

ORIGINAL RESEARCH

Study of the role of serum Parathormone level as a reliable indicator of hypocalcaemia following total thyroidectomy

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ABSTRACT

Background: Postoperative hypoparathyroidism manifesting as hypocalcaemia is still one of the most common complications seen in patients undergoing total thyroidectomy, despite every effort by the surgeon to preserve the parathyroid glands during surgery. Incidence varies from 0.5 to 65%(1). In the present study, we aimed to evaluate the role of serum Parathormone level as a reliable indicator of hypocalcaemia following total thyroidectomy. **Material and Methods:** Present study was a cross-sectional, observational study conducted in all the patients undergoing Total thyroidectomy at a tertiary hospital.

Results: In this study, the total number of patients included was 42. 90.5 % were female, and 9.5 % were male. In the present study, 57.1% (n=24) had benign disease, and 42.9 %(n=18) had malignant disease. The mean serum PTH value was 16.38 ± 7.70 pg/dl among the benign group and 13.66 ± 5.40 pg/dl in the malignant group. Serum PTH was lower among the malignant group than the benign group but was not statistically significant. The difference between pre-operative and post-operative values of corrected calcium levels was statistically significant. The correlation between the pre-operative and post-operative corrected calcium parameters showed a good positive correlation and is significant with a p-value of 0.007. The post-operative corrected calcium (<8mg/dl) and serum PTH (<15pg/m) showed a good positive correlation with significant p-value of <0.002.

Conclusion: Serum PTH hormone levels should be evaluated for all the patients undergoing total thyroidectomy at 24 hours postoperatively, which is a reliable early predictor for patients who can develop hypocalcaemia even before serum calcium levels drop and hence predicting patients at risk of developing hypocalcaemia and treating them prophylactically.

Keywords: Serum PTH hormone, total thyroidectomy, hypocalcaemia, serum calcium.

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INTRODUCTION

Postoperative hypoparathyroidism manifesting as hypocalcaemia is one of the most common complications seen in patients undergoing total thyroidectomy, despite every effort by the surgeon to preserve the parathyroid glands during surgery, the incidence of which varies from 0.5% to 65% (1). Postoperative hypocalcaemia is defined as serum Calcium levels <8.4mg/dl measured within 12 hours postoperatively as described by The British Association of Endocrine and Thyroid Surgeons (BAETS). The possible reasons for post-surgical hypocalcaemia are a) compromise to the parathyroid blood supply and unintentional gland excision, (b) Acute calcium transfer into bones resulting in hungry bone syndrome, (c) Calcitonin release after surgery, (d) Dilutional hypocalcaemia. Acute hypocalcaemia can cause paresthesia and neuromuscular instability (cramps, tetany, and convulsions), requiring immediate medical attention. Following total thyroidectomy, post-operative hypocalcaemia develops within 24-48 hours, can last up to day 4, and prolongs the hospital stay. As a result, detecting patients who need calcium replacement therapy with serial calcium measurements may require numerous blood tests. Placing all patients on calcium therapy leads to unnecessary treatment and is at risk for hypocalcaemia. It is crucial to identify people with risk factors for hypocalcaemia after a complete thyroidectomy. (2-4) In the present study, we aimed to evaluate the role of serum Parathormone level as a reliable indicator of hypocalcaemia following total thyroidectomy

MATERIAL AND METHODS

The present study was a cross-sectional, observational study conducted at a tertiary hospital in South India conducted between January 2020 to June 2021). Prior approval of the Institutional Ethics Committee was taken. The study was explained and informed, and written consent was taken for participation

Inclusion criteria

- All the patients undergoing total thyroidectomy

Exclusion criteria

- Patients not giving consent for the study and low serum calcium levels before surgery. . Demographic details, clinical history, investigations, clinical outcome was noted. Following investigations were done.

1. Serum PTH- at 24 hours after Total Thyroidectomy
2. Serum calcium – preoperatively and at 24 hours after Total Thyroidectomy
3. Serum Albumin – preoperatively and at 24 hours after Total Thyroidectomy
4. Corrected Calcium score to be calculated by the formula: Serum Calcium + 0.8 (4-serum albumin)

Data was collected and tabulated using Microsoft Excel 2016 software (Microsoft Office 2010) and analysed using statistical package for social sciences (SPSS) version 16.0. Cross tabulations, Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. The difference of proportions between qualitative variables was tested using the chi-square test or Fisher exact test as applicable. A P-value less than 0.05 was considered statistically significant.

RESULTS

In this study, a total of 42 patients were studied. The mean age of the population was 49.3 years, with the oldest patient being 85 years and the youngest being 26 years. Among the 42 people, the majority were in the 6th decade. Among 42 people, 90.5 percent were female, and 9.5 percent were male.

In the study group, 57.1% (n=24) had the benign disease, and 42.9% (n=18) had the malignant disease. 58% of the patients had normal PTH value in the benign group, and 42% had a low PTH level. Regarding the PTH levels among the malignant cases, it was found that 78% of patients had a low serum PTH and 22% of patients had a normal PTH. (Table 1)

The mean Serum PTH value was 16.38 ± 7.70 in the benign group and 13.66 ± 5.40 in the malignant group. Serum PTH was lower among the malignant group than the benign group but was not statistically significant. (p 0.207)

Table 1: Comparison of Serum PTH among benign and malignant groups

DIAGNOSIS	Number	Percentage	Mean \pm SD
Benign	24	57.1 %	16.38 ± 7.70
Serum PTH < 15pg/dl	10	42 %	
Serum PTH >15pg/dl	14	58 %	
Malignant	18	42.9	13.66 ± 5.40
Serum PTH < 15pg/dl	10	78 %	
Serum PTH >15pg/dl	8	22 %	

Out of 42 patients, 7 patients (16.7%) had low serum calcium levels (<8mg/dl). The remaining 35 patients (83.3%) had normal calcium levels. Among the 7 cases, 5 cases were in the benign group and 2 in the malignant group. Serum PTH levels were low in 57.1% of the patients, statistically significant. All 7 patients who had developed hypocalcaemia based on corrected calcium levels also had Hypoparathyroidism. The correlation between the serum PTH and the corrected calcium was done according to the Pearson correlation for the 42 patients. (Table 2) The mean value of corrected calcium was 0.472, and the p-value was 0.002, which was statistically significant.

Table 2: Corrected Calcium levels

Corrected Calcium (mg/dl)	Benign	Malignant	Total
< 8 mg/dl	5 (20.8 %)	2 (11.1 %)	7 (16.7%)
\geq 8 mg/dl	19 (79.2 %)	16 (88.9%)	35 (83.3%)
Total	24	18	42

The correlation between the parameters pre-operative and post-operative corrected Ca²⁺ (<8mg/dl) showed a positive correlation and is significant with a p-value of 0.007. The correlation between the parameters post-operative corrected calcium (<8mg/dl) and serum PTH (<15pg/m) shows a good positive correlation and is significant with a p-value of <0.002. The correlation between the Serum PTH level and lymph node dissection among the malignant cases showed low PTH levels among the patients who underwent lymph node dissection, but it was not statistically significant. (Table 3)

Table 3: Pearson's correlation to test the relation with the pre-op and post-op value

Parameters being correlated	Correlation(r)	P Value
Pre-Operative and Post-Operative Corrected Ca ²⁺ (<8mg/dl)	0.413	0.007
Post-op Corrected Calcium (mg/dl) and Serum PTH	0.472	0.002

(<15pg/m)		
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DISCUSSION

Thyroidectomy has been established as the preferred operation for various thyroid disorders. Postoperative hypocalcaemia is one of the major concerns following total thyroidectomy. It often extends the duration of the hospital stay for biochemical tests. It can lead to severe complications like laryngeal stridor and convulsions and requires intravenous therapy with calcium.¹⁻⁵ Our study showed a positive correlation between preoperative and postoperative values. The incidence of hypocalcaemia was higher in the postoperative group and had low serum PTH levels. The severe symptoms of hypocalcaemia like cardiac arrhythmias, spasms, and stridor were not reported in our study.

Nair *et al.*³ studied 806 patients, found the incidence of hypocalcaemia in patients undergoing total thyroidectomy was 23.6%, and that of permanent hypocalcaemia was 1.61%. Onset was delayed up to the third postoperative day in thirteen patients. Hypocalcaemia was significantly associated with thyroidectomy for Grave's disease, Hashimoto's thyroiditis, and incidental parathyroidectomy.

Graff AT *et al.*,⁴ suggested single early postoperative intact PTH measurement 6-18 hours after surgery was found to be the most cost-effective screening tool for hypocalcaemia. The greater specificity can be achieved by combining those findings with a serum calcium measurement taken 6 hours postoperatively.

Puzziello *et al.*,⁵ showed the relative decrease in PTH determined 2 hours after total thyroidectomy. The serum calcium concentration 24 hours after thyroidectomy proved to be valuable predictors of sustained hypocalcaemia and might change the clinical management of these patients after thyroid surgery requiring more extended hospitalization.

After total thyroidectomy, temporary hypocalcaemia has been reported in 1.6-50% of the patients. Permanent hypoparathyroidism results in 0-13% of patients after total thyroid surgery.⁶ Various factors account for these differences in the literature, such as the definition of hypocalcaemia, the type of disease, and the surgical technique. Among potential factors causing this decrease in serum calcium are post-operative haemodilution and calcitonin release.¹⁻⁷

Elevation of serum calcitonin (calcitonin leak), secondary to manipulating the thyroid, was suspected of participating in this calcium decrease, but this was not confirmed in further studies. Preoperative hyperthyroid status is associated with decreased gastrointestinal calcium absorption and osteoclast activity, with increased bone resorption to maintain serum calcium levels.⁶⁻¹⁰

The impaired parathyroid function is the major contributing factor in determining hypocalcaemia. Proper surgical technique is vital in preserving viable parathyroid glands, and several factors have been associated with impaired postoperative function. Susceptibility of parathyroid glands to injury during neck dissection mainly resides in their widely variable anatomical position, their relationship with the thyroid gland, and their very delicate vascular supply. A higher incidence of postoperative hypocalcaemia is seen after total thyroidectomy. Other factors associated include central neck dissection, surgery for carcinoma and surgery for Grave's disease.¹⁻¹⁰

In the present study, there was a high incidence of hypocalcaemia in malignant disease compared to benign conditions that underwent total thyroidectomy with or without neck dissection. However, the serum Parathormone level was low in the patients who underwent lymph node dissection for malignant thyroid cases. There was no difference in postop calcium levels for the age and sex of the patients. This emphasizes the need for careful

identification parathyroid gland with its vascular supply during total thyroidectomy to prevent postoperative hypocalcaemia.⁸⁻¹⁰

In this study, the postoperative serum calcium level was statistically lower than the preoperative serum calcium level irrespective of whether the patient is symptomatic or not, which correlated to the serum PTH levels postoperatively, signifying that PTH levels drop an early predictor of hypocalcaemia patients undergoing total thyroidectomy.

A study done by Cayo AK *et al.*, including 112 patients, concluded that postoperative PTH was an independent predictor of postoperative hypocalcaemia on multivariate analysis.⁹ Another study done by Awad Al Qahtani *et al.*,¹⁰ included 149 patients found that PTH-1 levels were predictive of symptomatic hypocalcaemia 24 hours after thyroidectomy. Routine measurement of PTH should be considered. It could prompt the early administration of calcitriol to patients at risk of developing hypocalcaemia and allow for the safe and early discharge of patients who are expected to remain eucalcemic.

A recent prospective study by Puzziello *et al.*,⁵ on 75 patients, showed the relative decrease in i-PTH determined 2 hours after total thyroidectomy together with the serum calcium concentration 24 hours after thyroidectomy proved to be valuable predictors of sustained hypocalcaemia and might change the clinical management of these patients after thyroid surgery requiring more extended hospitalization.

Our study found that hypocalcaemia is higher in patients undergoing total thyroidectomy for malignant thyroid conditions than benign. Still, our study found no statistically significant results concerning age or sex.

This study showed that the incidence of hypocalcaemia based on Corrected Calcium levels on POD-1 was 16.7% among the 42 patients. Still, Serum PTH levels were found to be low in 57.1% of the patients, which was statistically significant, proving an early predictor of hypocalcaemia after total thyroidectomy. All 7 patients who had developed hypocalcaemia based on corrected calcium levels also had Hypoparathyroidism.

CONCLUSION

Serum PTH hormone levels should be checked for all patients undergoing total thyroidectomy at 24 hours postoperatively, which is a reliable early predictor for patients who can develop hypocalcaemia even before serum calcium levels drop, predicting patients at risk of developing hypocalcaemia and treating them prophylactically and for early discharge.

Conflict of Interest: None to declare

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