Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol. 4 No. 12 (2023): December 2023 Issue
https://doi.org/10.51168/sjhrafrica.v4i12.983
Original Article

THE PREVALENCE OF HYPOCALCAEMIA AMONG PATIENTS UNDERGOING THYROIDECTOMY AT A SOUTH INDIAN TERTIARY HOSPITAL: A PROSPECTIVE STUDY.

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Abstract

Background
After total thyroidectomy, calcium levels drop temporarily and permanently. Parathyroid glands adjacent to the thyroid glands are important for calcium metabolism. An accidental parathyroid gland injury damages calcium metabolism. Surgery-related hypocalcemia may be observed 24-48 hours later. This research also attempts to uncover the biochemical and clinical causes of hypocalcemia. This research evaluates neuromuscular stability using Chvostek and Trousseau signs.

Method
An observational study was conducted prospectively at JSS Hospital from Mysuru, Department of General Surgery. The patients undergoing total thyroidectomy were included in the study. the patients were thoroughly examined for their calcium levels after the surgery. Follow up were taken for 6 months if the calcium levels were less than 8 mg then it was classified as permanent hypocalcemia. The data for 100 patients was collected and then statistically analyzed for the occurrence of hypocalcemia.

Results
It was found that the operating time ($p = 0.03$), indication ($p = 0.001$), and level of thyroid hormone ($p = 0.03$) can be correlated with the occurrence of hypocalcemia. Other factors, such as gender and age of the patient, could not be correlated to the occurrence of hypocalcemia as the p-value was not statistically significant.

Conclusion
After total thyroidectomy, the operating time, indication, and level of thyroid hormone can be correlated with the occurrence of hypocalcemia. Checking the calcium levels after 6 hours and 24 hours of the surgery and regular follow-up can prevent the worsening of hypocalcemia.

Recommendations
This research highlights the importance of monitoring calcium levels following total thyroidectomy and identifies key factors, including operating time, indication, and thyroid hormone levels, that can contribute to hypocalcemia. To mitigate the risk of hypocalcemia, it is recommended to check calcium levels at specific post-operative intervals and establish a regular follow-up protocol for patients undergoing total thyroidectomy.

Keywords: *Hypocalcemia, Total Thyroidectomy, Goitre*
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Introduction
Hypocalcemia is a prevalent disease that is often identified after surgical removal of the parathyroid gland. The parathyroid gland and the thyroid gland, situated in close proximity, both have significant functions in calcium metabolism. Unintentional injuries to the parathyroid gland may adversely affect the mechanisms involved in calcium metabolism. Hypocalcemia may be detected within a timeframe of 24 to 48 hours after surgery [1]. Hypocalcemia is caused by injury to the parathyroid gland, as well as increased urinary excretion of calcium and increased calcium absorption by the bones [2].

Post-total thyroidectomy, there are two distinct forms of hypocalcemia: transient hypocalcemia and persistent hypocalcemia. The temporary hypocalcemia will spontaneously resolve within a timeframe of six months to

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one year. Conversely, if the blood calcium levels do not improve even after a year, then the disease is considered to be chronic hypocalcemia. Hypocalcemia may be accompanied by several symptoms such as paresthesia, neuromuscular instability, tetanus, and seizures [3]. Asymptomatic presentation is also possible in cases of hypocalcemia.

Past studies suggest a lower incidence of permanent hypocalcemia compared to a greater incidence of transitory hypocalcemia among patients [4, 5]. Total thyroidectomy, the removal of the thyroid gland, is often associated with significant complications like vocal cord injury and hematoma which can increase the mortality rate. Hypocalcemia is also one of the complications of total thyroidectomy, but it does not lead to mortality. Total thyroidectomy is not associated with any mortality rates. Factors such as the reoccurrence of goitre, the existence of a large goitre, and the presence of advanced malignancy all increase the chance of developing hypocalcemia [6].

This study aims to identify the specific biochemical and clinical factors that contribute to the occurrence of hypocalcemia. The study used Chvostek's sign and Trousseau's sign, two well recognised indicators of hypocalcemia, to assess the neuromuscular stability of the clinical participants. The objective of this study is to examine the potential occurrence of hypocalcemia after a total thyroidectomy.

Methods

Study design

A prospective observational study

Study setting

The study was conducted at JSS Hospital, Mysuru, Department of General Surgery, in October 2017 to April 2019.

Study size

The study size was determined by applying strict inclusion and exclusion criteria. Inclusion criteria comprised patients undergoing thyroid gland removal at the General Surgery Department of JSS Hospital in Mysuru, India. However, patients with a history of prior endocrine surgeries or pre-existing electrolyte imbalances, particularly abnormal calcium levels, were excluded from the study to ensure a homogenous study population. Additionally, data from patients who experienced loss to follow-up were omitted from the final analysis, ensuring the integrity of the dataset and the reliability of the study's conclusions. These rigorous criteria were essential in refining and finalizing the study size, allowing for a more focused and meaningful investigation of post-thyroidectomy hypocalcemia.

Participants

A total of 100 individuals were included in the study.

Bias

There was a chance that bias would arise when the study first started, but it was avoided by giving all participants the identical information and hiding the group allocation from the nurses who collected the data.

Data Collection and Analysis

The triiodothyroxine, tetraiodothyronine, and thyroid-stimulating hormone levels were assessed in each patient. The calcium levels were assessed in the intravenous blood. Patients who had a calcium level between 8mg and 11 mg were included in the study. After the total thyroidectomy, the calcium levels were assessed after an hour, after 24 hours, after a month, and in a similar manner, patients followed up for 6 months. Details of total thyroidectomy, such as the position of the thyroid artery, the parathyroid gland damage, and duration for which surgery was carried out were noted. Biochemical analysis was performed for the function of the thyroid gland, and calcium replacement therapy was given in the form of oral calcium tablets or intravenous infusions of calcium gluconate to patients who had permanent hypocalcemia.

Statistical analysis

The data obtained from the study was arranged in a tabulated manner in an Excel sheet, and the data was then subjected to statistical analysis. Statistical analysis is accomplished using an appropriate software program (e.g., SPSS). A $p< 0.05$ change is considered to be statistically significant.

Ethical consideration

The institutional ethics committee approved the study and the patients who consented to the study were included. Written informed consent was received from all the participants.

Results

There were 100 patients included in the study who underwent total thyroidectomy; the age range of these patients was 20–78 years. 90 patients were female, and 10 patients were male. 41 of the 100 underwent thyroid removal surgery due to multinodular goiter, 27 had a thyroiditis gland, 22 patients had cancer in the thyroid gland, 7 patients had Grave's disease, and 2 had a toxic nodular goitre.

80% of the patients had normal thyroid levels, 10% had lower than normal, and 10% had higher than normal. After the surgery, calcium levels were assessed, and it was found that among 100 people, 20 had hypocalcemia; 15 of them demonstrated symptoms of hypocalcemia, whereas the other 5 did not show any symptoms. However, 19 of them had transient hypocalcemia, and only one of them had permanent hypocalcemia.

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Among the 20 patients who had hypocalcemia, 17 were females and 3 were males. Nine of them had thyroiditis, four of them had Grave's disease, and six of them had follicular carcinoma. 14 patients had a normal thyroid level, 5 had a higher level than normal, and 1 patient had a lower level than normal. Table 1 shows the correlation of various thyroid parameters with the occurrence of hypocalcemia.

Table no. 1: correlation of various thyroid parameters with the occurrence of hypocalcemia

Parameters	Temporary Hypocalcemia	Permanent hypocalcemia	No hypocalcemia	p-value
Indication				
Thyroiditis	08	01	18	0.001
Grave's disease	04	00	18	
Multinodular goiter	01	00	41	
Malignancy of thyroid gland	06	00	1	
Toxic nodular goitre	00	00	2	
Level of thyroid gland				
Normal level of thyroid	13	01	64	0.03
Higher than normal	05	00	04	
Lower than normal	01	00	09	
Duration of surgery				
Less than 2 hours	08	00	50	0.03
More than 2 hours	11	01	30	

A patient who had permanent hypocalcemia underwent surgery for more than 2 hours, had normal thyroid levels, and had thyroiditis. It was found that the operating time, indication, and level of thyroid hormone can be correlated with the occurrence of hypocalcemia. When the indications due to which total thyroidectomy was carried out were correlated with the occurrence of hypocalcemia, it was found that the p-value was 0.001. Similarly, while comparing the duration of the surgery and occurrence of hypocalcemia the p-value was 0.03. The level of thyroid hormones was compared statistically with the occurrence of hypocalcemia, the p-value was 0.03. The p-value of the aforementioned three factors was less than 0.05 which demonstrated that the correlation was statistically significant. Other factors such as gender and age of the patient could not be correlated to the occurrence of hypocalcemia as the p-value was not statistically significant.

Discussion

In this particular investigation, it was found that twenty percent of the patients were suffering from hypocalcemia. There were 19 cases of hypocalcemia that were just transient, and one case of hypocalcemia that was permanent. One study demonstrated that the proportion of permanent hypocalcemia ranges between 1 and 5 per cent [7], however, the values differ in the investigations that were carried out by various researchers [7, 8].

It was discovered that the majority of individuals who had malignancy turned out to acquire hypocalcemia when the indications were matched with the frequency of hypocalcemia. Grave's disease and thyroiditis were the subsequent indications. Only the presence of hypocalcemia was shown to be connected with Grave's disease, according to the findings of research [9]. According to the findings of the research, the presence of hypocalcemia was discovered to be associated with three different diseases: follicular carcinoma, thyroiditis, and grave disease.

Hypocalcemia was shown to be more likely to develop in individuals who had higher than normal levels of thyroid hormone. This was discovered by a comparison between the amount of thyroid hormone and the incidence of hypocalcemia. The results of the other research [10,11] were comparable with this phenomenon as well.

According to the findings of the association between the length of time spent undergoing surgery and the occurrence of hypocalcemia, the likelihood of hypocalcemia occurring rose in proportion to the length of time required for the surgery [12]. It was not possible to establish a statistically significant association between the demographic data and the prevalence of hypocalcemia. There was also no significant correlation between the identification of the parathyroid gland during the surgical procedure and the incidence of hypocalcemia.

Generalizability

The study found a 20% prevalence of hypocalcemia, with most cases being transient. Permanent hypocalcemia fell within the previously reported 1-5% range. Specific associations were observed with Graves' disease, thyroiditis, and follicular carcinoma. Higher thyroid hormone levels correlated with increased hypocalcemia risk. Longer surgeries were linked to higher hypocalcemia risk, but no

significant demographic or parathyroid gland identification associations were found, indicating complex determinants of hypocalcemia. These findings provide insights into hypocalcemia's generalizability across patient populations and surgical contexts.

Conclusion

Certain indications such as thyroiditis gland, grave's disease and follicular carcinoma are associated with the occurrence of hypocalcemia after total thyroidectomy. Similarly, a longer duration of surgery and higher than normal levels of thyroid hormone are associated with the occurrence of hypocalcemia. Hence necessary preventive measures should be taken to avoid the occurrence.

Limitations

The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendations

This research highlights the importance of monitoring calcium levels following total thyroidectomy and identifies key factors, including operating time, indication, and thyroid hormone levels, that can contribute to hypocalcemia. To mitigate the risk of hypocalcemia, it is recommended to check calcium levels at specific post-operative intervals and establish a regular follow-up protocol for patients undergoing total thyroidectomy.

Acknowledgement

We are thankful to the patients; without them the study could not have been done. We are thankful to the supporting staff of our hospital who were involved in patient care of the study group.

Source of funding

No funding received.

Conflict of interest

The authors have no competing interests to declare.

References

1. Smith P, Salomone L, Hanks JB. Sabiston Text Book of Surgery Volume 1. 19th edition. Townsend C, editor. Philadelphia: Saunders Elsevier. 2012;38:886-921.
2. Pfleiderer AG, Ahmad N, Drapers MR, Vrotsou K, Smith WK. The timing of calcium measurements in helping to predict temporary and permanent hypocalcaemia in patients having completion and total thyroidectomies. Ann R Coll Surg Engl. 2009;91:140-6.
3. Nair CG, Babu MJC, Menon R, Jacob P. Hypocalcaemia following total thyroidectomy: An analysis of 806 patients. Indian J Endocrinol Metab. 2013;17:298-303.
4. Walsh SR, Kumar B, Coveney EC. Serum calcium slope predicts hypocalcaemia following thyroid surgery. Int J Surg. 2007;5:41-4.
5. Sturniolo G, Lo Schiavo MG, Tonante A, D'Alia C, Bonanno L. Hypocalcemia and hypoparathyroidism after total thyroidectomy: a clinical biological study and surgical considerations. Int J Surg Investig. 2000;2:99-105.
6. Jacobs JK, Aland JW, Ballinger JF. Total thyroidectomy. A review of 213 patients. Ann Surg. 1983;197:542-9.
7. Lo CY, Lam KY, Weber CJ, Shaha AR, Davis O. Postoperative hypocalcemia in patients who did or did not undergo parathyroid autotransplantation during thyroidectomy: A comparative study. Surgery. 1998;124:1081-7.
8. Pattou F, Combemale F, Fabre S, Carnaille B, Decoulx M, Wemeau JL, et al. Hypocalcemia following thyroid surgery: Incidence and prediction of outcome. World J Surg. 1998;718-24.
9. Stathatos N. Thyroid Physiology. Med Clin North Am. 2012;165-73.
10. Husein M, Hier MP, Al-Abdulhadi K, Black M. Predicting calcium status post thyroidectomy with early calcium levels. Otolaryngol - Head Neck Surg. 2002;127:289-93.
11. Pisanu A, Cois A, Piu S, Altana ML, Uccheddu A. Factors predicting outcome of hypocalcaemia following total thyroidectomy. Chir Ital. 2003;55:35-40.
12. Ahmed MAS, Martinez A, Mariam S, Whitehouse W. Chvostek's sign and hypocalcaemia in children with seizures. Seizure. 2004;13:217-22.

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Original Article

Publisher details:

Publishing Journal: Student's Journal of Health Research Africa.
Email: studentsjournal2020@gmail.com or admin@sjhresearchafrica.org

(ISSN: 2709-9997)

Publisher: SJC Publishers Company Limited
Category: Non-Government & Non-profit Organisation
Contact: +256775434261(WhatsApp)
Email: admin@sjpublisher.org
Website: https://sjpublisher.org
Location: Wisdom Centre Annex, P.O. BOX. 701432 Entebbe, Uganda, East Africa.