Comparison of Frequency of Hypocalcemia Following Total Thyroidectomy For Thyroid Carcinoma and Benign Multinodular Goiter

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ABSTRACT

Objective: To compare the frequency of temporary hypocalcemia after total thyroidectomy done for thyroid malignancy and benign multinodular goiter.

Study design: Cross sectional comparative observational study.

Place & Duration of study: Department of General Surgery, Jinnah Postgraduate Medical Centre (JPMC) Karachi, from March 2023 to September 2023.

Methods: A total of 35 patients, 18- 80 years of age, both genders who underwent total thyroidectomy were included. Patients with comorbid conditions and preoperative hypocalcemia were excluded. Preoperative serum calcium level was estimated in all patients. In postoperative period serum calcium levels were measured at 12, 24, and 48-hours. Patients with serum calcium level below 8 mg/dl within 48-hours after surgery were considered as hypocalcemic,and their serum parathyroid hormone (S.PTH) levels were then assessed.

Results: The age of the patients was 18 to 80-years with a mean age of 49.17±11.72 years. There were 13 (37.14%) males and 22 (62.86%) females with a male to female ratio of 1:1.7. Temporary hypocalcemia was found in four (11.43%) patients. It occurred less commonly in benign conditions (4.35%) as compared to patients with malignant lesions (25.0%).

Conclusion: The frequency of temporary hypocalcemia after total thyroidectomy was high in patients with malignant.

Key words: Thyroidectomy, Hypocalcemia, Thyroid carcinoma, Benign multinodular goiter.

INTRODUCTION:

Thyroidectomy is a commonly performed surgical procedure. Number of procedure related complications are reported in the postoperative period that include recurrent laryngeal nerve injury, hemorrhage and tetany. These are more common after total thyroidectomy compared to hemi-thyroidectomy. Total thyroidectomy is usually performed in malignant and multinodular goiter. One of the most frequent complications following total thyroidectomy is hypocalcemia which occurs due to parathyroid gland removal or injury during surgery.[1]

Plasma calcium concentration ranges from 2.25 to 2.55 mmol/L, with ionized calcium playing a crucial role in the physiological processes. Its levels are regulated by vitamin D, parathyroid hormone (PTH), and calcitonin. Hypoparathyroidism leads to hypocalcemia that presents with neuromuscular irritability, paresthesia, perioral numbness, and muscle cramps. Chvostek's sign is present in some cases, while Trousseau's sign may indicate latent tetany.[2]

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Post-thyroidectomy hypocalcemia can be managed by oral calcium supplementation, with dosages gradually tapered over weeks. Severe cases require intravenous calcium gluconate. Monitoring serum calcium and magnesium levels is essential.[3] The frequency of injury is related to skills of the surgeons, duration of the procedure, age of the patient and gender. Female patients are more frequently affected (42%) than males (21.4%). Total thyroidectomy carries a higher risk (38.8%) compared to lobectomy (13.8%).[4]

Total thyroidectomy for malignancy carries a higher risk of parathyroid injury than for benign conditions like multinodular goiter. The prevalence of hypocalcemia is considered as a measure of surgical expertise as well developing protocols to improve the care of such patients in postoperative period.[5] The rationale of this study was to determine the frequency of hypocalcemia Zollowing total thyroidectomy for both benign and malignant conditions as it would reflect need of procedural changes in our setup.

METHODS:

Study design, place & duration: It was a cross-sectional comparative observational study conducted in the Department of Surgery at Jinnah Postgraduate Medical Centre Karachi, from March 2023 to September 2023.

Ethical considerations: The study was approved by the Institution Review Board NO.F.2-81/2022-GENL/215/ dated 27-7-2022. Informed consent was taken from the patients.

Inclusion and exclusion criteria: Patients aged 18 to 80-years, both males and females, were included in the study. Patients with comorbid conditions like malnutrition, renal failure, respiratory diseases, and preoperative hypocalcemia due to other causes, were excluded.

Sample size estimation: A formal sample size was not calculated. All patients fulfilling the inclusion criteria managed during the study period were included as a population.

Study protocol: Patients diagnosed with multinodular goiter and thyroid carcinoma were enrolled from the outpatient department based on history, clinical examination, and investigations. Fine needle aspiration cytology (FNAC) was performed. Patients with malignant cells were categorized as having a malignant goiter, whereas cases with multiple benign nodules were labelled as benign multinodular goiter. All patients underwent total thyroidectomy. Preoperative serum calcium levels were assessed to exclude hypocalcemia from other causes. Postoperative serum calcium levels were measured at 12, 24, and 48-hours. Patients with serum calcium levels below 8 mg/dL within 48-hours were classified as hypocalcemic, and their serum PTH levels were then measured.

Statistical analysis: Statistical analysis was performed using SPSS version 26. Quantitative variables such as age and serum calcium levels were expressed as mean ± standard deviation. Qualitative variables including gender, diagnosis (benign or malignant), and presence of hypocalcemia were expressed as frequencies and percentages. Stratification was applied to control effect modifiers such as age, gender, and type of disease. Post-stratification, Chi-square / Fisher exact test was applied. A p-value 0.05 was considered statistically significant.

RESULTS:

A total of 35 patients were included. There were 13 (37.14%) males and 22 (62.86%) females with male to female ratio of 1:1.7. The mean age of the cohort was 49.17±11.72 years. The Mean duration of the disease was 2.06±0.94 years. There were 23 (65.71%) patients with benign multinodular goiter and 12 (34.29%) with malignant conditions, both papillary and follicular carcinoma. The frequency of temporary hypocalcemia after total thyroidectomy in this study was 11.43%. Four patients developed this complication in postoperative period. Mean serum calcium levels were 9.34 ± 3.72 mg/dl. Serum parathyroid hormone levels were measured in patients who developed hypocalcemia, and all showed reduced PTH levels consistent with transient hypoparathyroidism.

Age wise distribution is given in table I. Temporary hypocalcemia in age group between 18 -50-years was reported in two (11.11%) patient. In the age group of 51-80-years, two patients (11.76%) had temporary hypocalcemia. After stratification no statistical significance was found (p=0.952). Among males, three patients (13.64%) experienced temporary hypocalcemia while single woman (7.69%) had same issue with p=0.593. In patients with duration of disease between 1-2-years, three (12.0%) experienced temporary hypocalcemia. In malignant cases with hypocalcemia two patients had papillary thyroid carcinoma and one follicular thyroid carcinoma. Details are given in table II.

Table I: Age Distribution of Patients (n=35)

Age (years)	No. of Patients(n)	Percentage (%)
18-50	18	51.43
51-80	17	48.57
Total	35	100.0

Table I: Comparison of the Frequency of Temporary Hypocalcemia in Total Thyroidectomy Between Benign and Malignant Diseases

	Temporary Hypocalcemia		p value
Diagnosis	Yes	No	
Benign Conditions	01 (4.35%)	22 (95.65%)	0.068
Malignant Conditions	03 (25.0%)	09 (75.0%)	

DISCUSSION:

After thyroidectomy hypocalcemia is common as a result of hypoparathyroidism due to parathyroid gland damage. In our study the frequency of hypocalcemia was more than 11%. However, our study also included malignant conditions where more extensive dissection is often required. Hypocalcemia clinically manifests as muscle cramps, paresthesia, tetany, or confusion and can prolong the hospital stay. Hypocalcemia may be transient or permanent. In permanent cases of hypocalcemia lifelong calcium is required.[6] Early detection of hypocalcemia is crucial, especially with the increasing trend of ambulatory thyroid surgery.

The rate of postoperative hypocalcemia shows variation significantly across studies, ranging from 0.3% to 66.2%. This due to the differences in the surgical procedures as well varying definitions of hypocalcemia.[7] In some studies patients undergoing subtotal thyroidectomy or lobectomy are also included thus true incidence is not refelcted.[8] Furthermore, definitions of hypocalcemia differ across institutions; some rely on clinical symptoms, while others use serum calcium levels. One study demonstrated that hypocalcemia rates in a single thyroidectomy cohort ranged from 0% to 46%, depending on which of them different definitions were applied.[9] In this study we used standard level of serum calcium as a measure of hypocalcemia.

In our study of 35 patients, temporary hypocalcemia was observed in four patients. Other studies have reported postoperative hypocalcemia rates of 21.6% and 39%.[10] A study from Saudi Arabia reported that hypocalcemia occurred more on the second day after surgery in 67.4% of patients. Most of the patients were asymptomatic. This included 83.9% females and 16.1% males.[11] The risk was higher in thyroid cancer, nodal dissection, and female patients. Additionally, preserving at least three parathyroid glands during surgery reduces the risk of permanent hypocalcemia.[12]

Postoperative hypocalcemia is more common in toxic thyroid diseases, such as Graves' disease and Hashimoto's thyroiditis, due to the extensive surgical dissection required in these cases.[13] Incidental parathyroidectomy and delayed onset of hypocalcemia beyond the third postoperative day have also been linked to increased risk.[14] Studies suggest that intraoperative parathyroid hormone (PTH) monitoring has limited sensitivity but high specificity in predicting hypocalcemia.[15] We did not use this approach. Identifying at-risk patients, standardizing definitions, and ensuring careful surgical techniques are essential to document and minimize postoperative complications and improving patient outcomes.[16,17] A larger sample and longer follow-up would provide more comprehensive insights into the frequency of temporary hypocalcemia after total thyroidectomy.

LIMITATIONS OF THE STUDY:

This study spanned over a short period of time with a limited sample size that restrict the generalizability of its findings.

CONCLUSION:

The frequency of temporary hypocalcemia after total thyroidectomy in this study was 11.43%, occurring more frequently in malignant than benign cases. Careful identification and preservation of the parathyroid glands are essential during the surgery. Greater attention during malignant thyroidectomy is particularly important as our data showed more frequent occurrence of this complication in these cases.

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