

Hypocalcemia in Thyroid Surgery: A Prospective Study

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Abstract

Background: Hypocalcemia is low calcium levels in the blood serum. It most commonly occurs as a complication of thyroid surgery. The aim of the study is to determine the incidence, distribution, and cause of the hypocalcemia following thyroid surgery.

Materials and Methods: This is a prospective study conducted for 1 year on 100 patients who were selected for thyroidectomy were randomly selected. Hypocalcemia following thyroidectomy was correlated with parameters such as patients' gender, age, clinical diagnosis, surgical details - type of surgery and number of parathyroid identified. Student's *t*-test was used to assess the quantitative and Chi-square test for qualitative differences. $P < 0.05$ was considered statistically significant.

Results: The maximum incidence of thyroid surgery is in the age group of 30-39 years. The incidence of disease was high in both males and females of age 30-39 years. Out of 100 patients, 30 patients were diagnosed preoperatively as multinodular goiter, 32 patients presented with solitary nodule thyroid, 25 patients were diagnosed as papillary carcinoma thyroid, and the remaining 13 patients with follicular neoplasm. Out of 100 patients, 34 patients developed temporary hypocalcemia; none of them developed permanent hypocalcemia. Average number of parathyroid glands identified was 3. Maximum incidence of developing hypocalcemia was when only one parathyroid gland was identified.

Conclusion: Thyroid surgery is the most common etiology of temporary hypocalcemia. Post-operative hypocalcemia usually results from accidental removal of the parathyroid glands.

Key words: Hypocalcemia, Parathyroid gland, Thyroid surgery

INTRODUCTION

Hypocalcemia is low calcium levels in the blood serum. The normal range is 2.1-2.6 mmol/L. Levels < 2.1 mmol/L is defined as hypocalcemia. Mildly low levels that develop slowly often have no symptoms. Otherwise, symptoms may include numbness, muscle spasms, seizures, confusion, or cardiac arrest.^{1,2}

Chronic hypoparathyroidism, one of the important causes of hypocalcemia, is a stern and potentially devastating disorder that results from different causes.

It most commonly occurs as a complication of thyroid surgery. Some studies have concluded that the transient hyperparathyroidism prevalence rate varies from 6.9% to 46% and permanent hyperparathyroidism rates from 0.4% to 33%.³⁻⁵

Another important reason of hypocalcemia following thyroidectomy is secondary to surgical trauma, devascularization, and unintentional removal of parathyroid glands. The best way to avoid accidental excision is properly identifying the parathyroid glands. Risk of complication is higher when fewer than three glands are identified during surgery.^{6,7}

Physiologically, blood calcium is tightly regulated within a narrow range for proper cellular processes. Calcium in the blood exists in three primary states: Bound to proteins (mainly albumin), bound to anions such as phosphate and citrate, and as free (unbound) ionized calcium. Only the ionized calcium is physiologically active. Normal blood

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calcium level is 8.5-10.5 mg/dL, and that of ionized calcium is 4.65-5.25 mg/dL.^{3,5}

Because a significant portion of calcium is bound to albumin, any alteration in the level of albumin will affect the level of calcium is measured. A corrected calcium level based on the albumin level is: Corrected calcium (mg/dL) = Measured total Ca (mg/dL) + 0.8 * (4.0 – serum albumin [g/dL]). Another way to determine the calcium level is to measure directly the ionized calcium level.^{8,9}

The aim of the study is to determine the incidence, distribution, and cause of the hypocalcemia following thyroid surgery.

MATERIALS AND METHODS

This is a prospective study conducted in Department of General Surgery, Teerthankar Mahaveer Medical College and Research Centre for 1 year. We enrolled 50 patients in the study who were posted for thyroidectomy. The patients were informed about the study, and written consent was taken. Patients who had recurrent thyroid, concurrent lymph node dissection, and pre-existing hypocalcemia were excluded from the study. Serum albumin and calcium levels were calculated 12 h before surgery. Serum calcium levels were repeated 12 h after surgery, post-operative day 1 and 2.

In this study, calcium level below 8 mg/dL is defined as hypocalcemia. Permanent hypocalcemia was defined as persistent corrected calcium levels <8 mg/dL for 6 months after surgery.

Hypocalcemia following thyroidectomy was correlated with parameters such as patients' gender, age, clinical diagnosis, surgical details - type of surgery and number of parathyroid identified.

Student's *t*-test was used to assess the quantitative and Chi-square test for qualitative differences. *P* < 0.05 was considered statistically significant.

RESULTS

A total of 50 patients were included in the study, the median age in this study being 34 years. The age ranged from 20 to 79 years with maximum incidence in age group in 30-39 years (Figure 1). The incidence of disease was high in both males and females of age 30-39 years (Figure 2).

Out of 50 patients, 15 patients were diagnosed pre-operatively as multinodular goiter, 16 patients presented

with solitary nodule thyroid, 14 patients were diagnosed as papillary carcinoma thyroid, and the remaining 5 patients with follicular neoplasm (Figure 3).

Out of 50 patients, 17 patients developed temporary hypocalcemia; none of them developed permopocalcemia. The mean age of patients developing hypocalcemia was 42.16 years. Average number of parathyroid glands identified was 3. Maximum incidence of developing hypocalcemia was when only one parathyroid gland was identified (Table 1 and Figure 4).

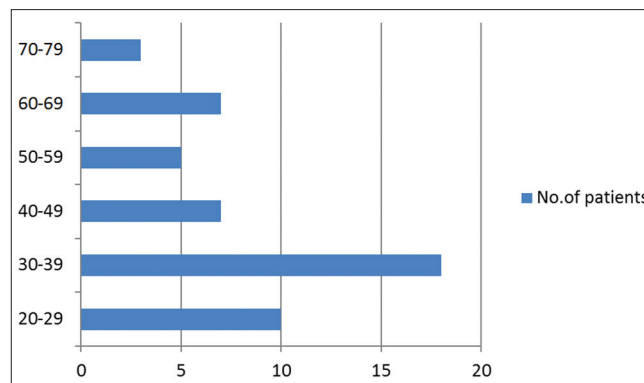


Figure 1: Distribution of age (years)

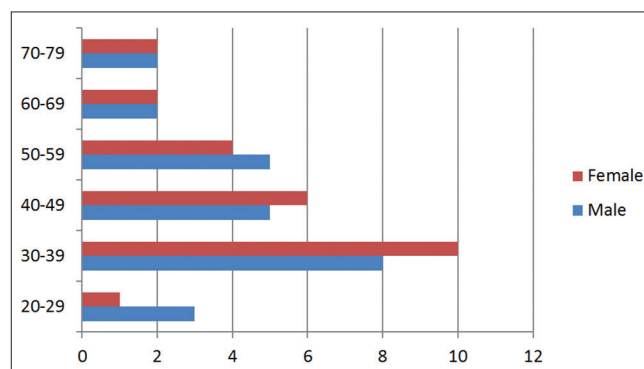


Figure 2: Distribution of sex in different age groups

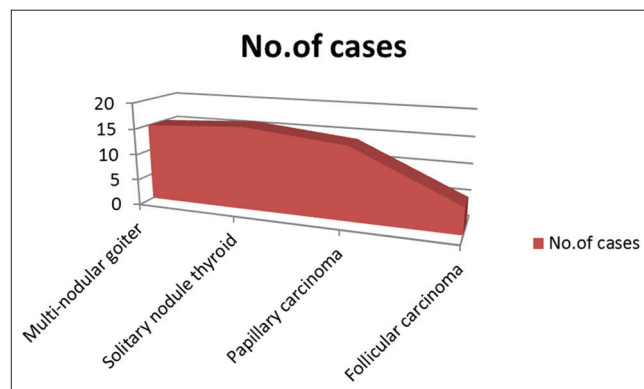
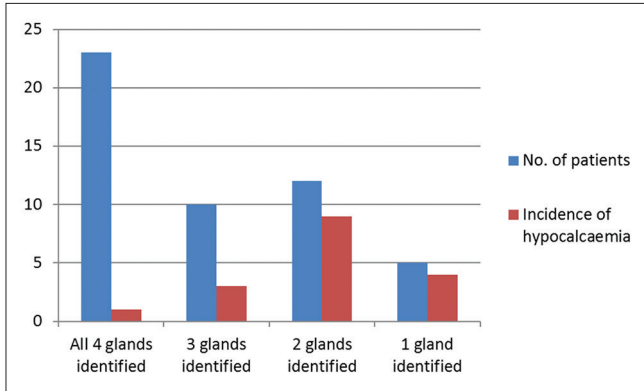


Figure 3: Distribution of patients on the basis of pre-operative clinical diagnosis

Table 1: Number of parathyroid glands identified and incidence of hypocalcemia

Number of glands	Number of patients	Incidence of hypocalcemia	Percentage of incidence
All 4 glands identified	23	1	4.3
3 glands identified	10	3	30
2 glands identified	12	9	75
1 gland identified	5	4	80

**Figure 4: Graph representing the incidence of hypocalcemia on the basis of number of glands identified**

DISCUSSION

Thyroid surgery is mainly followed by hypocalcemia. The incidence of hypocalcemia is high in the first post-operative day in this study. The common symptoms which patients complained are circumoral numbness and tingling sensation. In 5% of patients, carpopedal spasm was the main complaint. In contrast to our study, Sasson *et al.*¹⁰ and Lin *et al.*⁸ did not find any link between hypocalcemia and incidental parathyroid removal; Sippel *et al.*¹¹ stated that the incidental parathyroid removal group had significantly lower post-operative calcium levels, and this is in favor with our outcomes.

Post-operative hypocalcemia mainly results from injury, devascularization, and accidental removal of the parathyroids. Hypocalcemia can remain for longer periods in patients who encounters injury/amputation of parathyroid glands.³

In the present study, total thyroidectomy was found to be a threat for the accompanying parathyroid exclusion. Near-total thyroidectomy can also be a risk factor for hypocalcemia but lesser than total thyroidectomy. This finding is favored by many studies.^{3,6,12}

All the patients who developed hypocalcemia were due to temporary hypoparathyroidism, and succeeding follow-up exhibited normal serum calcium levels. The reason behind

this may be temporary spasm of the vessels supplying the parathyroid glands and hence the consequential tetany. To avoid hypoparathyroidism, it is important to preserve the parathyroid glands and their vascular supply during thyroid surgery.³

The normal location of parathyroid glands is extracapsular mainly on the posterior surface of the thyroid gland. Other variations in the location are extracapsular (58%), intracapsular (20%), and intrathyroidal (22%). The superior parathyroid glands are usually located at the superior pole of the posterior thyroid gland near the cricothyroid junction, while the inferior parathyroid glands are usually found in the lower pole of the thyroid gland.⁵

While identification of all four parathyroid glands is traditionally recommended to reduce post-operative hypoparathyroidism, there are recent studies suggesting that the identification of a greater number of identified parathyroid glands intraoperatively does not reduce the incidence of hypoparathyroidism. In contrast to these studies, we found that the incidence of hypocalcemia is directly proportional to decrease in the number of parathyroid glands identified.

CONCLUSION

The present study furnished the following suggestions:

- Thyroid surgery is the most common etiology of temporary hypocalcemia
- Post-operative hypocalcemia usually results from accidental removal of the parathyroid glands.

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