Original Research Article

Prospective study of postoperative hypocalcemia after total thyroidectomy

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Abstract

Background: Postoperative hypocalcemia is a common complication following total thyroidectomy. Various risk factors lead to damage of parathyroid gland or its blood supply or accidental removal of gland. Early identification and supplementation with calcium and Vitamin D reduces the severity of symptoms and morbidity to the patients. **Aim:** The study aims to identify the incidence of hypocalcemia in patients undergoing total thyroidectomy. **Materials and Methods:** Prospective analysis was made in 50 patients undergoing total thyroidectomy for benign thyroid disorders, to identify the incidence of hypocalcemia by measuring Serum calcium levels postoperatively at 24 hours, on day 3, day 14 and after 6 months. **Results:** Incidence of 22% of hypocalcemia, with transient hypocalcemia in 20% and permanent hypocalcemia in 2% of cases were noted. **Conclusion:** Meticulous surgical technique to preserve parathyroid gland, early identification of hypocalcemia, with adequate supplementation with calcium and vitamin D reduces the morbidity in patients undergoing total thyroidectomy.

Keywords- Hypocalcemia, Hypoparathyroidism, Total Thyroidectomy

Introduction

Total thyroidectomy constitutes the treatment modality for thyroid disorders like multinodular goitre and also for Thyroid malignancies. One of the common early complication expected following total thyroidectomy is hypocalcemia [1,2]. Accidental removal of parathyroid gland or damage to its blood supply during surgery is an important cause for hypocalcemia following total thyroidectomy. 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 [3,4,5].

Hypocalcemia presents with symptoms such as Paraesthesia at mouth and extremities, muscle spasms, Chvostek's and Trousseau's sign. Patients can have Seizures, Laryngeal stridor, Bronchospasm in acute severe condition. Cardiac arrhythmias, refractory congestive heart failure, cataract and xeroderma are the other manifestations described. Postoperative hypocalcemia requires administration of calcium and vitamin D supplementation along with monitoring of blood calcium levels [6,7]. This study aims at identification of incidence of hypocalcemia in patients undergoing total thyroidectomy based on serum calcium levels.

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Material and Methods

Study Design– This was a prospective study done to identify incidence of hypocalcemia in patients who underwent total thyroidectomy at Raja Rajeswari Medical College and Hospital, Bangalore, from August 2016 to August 2018 after obtaining the institutional ethical committee clearance and informed written consent from patients.

Study Sample -With 95% confidence level and margin of error of ±15%, a sample size of 43 subjects will allow the study to determine the incidence of postoperative hypocalcemia after total thyroidectomy Adjusting for 15% drop out rate, recruitment target will be set at 50 subjects by using the formula:

$$n = \frac{z^2 p(1-p)}{d^2}$$

where
Z= z statistic at 5% level of significance
d is margin of error
p is anticipated prevalence rate (50%)

Inclusion Criteria: Patients who underwent total thyroidectomy without neck dissection.

Exclusion criteria: Patients with previous history of thyroid surgery, abnormal serum albumin and serum calcium level preoperatively, patients on preoperative calcium replacement therapy.

Data Collection: In all the Prospective cases, preoperative calcium level and post operative calcium level after 24 hours of surgery, on postoperative day 3, day 14 and after 6 months of surgery were assessed. Intraoperatively, all efforts were made to recognize and preserve at least two parathyroid glands with intact blood supply.Postoperatively, presence of hypocalcemic symptoms like tingling and numbness of fingers, perioral region, muscles spasms, paraesthesia, Chvostek's and Trousseau's sign were noted if present. Histopathology reports were followed up for presence of one or more parathyroid glands in surgical specimen. Patients were discharged on post operative day 3 after drain removal. Patients diagnosed to have hypocalcemia post operatively were treated with IV calcium gluconate, 10ml of 10% calcium gluconate in 50ml of 5% dextrose or normal saline over 15minutes in case of severe symptoms with Single dose of Injection Vitamin D3 600000 IU IM and in case of continuing hypocalcemic symptoms in these patients, infusion of 1000ml of normal saline or 5% Dextrose containing 11g calcium gluconate at 50ml/hour was given along with serum calcium monitoring. Oral calcium 500mg twice daily and vitamin D supplements (1mcg calcitriol OD) was administered to those who had mild symptoms and in postoperative asymptomatic patients with biochemically lowered serum calcium levels <8mg/dl.

Blood calcium levels were monitored and patients were discharged once blood calcium levels are normalised. Patients requiring supplementation more than 6 months were considered to have permanent hypocalcemia.

Statistical Methods- All characteristics were summarized descriptively. For continuous variables, the summary statistics of mean ± standard deviation (SD) were used. For categorical data, the number and percentage were used in the data summaries. Data were analyzed using SPSS software v.23.0 and Microsoft office 2007.

Results

In the prospective study done, mean age of the patients was 41.4 years with standard deviation of 9.1. Maximum number of patients belonged to age group between 41-50 years, which constituted 34% of patients (Table 1).

Table-1: Distribution of cases according to age.

Age (yrs)	N	%
21-30	8	16
31-40	15	30
41-50	17	34
51-60	10	20

Age	Range	Mean	SD
	25-57	41.4	9.1

92% of patients were females and 8% of patients were male, which further substantiates the increased incidence of thyroid disorders in females (Table 2)

Table-2: Distribution of cases according to sex.

Sex	N	%
Male	4	8.0
Female	46	92.0
Total	**50**	**100.0**

Postoperative hypocalcemia with serum calcium level less than 8mg/dl was noted in 11 patients which constitutes 22% of cases. Of the 11 patients, 10 patients (20%) had transient hypocalcemia, and 1 patient (2%) who had huge toxic multinodular goiter developed permanent hypocalcemia after total thyroidectomy. Of the 10 patients who had transient hypocalcemia, 3 patients developed symptoms with in 24hrs and were treated with IV calcium gluconate, followed by oral supplements. Serum calcium level returned to normal by 3rd postoperative day. 8 patients developed hypocalcemia by day 3 of surgery, of whom 5 were symptomatic and 3 were asymptomatic. Oral calcium and vitamin D supplements were given to these patients for a period of 2 weeks and by day 14 serum calcium level were normalized in 7 patients. 1 among these symptomatic patients continued to have low serum calcium level on day 14 and also at 6 months and hence considered to have permanent hypocalcemia (Table 3).

Table-3: Distribution of cases according to post operative hypocalcemia.

Hypocalcemia	N (11)	%
Postop day 1	3	6.0
Day 3	8	16.0
Day 14	1	2.0
After 6 months	1	2.0

Histopathology reports were followed up and no parathyroid gland in the specimen were reported.

Of the 50 cases, in the final diagnosis, 42% were noted to have colloid goiter, 22% had toxic multinodular goiter who were operated after bringing to Euthyroid state, 18% had Hashimoto's thyroiditis, 14% had thyroid adenoma and 4% had Lymphocytic thyroiditis. (Table 4)

Table-4: Distribution of cases according to final diagnosis.

Diagnosis	N	%
Colloid Goitre	21	42.0
Toxic MNG	11	22.0
Hashimoto's thyroiditis	9	18.0
Thyroid Adenoma	7	14.0
Lymphocytic thyroiditis	2	4.0
Total	**50**	**100.0**

Table-5: Distribution of cases according to age correlation to hypocalcemia

Age correlation to hypocalcemia	N	%
> 30 years	2	4.0
>40 years	3	6.0
>50 years	6	12.0
Total	**11**	**22%**

Discussions

Hypoparathyroidism is one of the frequently encountered early complications following total thyroidectomy. Depending on the extent of dissection involved during total thyroidectomy and the surgical technique followed, there are chances that may lead to incidental parathyroidectomy, or injury to parathyroid gland and also can affect the blood supply to parathyroid glands leading to its edema, ischemia or infarction. Secondary to reduction in parathyroid hormone secretion, mobilization of calcium from bones is impaired, resorption of calcium from distal nephron is reduced and stimulation of renal 1-alpha hydroxylase activity is affected, thus causing hypocalcemia. There is a varied incidence of hypocalcemia, with transcient hypocalcemia incidence ranging from 6.9% to 49%, and permanent hypocalcemia incidence between 0.4% to 33% following total thyroidectomy [8,9,10]. Surgery involving neck dissection in case of thyroid malignancies, reoperation for other benign thyroid disorders increases the risk of parathyroid injury

[11,12]. Preserving at least 1 or 2 parathyroid gland with its intact blood supply has shown to reduce risk of hypocalcemia post surgery [13]. In our study as total thyroidectomy for bening thyroid disorders was done with ensuring to identify and preserve at least 2 parathyroid gland and no incidental parathyroidectomy specimen was found in histopathology reports, the incidence of hypoparathyroidism is 22% with 20% of transcient hypocalcemia and 2% of patients having permanent hypocalcemia. Age related correlation in studies by Erbil Y et al, Salvatore Tolone et al 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 [14,15].

In our study 12% of patients above 50 years, 6% above 40 years and 4% above 30 years have developed postoperative hypocalcemia (Table 5) Grave's disease, presence of hyperthyroidism are other risk factors for the development of postoperative hypocalcaemia where in there can be increased bone turnover and increased vascularity of thyroid gland leading to difficult dissection [16,17]. In our study 1 patient who had huge toxic multinodular goitre developed permanent hypocalcemia following surgery.

Symptoms of hypocalcemia manifests in the early post operative days and need to be treated with IV calcium gluconate in case of severe symptoms followed by oral Supplementation with addition of Vitamin D as it increases the intestinal absorption of calcium. Patients suspected to be going for permanent hypocalcemia need serial serum calcium level monitoring once a month for at least 6 months and twice annually once confirmed. Some studies also advocate prophylactic administration of calcium and vitamin D supplements in all patients undergoing total thyroidectomy. Though its effective in patients who had preoperative low calcium levels, considering the varied incidence of hypocalcemia, routine usage especially in surgery for benign thyroid disorders is still controversial.

Author contribution: Author 1 & 2 - Study conception and design, acquisition of data, analysis an interpretation of data, drafting of manuscript, critical revision. Author 3 & 4 - analysis and interpretation of data, drafting of manuscript, critical revision.

Conclusion

Post operative hypocalcemia remains a frequent complication which can be avoided by identification of risk factors, by following proper meticulous surgical technique. Serum calcium levels aids in early management with calcium and vitamin supplements reducing the morbidity involving total thyroidectomy.

What does this study add to existing knowledge?

The study describes the similar incidence of hypocalcemia after total thyroidectomy even when only benign thyroid disorders are taken into account.

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