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Original Research Article

Audit of hypocalcemia as a clinical marker following total thyroidectomy: a retrospective chart review

Sanjeev Mohanty*, Deepthi Padmanabhan

Institute of ENT, Head and Neck Surgery, MGM Health Care, Chennai, Tamil Nadu, India

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***Correspondence:**
Dr. Sanjeev Mohanty,
E-mail: drsanjeevmohanty@gmail.com

ABSTRACT

Background: Surgical removal is one of the most important treatment options for the thyroid swellings. Metabolic derangement due to injury to parathyroid glands is one of the complication to be dealt with frequently. The aim of this study is to assess the incidence of postoperative hypocalcemia after total thyroidectomy and to analyze various pre-operative risk factors that lead to the same.
Methods: A retrospective study was conducted on patients who underwent total thyroidectomy at department of ENT and head and neck surgery over a period of 2 years. The level of post-operative serum calcium was analyzed, to determine the incidence of hypocalcemia. In all the patients the following parameters were assessed – age, gender, pre and post-operative serum calcium and type of thyroid disease. Unpaired t test and Mann-Whitney U test was used for statistical analysis.
Results: The total study population was 65. The mean age of the patients was 45.5 and 83% of the patients were female. The incidence of postoperative hypocalcemia was noted to be 37%. Pre-operative serum calcium ($p<0.0001$) was found to be significant risk factor ($p<0.05$) for prediction of post-operative hypocalcaemia. The same was not noted between variables like age, gender and type of thyroid disease and incidence of hypocalcemia.
Conclusions: A thorough knowledge of normal anatomy of neck, possible anatomical variations and parathyroid physiology is of paramount importance to prevent complications during thyroid surgery. Early identification of hypocalcemia can be achieved only by stringent postoperative monitoring, which in turn will reduce morbidity to the patient.

Keywords: Hypocalcemia, Thyroidectomy, Serum calcium

INTRODUCTION

Diseases of the thyroid gland are common in general population. Surgical removal is one of the most important treatment options for the thyroid swellings. Surgeries are done for both benign and malignant thyroid disorders. One of the complications which need to be addressed in thyroid surgeries is metabolic derangement related to the injury of the parathyroid gland, which can happen either due to thermal trauma, gland devascularisation or inadvertant removal of one or more parathyroid gland.

Larger thyroid gland, type of thyroid disorder, experience of operating surgeon, extent of dissection involved in surgery, surgical technique followed and also biochemical blood parameters, like serum calcium and serum parathyroid hormone levels before and after surgery are the various risk factors described.[1] According to the American Thyroid Association (ATA) guidelines, temporary hypocalcemia is defined as low calcium 6 months or less following surgery, with permanence defined beyond that threshold.[2] The incidence of post-operative hypocalcemia vary across multiple studies, with temporary hypocalcemia ranging from 7.6-35% and permanent hypocalcemia 1-3%.[3,4]

Adequate pre-operative planning and evaluation like pre op thyroid function test and serum calcium help plan the

post-operative period better. Postoperative management ranges from oral calcium supplements to intravenous calcium administration based on the serum calcium levels.

Aim

This study aims to focus on the risk factors and incidence of post-operative hypocalcemia after total thyroidectomy.

Objectives

Objectives of the study were: to assess the incidence of postoperative hypocalcemia after total thyroidectomy, to analyze various pre-operative risk factors that lead to the same, and to factor the incidence of temporary and permanent hypocalcemia.

METHODS

Study design

This is a retrospective study done to analyze the incidence of post-operative hypocalcemia in the patients who have undergone total thyroidectomy. The data was obtained from the patient medical records.

Study period

The study period was from May 2022 to April 2024 (2 years).

Inclusion criteria

Patients who underwent total thyroidectomy with or without neck dissection, and who underwent revision or completion thyroid surgery were included.

Exclusion criteria

Patients with previous history of irradiation to neck, and patients who underwent hemi thyroidectomy were excluded.

Post-operative serum calcium level was checked for all patients on the morning of the first post-operative day. Hypocalcemia was defined as serum calcium level below 8.4 mg/dl.[2] This is as per the definition of hypocalcemia by American Thyroid Association surgical affairs committee statement, which defines hypocalcemia as total serum calcium level less than the lower limit of the center specific reference. Bedside assessment of patients was done twice daily, to look for clinical symptoms and signs of hypocalcemia like peri oral paresthesia, tingling and numbness of fingers, Chvostek's and Trousseau's sign.

In all the patients the following parameters were assessed – age, gender, pre and post-operative serum calcium and type of thyroid disease.

Statistical analysis

Statistical package for the social sciences (SPSS) software was used for the statistical analysis. To determine the association between categorical variables Chi-square test was used. To determine the association between age and hypocalcemia, unpaired t-test was used. To determine association between pre-operative calcium levels and hypocalcemia Mann-Witney U test was used. Descriptive statistics calculated for background variables. Statistical significance was defined as a p value of <0.05.

RESULTS

In our study, the total study population was 65. Among them, the mean age of the patients was 45.5. Maximum number of patients belonged to the age group of 18-45 years (Figure 1). 83% of the patients were female, which further highlights the higher incidence of thyroid disease in women (Figure 2).

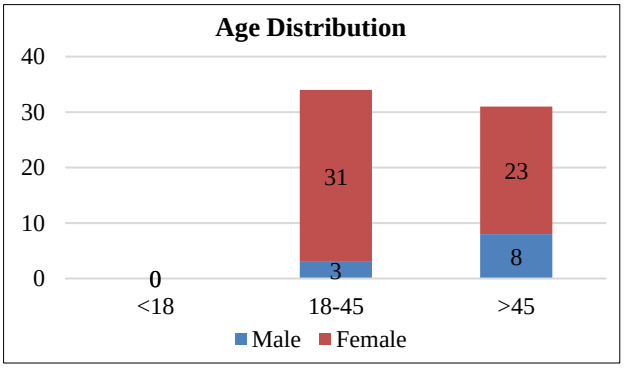

Figure 1: Age distribution.

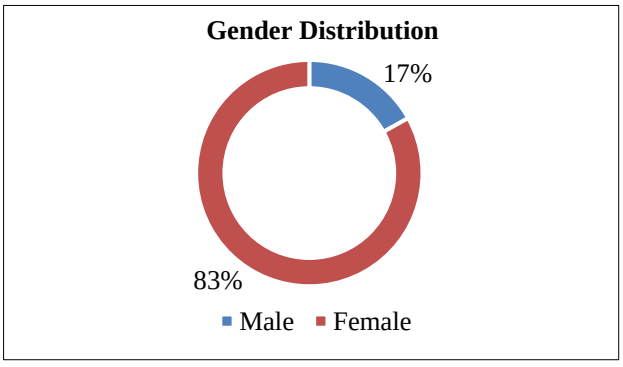

Figure 2: Gender distribution.

Postoperative hypocalcemia with serum calcium level less than 8.4 mg/dl was noted in 24 patients which constitutes 37% of patients. Of them, 2 patients had serum calcium <7 mg/dl. Of the 24 patients, only 8 had clinical signs and symptoms of hypocalcemia (Figure 3).

All patients were followed up after 1 month, 3 months and 6 months with serum calcium. On 6 months follow up, none of the patients had permanent hypocalcemia. In our

study, all the patients had temporary hypocalcemia (Figure 4).

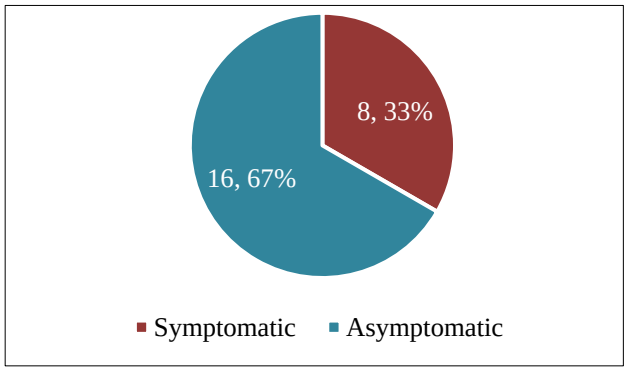

Figure 3: Symptomatology percentage.

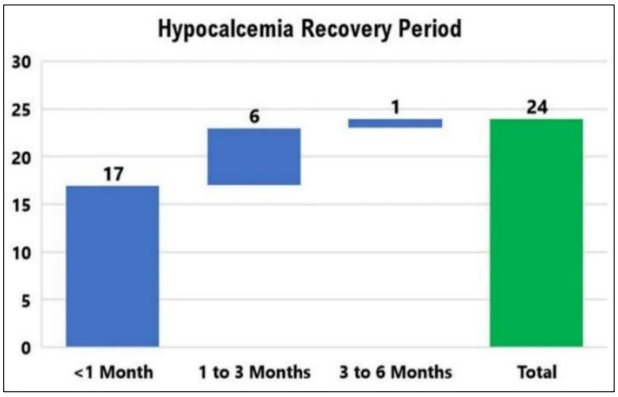

Figure 4: Post op recovery on follow up.

Of the 65 patients, on histopathological examination, 31 (47.6%) patients had a malignant thyroid pathology and the rest were benign.

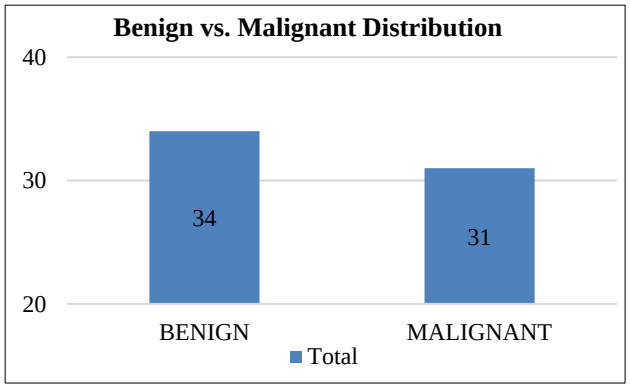

Figure 5: HPE distribution.

Statistical analysis was conducted to assess the risk factors that lead to development of Post-operative hypocalcemia. Variables like age, gender and type of thyroid disease were not statistically significant factors. Pre-operative serum calcium ($p<0.0001$) was found to be significant risk factor ($p<0.05$) for prediction of post-operative hypocalcaemia.

Table 1: Statistical analysis summary and results.

Characte-ristics	Post thyroidectomy		P value
	Without hypocal-cemia	With temporary hypocalcemia	
Age			
Mean	43.7	48.6	0.118
Std. deviation	13.7	8.2	
Gender: male			
Count	5	6	0.184
%	12.2	25.0	
Gender: female			
Count	36	18	
%	87.8	75.0	
Pre-op S. Ca			
Mean	9.01	8.74	<0.0001
Std. deviation	0.23	0.36	
HPE - benign			
Count	23	11	0.424
%	56.1	46.0	
HPE - malignant			
Count	18	13	
%	43.9	54.0	

DISCUSSION

Iatrogenic hypoparathyroidism with subsequent hypocalcaemia can be a debilitating consequence of thyroidectomy which affects the quality of life, prolongs hospital stay and often requires substantial medical management. There is varied incidence of hypocalcaemia across literatures, the incidence of transient hypoparathyroidism and permanent hypoparathyroidism ranges from 0.3% to 49% and 0% to 13%, respectively according to a study by Lee et al.[5,6] Certain studies state transient hypocalcaemia incidence ranging from 6.9% to 49%, and permanent hypocalcaemia incidence between 0.4% to 33% following total thyroidectomy.[7] In our study, the Incidence of temporary hypocalcaemia was 37% and there was no incidence of permanent hypocalcaemia, which is in accordance with existing literature.

The primary cause of hypocalcaemia is secondary hypoparathyroidism following damage to, or devascularisation of, one or more parathyroid glands during surgery. Impaired PTH secretion results in postoperative hypocalcemia by inhibiting bone resoption, reduction of 1,25–dihydroxy Vitamin D synthesis by kidneys and reduced intestinal absorption of calcium. The short half-life of parathyroid hormone (3 to 5 mins), along with the fragile nature of the parathyroid glands, sets the stage for their functional derangement following manipulation. Erroneous parathyroid removal may also be responsible.[8] Surgery involving neck dissection in case of thyroid malignancies, reoperation for other benign thyroid disorders increases the risk of parathyroid injury.[9,10] In our series four patients underwent completion thyroidectomy.

In contrast to other studies, none of the completion thyroidectomy cases in our series developed post-operative hypocalcaemia.

Patients with low serum calcium levels before surgery are more likely to develop temporary post-thyroidectomy hypocalcemia.[6] In addition, low calcium levels within the first 24 hours after surgery, is a predictive factor for developing permanent hypocalcemia.[8,11] The standard of care at our institution is, to monitor serum calcium level for all patients on the first morning of the post-operative day. Symptoms associated with post-operative hypocalcaemia can be paraesthesias of the perioral region and extremities, muscle stiffness, cramps and spasms. But patients with chronic hypocalcaemia can be less symptomatic or even asymptomatic, thus emphasizing on the importance of serial serum calcium level monitoring in the post-operative period.

Patients with serum calcium <8.4 mg/dl were started on calcium supplementation as well as activated vitamin D supplementation. Two patients in our series with progressive symptoms and serum calcium <7.0 mg/dl were treated with IV calcium gluconate with cardiac monitoring.

Age related correlation in certain studies have found that incidence of hypocalcemia is increased in older age patients more than 50 years owing to reduced vitamin D which further reduces intestinal absorption of calcium.[12,13] Whereas in our series, we dint not find a significant correlation between age of the patient and development of hypocalcemia in the post-operative period.

Several studies investigated the factors associated with complications following thyroid surgery including age, increased gland size, sex, presence of fibrosis and inflammation, extent of thyroidectomy, and lymph node dissection.[14] In addition, extensive surgery, redo surgeries, and a surgeon's experience contribute to post-thyroidectomy hypocalcemia.[15] Total thyroidectomy proved to be a significant risk factor for hypocalcemia in our series.

Limitations

Limitation of our study include examination of parathyroid gland in the histopathology specimen to look for inadvertent removal of the gland. This parameter needs to be evaluated in future studies.

CONCLUSION

Competence in thyroid surgery requires a thorough knowledge of normal anatomy of neck and possible anatomical variations that one might encounter, along with mastering of basic surgical techniques. Nonetheless, in spite of skill and experience, complications may occur, either due to extent of patient disease or as a result of surgical error. Early identification of hypocalcemia can be achieved only by stringent postoperative monitoring, which in turn will help to start on adequate supplementation with calcium and vitamin D reduce the morbidity in patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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