



A Prospective Study of Serum Calcium Changes Following Thyroid and Non-Thyroid Neck Surgeries

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ABSTRACT

Introduction: Post-thyroidectomy hypocalcemia is a common complication that may present with symptoms ranging from mild tingling to severe convulsions. Conventionally, patients undergoing thyroid surgery are monitored in hospitals for several days for serial calcium assessments. This complication arises in approximately 30–60% of patients, primarily due to impaired parathyroid hormone (PTH) secretion following inadvertent injury or dysfunction of the parathyroid glands during surgery.

Objective: To assess and compare the patterns of corrected serum calcium fluctuations after thyroid and non-thyroid neck surgeries.

Methods: A prospective observational study was conducted at the Department of Otolaryngology-Head & Neck Surgery, BSMMU, Dhaka, Bangladesh, from January to June 2022. A total of 90 patients undergoing thyroid or other neck surgeries under general anesthesia were included. Patients with prior parathyroid disorders, history of calcium supplementation, or previous neck radiation were excluded.

Results: Of the 90 patients, 42 underwent thyroid surgery and 48 underwent non-thyroid procedures. A statistically significant drop in serum calcium was noted immediately post-surgery in both groups. However, calcium levels generally returned to near preoperative levels by post-operative day four. The observed changes were comparable between both groups.

Conclusion: Transient hypocalcemia is not exclusive to thyroidectomy. Immediate post-operative calcium decline appears to be influenced more by haemodilution and surgical stress than by the specific type of neck surgery. Monitoring corrected calcium is essential for guiding post-operative management.

Keywords: Serum Calcium, Thyroidectomy, Neck Surgery, Hypocalcemia, Parathyroid Function



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INTRODUCTION

Hypocalcemia is one of the most frequently encountered complications following thyroidectomy, with clinical manifestations ranging from mild paresthesia to life-threatening convulsions and cardiac arrhythmias [1]. Historically, patients undergoing thyroid surgery were required to remain hospitalized for extended observation and serial calcium level monitoring [2]. The incidence of hypocalcemia after total or near-total thyroidectomy ranges between 30% and 60%, predominantly due to disruption of parathyroid hormone (PTH) secretion. Such dysfunction may result from inadvertent removal, trauma, edema, or vascular compromise of the parathyroid glands during surgery [3, 4].

The introduction of safer surgical techniques and healthcare resource limitations have promoted shorter hospital stays, including same-day or 23-hour surgeries [5, 6]. Temporary hypocalcemia, which persists up to 6–12 months, remains a significant concern. Identification of this condition is essential, as untreated cases can result in serious outcomes like seizures and laryngospasm [1]. Although hypoparathyroidism is a known primary cause, additional factors like haemodilution and electrolyte disturbances may also play a significant role in postoperative calcium imbalances [7, 8].

More accurate measurements—such as ionized calcium rather than total serum calcium—are recommended when albumin levels are abnormal or when calcium abnormalities are suspected despite normal total calcium levels [9, 10]. Monitoring corrected calcium levels is particularly important to avoid unnecessary supplementation, which may cause side effects like constipation and appetite loss [11].

This study aims to evaluate and compare the trends in corrected serum calcium levels after thyroid and non-thyroid neck surgeries to better understand the underlying causes of postoperative hypocalcemia and inform improved management strategies.

Materials And Methods

This prospective study was conducted in the Department of Otolaryngology-Head & Neck Surgery at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, over a period of six months from January to June 2022. A total of 90 patients who underwent neck surgeries were enrolled, including both thyroid and non-thyroid procedures under general anesthesia.

Inclusion criteria encompassed patients over 12 years of age, of all genders, who were scheduled for either thyroid or non-thyroid neck surgeries. Exclusion criteria included individuals with pre-existing calcium disturbances (primary, secondary, or tertiary hyper/hypocalcemia), those on calcium supplements prior to surgery, patients with a history of parathyroid surgery, and those who had received radiation therapy to the neck.

Prior to surgery, all participants underwent standard preoperative assessments, including baseline serum calcium and albumin measurements, typically performed three to four days before the procedure. Patients with thyroid dysfunction (hypothyroidism or hyperthyroidism) were rendered euthyroid before the operation. All surgeries were performed by experienced faculty members following standard operative protocols.

Tourniquet use was avoided to prevent inaccuracies in calcium readings. Blood samples were collected at four time points: pre-operatively, immediately after surgery in the recovery room, on post-operative day one (POD-1), and on post-operative day four (POD-4). Serum calcium levels were corrected using the corresponding serum albumin values to account for protein-bound calcium variations [5, 10].

The collected data were compiled in Microsoft Excel and analyzed using SPSS version 23.0. Continuous variables were presented as mean \pm standard deviation. Patients were stratified into groups based on whether they developed post-operative hypocalcemia. Statistical comparisons of calcium values between thyroid and non-thyroid groups were performed using Student's t-test and Fisher's exact test. A p-value of <0.05 was considered statistically significant.

Results

A total of 90 patients were included in the study, comprising 42 cases who underwent thyroid surgery and 48 cases who had non-thyroid neck procedures. The average age of participants in the thyroid group was 38.6 years, notably higher than that of the non-thyroid group, which had a mean age of 29 years.

Corrected serum calcium levels were recorded at four different time points: pre-operatively, immediately post-surgery (recovery room), on post-operative day one (POD-1), and on post-operative day four (POD-4). As illustrated in Table 1, the pre-operative mean calcium level was identical in both groups at 2.04 mmol/L. A decline was noted in the immediate post-operative period, with levels dropping to 1.75 mmol/L in the thyroid group and 1.89 mmol/L in the non-thyroid group. On POD-1, the mean corrected calcium level improved to 1.92 mmol/L in the thyroid group and 1.94 mmol/L in the non-thyroid group. By POD-4, levels had nearly returned to baseline: 2.00 mmol/L for the thyroid group and 1.99 mmol/L for the non-thyroid group.

Statistical analysis revealed that the immediate post-operative calcium drop (from pre-op to recovery) was significant in both groups ($p < 0.05$). However, changes observed from pre-operative values to POD-4 were not statistically significant ($p > 0.05$), indicating recovery of calcium levels by the fourth day post-surgery.

As detailed in Table 2, the average decline in calcium from pre-operation to recovery was more prominent in the thyroid group (0.284 ± 0.27 mmol/L) compared to the non-thyroid group (0.15 ± 0.22 mmol/L), and this difference was statistically significant ($p < 0.05$). On POD-1, the reduction was minimal and comparable across both groups (thyroid: 0.126 ± 0.19 mmol/L; non-thyroid: 0.10 ± 0.17 mmol/L; $p > 0.05$). On POD-4, the mean differences in both groups were negligible and statistically non-significant (thyroid: 0.04 ± 0.10 mmol/L; non-thyroid: 0.04 ± 0.12 mmol/L; $p > 0.05$).

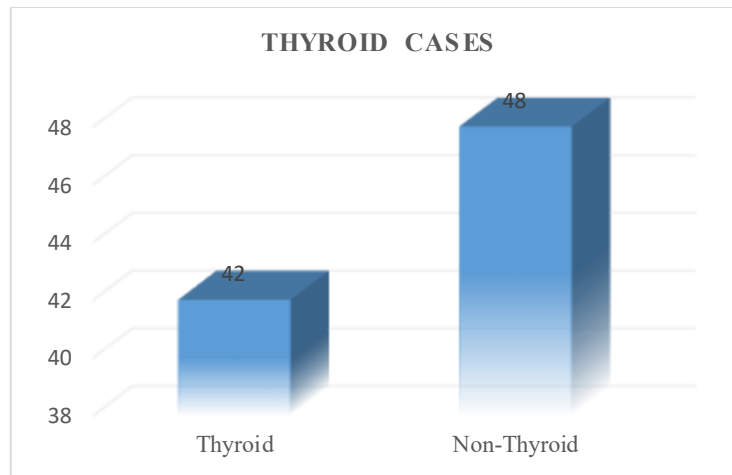


Fig-1: Distribution of thyroid cases

Table 1: Mean value of corrected Ca++ in both groups (n=90)

Days	Thyroid Surgery mean calcium levels (mmol/l)	Non-Thyroid Surgery mean calcium levels (mmol/l)	p-value (Fisher's exact)
Pre-op	2.04 ± 0.07	2.04 ± 0.09	>0.05 ^{ns}
Recovery	1.75±0.26	1.89 ± 0.19	<0.05 ^s
POD-1	1.92±0.16	1.94± 0.13	>0.05 ^{ns}
POD-4	2.00 ± 0.07	1.99 ± 0.05	>0.05 ^{ns}

Table 2: Comparison of different readings of calcium level in thyroid and non-thyroid cases

Thyroid (n=42)	Thyroid (n=42)	Non-Thyroid (n=48)	p-value
Days	Mean difference (95% CI)	Mean difference (95% CI)	
Recovery	0.284 ± 0.27	0.15 ± 0.22	p<0.05 ^{ss}
POD-1	0.126±0.19	0.10 ± 0.17	p>0.05 ^{ss}
POD-4	0.04 ± 0.10	0.04 ± 0.12	p>0.05 ^{sns}

Discussion

Calcium plays an essential role in numerous physiological processes, including muscle contraction, nerve transmission, and blood coagulation [10]. Hypocalcemia is a recognized complication following neck surgeries, particularly thyroidectomy, and can result from a variety of intraoperative factors such as inadvertent trauma to the parathyroid glands, ischemia, or resection [3, 4]. However, the precise etiology is often multifactorial.

In our study, both thyroid and non-thyroid neck surgery groups experienced a significant decline in corrected serum calcium levels immediately post-operatively, with the thyroid group showing a greater drop (0.284 ± 0.27 mmol/L) compared to the non-thyroid group (0.15 ± 0.22 mmol/L). This aligns with previous reports indicating that thyroidectomy has a higher likelihood of transient calcium disturbances due to proximity and manipulation of the parathyroid glands during surgery [12, 13].

Interestingly, the calcium levels in both groups showed recovery trends by POD-1 and nearly normalized by POD-4. This pattern suggests that transient hypocalcemia, while more pronounced in thyroid surgery, is not exclusive to it. Haemodilution during intraoperative fluid resuscitation and surgical stress responses may also contribute to temporary calcium shifts in non-thyroid procedures [7, 8].

Studies such as those by Mehta et al. and Pattou et al. have indicated that serum ionized calcium <1.03 mmol/L on POD-1 correlates with clinical symptoms of hypocalcemia and may necessitate supplementation [6, 14]. However, universal supplementation is not always appropriate, as unnecessary calcium or vitamin D intake can cause adverse effects like gastrointestinal discomfort or hypercalcemia [15].

Routine assessment of corrected serum calcium, particularly in the immediate post-operative period, can serve as an effective tool for identifying patients at risk. This approach enables tailored supplementation protocols and supports earlier discharge planning without compromising patient safety [9, 16].

Moreover, factors like surgical technique, operative duration, patient age, thyroid pathology, and preoperative biochemical status have all been cited as influencing the incidence and severity of hypocalcemia [17, 18]. In our study, since the surgical procedures were performed by experienced faculty and no major inter-group demographic differences were present except for age, the difference in calcium drop was primarily attributed to the type of surgical intervention.

Conclusion

This prospective study demonstrated that transient hypocalcemia is a common occurrence after both thyroid and non-thyroid neck surgeries. Although the calcium decline was more pronounced in the thyroid group, the difference was not significant by the fourth post-operative day, indicating effective physiological recovery in most cases. These findings suggest that hypocalcemia is not an exclusive complication of thyroidectomy but may result from broader surgical factors, including haemodilution and tissue trauma.

Corrected serum calcium measurements offer a reliable and accessible method for identifying at-risk patients early. Routine monitoring in the immediate post-operative period can guide timely intervention, help avoid unnecessary supplementation, and support safe early discharge protocols. Future studies involving larger sample sizes and multi-center comparisons could further elucidate the specific mechanisms and risk factors contributing to post-operative calcium imbalance.

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