). Symptoms began appearing within 24–48 hours post-surgery, with an average onset time of 34.2 ± 6.9 hours.

Table 5. Clinical manifestations and timing of onset of postoperative hypoparathyroidism (n=17)

Clinical manifestation	Frequency, n (%)	Time of onset (hours)
Muscle cramps	7 (41.2)	24–48
Paresthesia	7 (41.2)	24–48
Muscle twitching	5 (29.4)	24–36
Carpopedal spasm	3 (17.6)	24–36
Tetany	2 (11.8)	24–36
Mean onset time	—	34.2 ± 6.9

Discussion:

In this study, postoperative hypoparathyroidism patients were mainly females aged 40–49, similar to those who did not have the condition. This result aligns with earlier studies from Bangladesh indicating that thyroid surgery is predominantly carried out in middle-aged women because of the greater occurrence of thyroid disorders in this demographic [14,15].

Postoperative hypoparathyroidism was most frequently seen in patients with papillary thyroid carcinoma, while multinodular goitre was more common in those without hypoparathyroidism. Comparable results have been observed in earlier studies from Bangladesh, indicating that thyroid cancer carries a greater likelihood of postoperative complications than benign thyroid conditions, probably due to the more extensive surgical dissection that is needed [14,16].

The current study showed a notable decrease in serum PTH levels postoperatively, suggesting a temporary reduction in parathyroid function following thyroid surgery. A comparable notable decrease in postoperative PTH has

been documented earlier, underscoring early PTH evaluation as a dependable indicator of postoperative parathyroid impairment and ensuing hypocalcemia [17].

Serum PTH decreased post-surgery in all thyroid conditions, with the most significant drop noted in individuals with papillary thyroid carcinoma. Previous reports have indicated similar outcomes, linking the more significant PTH reduction in thyroid cancer to more extensive surgical dissection and a heightened risk of parathyroid gland damage [5,18].

Muscle cramps and paresthesia were the most frequent signs of postoperative hypoparathyroidism, with symptoms emerging within 24–48 hours post-surgery. Previous studies have indicated similar results, with the majority of clinical symptoms emerging in the initial two postoperative days after a reduction in parathyroid hormone levels [19].

Overall, Thyroid surgery leads to a notable decrease in serum PTH levels after the operation, especially in individuals with papillary thyroid carcinoma, and early monitoring of PTH aids in the prompt detection of postoperative hypoparathyroidism prior to the emergence of clinical symptoms.

Limitations:

This single-center study had a relatively small sample size. Postoperative calcium and complete surgical-type data were unavailable, limiting assessment of biochemical hypocalcemia and surgery-specific associations. As ≥ 12 -month follow-up was unavailable, permanent hypoparathyroidism could not be determined.

Conclusion:

Thyroid surgery was associated with a significant postoperative decline in serum parathyroid hormone (PTH) levels, and 14.2% of patients developed postoperative hypoparathyroidism. A reduction in PTH was observed across all thyroid pathologies, while clinical manifestations—most commonly muscle cramps and paresthesia—typically appeared within 24–48 hours after surgery. These findings emphasize that early postoperative biochemical assessment together with careful clinical monitoring may facilitate the timely recognition and management of hypoparathyroidism following thyroid surgery.

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