Original Research Article

Incidence of hypocalcaemia among post-thyroidectomy patients at a tertiary care hospital at Trivandrum, Kerala, South India

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ABSTRACT

Background: Hypocalcemia is one of the most common complications of thyroid surgery. It is usually temporary, but it may rarely take several months to resolve. The aim of this study was to determine the incidence of hypocalcaemia after total thyroidectomy and assess the biochemical factors that may be predictive of hypocalcaemia.

Methods: An observational study was conducted in 98 patients at the general surgery department of a tertiary care medical college hospital for a period of one year. Convenient method of sampling was done. All the patients undergoing total thyroidectomy were included in this study. The serum calcium level was evaluated at different times in the postoperative period as a part of the routine post-operative care at the hospital. During the postoperative period patients were carefully watched for clinical symptoms and signs of hypocalcaemia.

Results: In the study group, 19 (19.4%) had hypocalcemia. In the study group, 14 (14.3%) had symptomatic hypocalcemia and 5 patients (5.1%) had asymptomatic hypocalcemia. 18 patients (18.4%) had temporary hypocalcemia and 1 patient (1%) had permanent hypocalcemia. Among the patients with hypocalcemia, 18 (95%) were females and 1 (5%) patient was male. 13 (68%) patients were euthyroid, 5 (26%) patients were hyperthyroid and 1 (5%) patient was hypothyroid. Significant association was seen between diagnosis of thyroid disorders and hypocalcaemia, thyroid function and hypocalcaemia and between operating time and hypocalcaemia.

Conclusions: Incidence of hypocalcemia in patients who had undergone total thyroidectomy was found to be less. Majority of them had temporary hypocalcemia and permanent hypocalcemia was seen only in one patient.

Keywords: Hypocalcemia, Post-thyroidectomy, Thyroid surgery

INTRODUCTION

Thyroidectomy is one of the most commonly done surgical procedures all over the world. It is a very safe operation and mortality is nearly zero other than those associated with complications of general anaesthesia.1,2 The complications of thyroidectomy such as injury to recurrent laryngeal nerve and/or the superior laryngeal nerve, hypoparathyroidism and airway obstruction remain a matter of concern especially in younger patients who have long life expectancy.3

Hypocalcaemia is one of the most common complications of thyroid surgery. The incidence varies according to the differences in defining hypocalcemia and the laboratory ranges for normocalcemia. Various causes for postoperative hypocalcemia include haemodilution or increased urinary calcium excretion secondary to surgical stress, endothelin release following manipulation of thyroid and parathyroid leading to decreased parathormone secretion, active calcium uptake by bone after surgery through mechanism called hungry bone syndrome and interference with the functioning of the
parathyroid glands either through direct injury, removal or
devascularisation.1–4

In most cases, hypocalcemia following thyroidectomy is
temporary, but rarely it may take several months to resolve.5 A small percentage persist beyond this stage and
are considered permanent, the cut-off time between
temporary and permanent hypocalcemia varies between
six months to one year.6–10 Large volume goiter, total
thyroidectomy, recurrent goiter, retrosternal extension,
advanced cancer, hyperthyroidism and experience of the
surgeons are the risk factors predisposing to post–
thyroidectomy hypocalcaemia.11

Hypocalcemia presents with signs of generalized
neuromuscular irritability including paresthesia, muscle
cramps, laryngospasm, tetany and seizures. This
neuromuscular instability can also be elicited by
Chvostek’s sign and Trousseau’s sign. Both Chvostek’s
sign and Trousseau’s sign are time-honoured physical
predictors that are well- chronicled in medical history to
be frequently associated with hypocalcemia.12,13

The aim of this study was to determine the incidence of
temporary and permanent hypocalcaemia after total
thyroidectomy and assess the clinical and biochemical
factors that may be predictive of hypocalcemia.

METHODS

An observational study was conducted at the General
surgery department of a tertiary care medical college
classical at Trivandrum, Kerala for a period of one year
from November 2012 to November 2013. Convenient
method of sampling was done. All the patients undergoing
total thyroidectomy in the general surgery department of
the tertiary care hospital was included in the study. All
patients with history of previous thyroid and parathyroid
surgeries, endocrine and electrolyte abnormalities were
excluded from the study. Sample size was calculated to be
98 using the formula given.

\[ n = \frac{z^2(p \times q)}{d^2} \]

Where \( z=1.96 \) (for 95% confidence interval),
\( p=\text{prevalence of hypothyroidism in post-operative period,} \)
\( q=100-p, \) and \( d=\text{absolute precision of } 5. \)

Patients were selected after obtaining ethical approval
from the Institutional Ethics committee and written
informed consent from the participant for the study. The
thyroid status was assessed by doing T3, T4 and thyroid
stimulating hormone (TSH) estimation prior to the surgery
as a part of routine investigation. The serum calcium level
was estimated by drawing blood by venepuncture without
manipulation. This was also part of the routine post-
operative care at the hospital. The normal calcium level
ranges from 8-11 mg/dl and values less than 8 mg/dl were
considered as hypocalcaemia. Per operative findings such
as capsular ligation of inferior thyroid artery, identification
of parathyroid, auto-transplantation of parathyroid and
duration of surgery were also recorded.

During the postoperative period patients were carefully
watched for clinical symptoms and signs of hypocalcemia.
Fatigue, weakness, perioral numbness and positive
Chvostek’s sign (twitching and/or contracture of the facial
muscles produced by tapping on the facial nerve at a
specific point on the face) and Trousseau's sign
(carpopedal spasm occurring after a few minutes of
inflation of a sphygmomanometer cuff above systolic
blood pressure) were considered as mild hypocalcemia.12–
14 Tetany and those with carpopedal spasm, convulsions
and laryngeal spasm were considered as severe
hypocalcemia.

Hypocalcemic patients having symptoms and not having
symptoms are separately grouped. Serum calcium levels at
6 hours and 24 hours postoperatively and at the time of
discharge were evaluated. Follow up was done after 1
month and if hypocalcemia persists follow up was
continued for 6 months. Patients who were hypocalcemic
beyond 6 months were considered permanent
hypocalcemia and others temporary. The histopathology
reports were collected and also the identification of
parathyroid in the specimen were noted. Patients requiring
oral and intravenous (IV) calcium supplementation were
recorded. Oral calcium was given in the form of calcium
carbonate 500 mg 2 tablets thrice daily along with
calcitriol 0.25 microgram twice daily. Intravenous calcium
was given in the form of 10% calcium gluconate 10 ml
over 10–20 minutes and same dose repeated if needed.15,16

Data was entered into Microsoft excel sheet and data
analysis was done using statistical package for the social
sciences (SPSS) version 20 statistical software.

RESULTS

A total of 98 patients who had undergone total
thyroidectomy for various indications were included in the
study. The minimum age of patient who had undergone
total thyroidectomy was 20 and maximum age was 72
years. Out of the 98 patients included in the study, 89
(90.2%) were females and 9 (9.8%) were males (Table 1).

Table 1: Distribution of patients based on age and
gender.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group (in years)</td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>5 (5.1)</td>
</tr>
<tr>
<td>30-39</td>
<td>20 (20.4)</td>
</tr>
<tr>
<td>40-49</td>
<td>39 (39.8)</td>
</tr>
<tr>
<td>50-59</td>
<td>19 (19.4)</td>
</tr>
<tr>
<td>60-69</td>
<td>10 (10.2)</td>
</tr>
<tr>
<td>70-79</td>
<td>5 (5.1)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>9 (9.8)</td>
</tr>
<tr>
<td>Female</td>
<td>89 (90.2)</td>
</tr>
</tbody>
</table>
In the study group, maximum number of patients were those diagnosed with multinodular goiter 44 (44.9%) patients. Thyroiditis patients were 25 (25.5%) and malignancy was seen in 23 (23.5%) patients (Table 2).

Table 2: Distribution of patients based on diagnosis.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multinodular goitre</td>
<td>44 (44.9)</td>
</tr>
<tr>
<td>Thyroiditis</td>
<td>25 (25.5)</td>
</tr>
<tr>
<td>Malignancy</td>
<td>23 (23.5)</td>
</tr>
<tr>
<td>Grave’s disease</td>
<td>4 (4.1)</td>
</tr>
<tr>
<td>Toxic nodular goiter</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Total</td>
<td>98 (100)</td>
</tr>
</tbody>
</table>

Majority of patients in this study were euthyroid 81 (82.7%), 10 (10.2%) were hyperthyroid and 7 (7.1%) were hypothyroid. Of the 98 patients who had undergone thyroidectomy, 57 (58.2%) patients had operating time more than 2 hours and 41 (41.8%) had operating time less than 2 hours. Among the study participants, 88 (89.8%) had their parathyroids identified intraoperatively and in 10 (10.2%) patients parathyroids were not identified. Parathyroids were identified in the specimen of 14 (14.6%) patients. In the study group of 98 patients, parathyroid auto-transplantation was done in 4 patients. In the patients who had undergone total thyroidectomy, 19 (19.4%) had hypocalcemia and 79 patients (80.6%) did not have hypocalcemia. In the study group, 14 (14.3%) had symptomatic hypocalcemia and 5 patients (5.1%) had asymptomatic hypocalcemia. 18 patients (18.4%) had temporary hypocalcemia and 1 patient (1%) had permanent hypocalcemia (Table 3).

Table 3: Distribution of hypocalcemia in post thyroidectomy patients.

<table>
<thead>
<tr>
<th>Hypocalcemia</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>19 (19.4)</td>
</tr>
<tr>
<td>Temporary</td>
<td>18 (18.4)</td>
</tr>
<tr>
<td>Permanent</td>
<td>1 (1)</td>
</tr>
<tr>
<td>No</td>
<td>79 (80.6)</td>
</tr>
<tr>
<td>Total</td>
<td>98 (100)</td>
</tr>
</tbody>
</table>

Majority of the hypocalcemic patients 9 (47.4%) were of the age group 40–49 years. There were no patients with hypocalcemia above the age of 60 years in the study group. Among the patients with hypocalcemia, 18 (95%) were females and 1 (5%) patient was male. 8 (42%) were diagnosed to have thyroiditis, 6 (32%) patients had malignancy and 3 patients had Grave’s disease in the hypocalcemic group.

Among the hypocalcemic patients, 13 (68%) patients were euthyroid, 5 (26%) patients were hyperthyroid and 1 (5%) patient was hypothyroid. Out of the 5 hyperthyroid patients 3 had Grave’s disease and 2 patients had thyroiditis. Oral calcium correction was given for 5 (26%) patients and combined intravenous and oral calcium supplements were given for 14 (74%) patients. Calcium values were observed at different stages of the post-operative period and values calculated as mean. The calcium level below which patients were symptomatic was 6.5 mg (Table 4).

Table 4: Calcium values observed at different stages of the study.

<table>
<thead>
<tr>
<th>Timing of calcium estimation</th>
<th>Mean calcium value (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-operative</td>
<td>8.66 (8.57–8.76)</td>
</tr>
<tr>
<td>At discharge</td>
<td>8.44 (8.31–8.56)</td>
</tr>
<tr>
<td>Symptomatic patients with hypocalcemia</td>
<td>6.5 (6.05–6.94)</td>
</tr>
<tr>
<td>Asymptomatic patients with hypocalcemia</td>
<td>7 (6.07–7.92)</td>
</tr>
</tbody>
</table>

Significant association was seen between diagnosis of thyroid disorders and hypocalcemia (p value=0.001), thyroid function and hypocalcemia (p value=0.03) and between operating time and hypocalcemia (p value=0.03).

No significant association was found between demographic factors like age and gender with hypocalcemia. No association was seen between intraoperative identification of parathyroid gland and hypocalcemia (Table 5).

Table 5: Association between hypocalcemia with diagnosis, thyroid function and operating time.

<table>
<thead>
<tr>
<th>Variable</th>
<th>MNG</th>
<th>Thyroiditis</th>
<th>Malignancy</th>
<th>Graves d/s</th>
<th>Toxic nodular goitre</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No hypocalcemia</td>
<td>42</td>
<td>17</td>
<td>17</td>
<td>1</td>
<td>2</td>
<td>0.001</td>
</tr>
<tr>
<td>% within diagnosis</td>
<td>95.5</td>
<td>68</td>
<td>73.9</td>
<td>25</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Hypocalcemia</td>
<td>2</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>% within diagnosis</td>
<td>4.5</td>
<td>32</td>
<td>26.1</td>
<td>75</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>TFT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Euthyroid</td>
<td>68</td>
<td>6</td>
<td>5</td>
<td></td>
<td></td>
<td>0.03</td>
</tr>
<tr>
<td>% within TFT</td>
<td>84</td>
<td>85.7</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypocalcemia</td>
<td>13</td>
<td>5</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% within TFT</td>
<td>16</td>
<td>14.3</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Continued.
Variable | P value
--- | ---
Operating time (hours) | <2 | >2
No hypocalcemia | 50 | 29
% within operating time | 87.7 | 70.7
Hypocalcemia | 7 | 12
% within operating time | 12.3 | 29.3

DISCUSSION

In our study hypocalcemia was seen in 19.4% of patients and that of temporary hypocalcemia was 18.4% and permanent hypocalcemia was 1%. The incidence of hypocalcemia reported by various authors in different studies varied from 23.6 to 48% out of this temporary hypocalcemia was up to 40% and permanent hypocalcemia ranged from 0 to 5% (Table 6).16-19

Table 6: Comparison of hypocalcemia values in different studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Percentage of post-operative hypocalcemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nair et al</td>
<td>23.6</td>
</tr>
<tr>
<td>Pfleiderer et al</td>
<td>48</td>
</tr>
<tr>
<td>Puzziello et al</td>
<td>28.8</td>
</tr>
<tr>
<td>Page et al</td>
<td>38</td>
</tr>
<tr>
<td>Herranz et al</td>
<td>33.8</td>
</tr>
<tr>
<td>Present study</td>
<td>19.4</td>
</tr>
</tbody>
</table>

Out of the four patients in the study who had Grave’s disease, three were found to have hypocalcemia indicating that Grave’s disease is significantly associated with hypocalcemia. This result is in concordance with other similar studies by Nair et al and Herranz et al.3,16

Comparing the incidence of temporary and permanent hypocalcemia with the other series of studies, we observed the incidence of temporary hypocalcemia varied between 18.4-43% and incidence of permanent hypocalcemia varied between 0.9-5%. Incidence of temporary hypocalcemia in our study was 18.4% and that of permanent hypocalcemia was 1% (Table 7).

Table 7: Temporary and permanent hypocalcemia values in different studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Temporary hypocalcemia (%)</th>
<th>Permanent hypocalcemia (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nair et al</td>
<td>22</td>
<td>1.6</td>
</tr>
<tr>
<td>Pfleiderer et al</td>
<td>43</td>
<td>5</td>
</tr>
<tr>
<td>Puzziello et al</td>
<td>27.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Page et al</td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td>Herranz et al</td>
<td>29.1</td>
<td>4.7</td>
</tr>
<tr>
<td>Present study</td>
<td>18.4</td>
<td>1</td>
</tr>
</tbody>
</table>

In our study, hypocalcemia was compared to euthyroid and hypothyroid groups, the hyperthyroid status was found to be more commonly associated with hypocalcemia and similar results were obtained in a study by Abboud et al.22 It may be due to hungry bone syndrome observed in hyperthyroid state associated with low bone mineral density.

CONCLUSION

Incidence of hypocalcemia in patients who had undergone total thyroidectomy was found to be 19.4%. Temporary hypocalcemia was 18.4% and that of permanent hypocalcemia was 1%. Symptomatic hypocalcemia was 14.3% and that of asymptomatic hypocalcemia was 5.1%. The mean calcium value below which patients were symptomatic was 6.5 mg.

The incidence of hypocalcemia was not found to be influenced by age or gender. Hypocalcemia was significantly higher in patients with thyroiditis. Patients with hyperthyroid status have a higher incidence of postoperative hypocalcaemia and the subgroup of Grave’s disease showed significant association while toxic nodular goitre showed no association. No association was noticed with intra operative identification of parathyroids and hypocalcemia.

Prolonged duration of surgery showed significant association with hypocalcemia. Incidental parathyroidectomy also showed significant association with hypocalcemia.

Calcium measurement at 6 hours and 24 hours after thyroidectomy would be helpful in early identification of hypocalcemia and starting treatment early preventing onset of the symptoms.

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