

## Original Research Article

# A prospective study on parathyroid hormone levels in detecting early hypocalcemia after total thyroidectomy

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## ABSTRACT

**Background:** Hypoparathyroidism and the resultant hypocalcaemia is a major cause of postoperative morbidity after total thyroidectomy with the incidence varying from 1% to 71%. This study aims to determine the incidence of parathyroid hormone deficiency as an earliest indicator for detecting hypocalcemia following total thyroidectomy.

**Methods:** A prospective study was carried out among 50 subjects attending Department of Surgery, K. R. Hospital, Mysuru over a period of 12 months. Subjects of either sex undergoing total thyroidectomy had their serum parathyroid hormone levels tested at 1, 4, 12 and 24 hours after surgery were included in the study. Patients with poor compliance, calcium supplementation prior to surgery, coexisting parathyroid or renal pathology were excluded from the study. Descriptive statistics and Pearson correlation coefficients were used to analyse the results.

**Results:** Among 50 study subjects, Hypocalcemia developed in 3 subjects (6%) 24 hours after thyroidectomy showing a sensitivity, specificity, negative and positive predictive value of 91%, 100%, 98% and 96% respectively.

**Conclusions:** Parathyroid hormone levels in postoperative total thyroidectomy is an earliest indicator to detect symptomatic hypocalcemia subjects 24 hours after surgery, which prompts early administration of oral calcium replacement therapy in high risk subjects and potential safe early discharge post-operatively.

**Keywords:** Hypocalcemia, Parathyroid hormone, Total thyroidectomy

## INTRODUCTION

The total calcium concentration in plasma is 2.25-2.55mmol/L. Fifty percent is ionized, 40% is bound to proteins of which 90% binds to albumin, and 10% circulates bound to anions (phosphate, carbonate, citrate, lactate, and sulphate). Ionized calcium is a necessary plasma fraction for normal physiologic processes. The levels of ionized calcium are rigidly controlled by parathyroid hormone, vitamin D and calcitonin through complex feedback mechanisms. The absence or deficiency of parathyroid hormone results in hypocalcaemia.<sup>1,2</sup>

Hypoparathyroidism is one of the most common and serious complications from thyroid and parathyroid

surgery resulting from direct trauma to the parathyroid glands, devascularization of the glands, or removal of glands during surgery. However, in most instances post-operative hypoparathyroidism is a temporary condition. When it is permanent, the patient is committed to lifelong symptomatic treatment with calcium, and/or Vitamin-D. To avoid this complication, the surgeon must make every effort to preserve one or more viable parathyroid glands, particularly while performing a total thyroidectomy.<sup>3,4</sup>

Hypocalcaemia after thyroidectomy is initially asymptomatic in most cases. Clinical manifestations of hypocalcaemia may appear between 1 to 7 days after surgery. The symptoms and signs of hypocalcaemia result from increased neuromuscular excitability caused by low levels of ionized calcium. If it is not treated, the patient

will develop potentially life-threatening manifestations, such as carpopedal spasm, tetanic seizures, and laryngeal spasm.<sup>4,5</sup>

Evaluation of parathyroid function is performed by measuring either ionized calcium (or total calcium and albumin) and phosphate levels perioperatively, or parathyroid hormone levels postoperatively.<sup>4</sup>

## METHODS

After obtaining Institutional ethical committee approval, a prospective, open label, randomized, single centered study was conducted among 50 subjects attending General Surgery OPD, K.R. Hospital, Mysuru meeting the inclusion and exclusion criteria over a period of 12 months (January - December 2016) after obtaining a written informed consent using a purposive sampling technique. Patients undergoing total thyroidectomy were measured pre-operative serum calcium and parathyroid hormone levels and their serum parathyroid hormone levels tested at 1, 4, 12 and 24 hours after surgery. Parathyroid hormone levels below 12pg/ml were at high risk for developing hypocalcemia postoperatively. Patients remain low risk at parathyroid hormone levels more than 12pg/ml.

Subjects of either sex undergoing total thyroidectomy had their serum parathyroid hormone levels tested at 1, 4, 12 and 24 hours after surgery were included in the study. Patients with poor compliance, calcium supplementation prior to surgery, coexisting parathyroid or renal

pathology were excluded from the study. Descriptive statistics and Pearson correlation coefficients were used to analyse the results.

## RESULTS

During the twelve months study period, 50 patients who underwent total thyroidectomy were tested for parathyroid hormone levels postoperatively. The mean age group of the study subjects was 47.8 (range 22-78) years. The gender distribution showed 43 females (86%) as compared to 7 males (14%). 38 subjects were diagnosed with multinodular goitre, 9 subjects were of thyroid neoplasms and 3 subjects were of inflammatory thyroid conditions.

Out of 50 study subjects, 12 (24%) subjects had a parathyroid level of less than 12pg/ml at 1, 4, 12 and 24 hours and were at a higher risk of developing hypocalcemia. Although they received calcium supplementation, 2 (4%) subjects manifested with hypocalcemia (Table 1).

38 (76%) subjects had their parathyroid levels more than 12pg/ml following total thyroidectomy at 1, 4, 12 and 24 hours and were at lower risk of developing hypocalcemia. However, 1 (2%) study subject developed hypocalcemia having a negative predictive value of parathyroid hormone levels greater than 12pg/ml is 98% (Table 1). None of the hypocalcemic study subjects showed serious sequelae like arrhythmia, tetany etc., but presented with mild symptoms.

**Table 1: Risk stratification of subjects undergoing total thyroidectomy.**

Parameters	Risk of hypocalcemia following thyroidectomy	Subjects with symptomatic hypocalcemia following 24 hours
High risk (Serum PTH levels <12pg/ml)	12 (24%)	2 (4%)
Low risk (Serum PTH levels >12pg/ml)	38 (76%)	1 (2%)

## DISCUSSION

Many studies have shown a definite relationship between pre-operative serum parathyroid levels and total thyroidectomy. The incidence of hypocalcemia following total thyroidectomy varies from 1%-50% which is the commonest complication reported. Early identification of patients at risk of hypocalcemia would allow prophylactic calcium supplementation therapy preventing development of symptomatic hypocalcemia.<sup>6</sup>

In this study, 12 subjects had <12ng/ml parathyroid levels at 1,4,12 and 24 hours who were at high risk of developing hypocalcemia; started on oral calcium supplementation but later 2 (4%) out of 12 subjects developed symptomatic hypocalcemia and 38 subjects

had  $\geq 12$ ng/ml parathyroid levels done at similar intervals as above were at low risk of developing hypocalcemia; although later 1 (2%) subjects developed symptomatic hypocalcemia as compared to study done by Chow et al, which used serum parathyroid levels as a criteria showed 2.8% of the patients developed hypocalcemia postoperatively.<sup>7</sup>

Pattou et al, found that a postoperative PTH level of 12 pg/mL or less was a good predictor of hypocalcemia, but they did not state how long after surgery PTH values were obtained.<sup>8</sup> Lam and Kerr reported that all patients with a PTH level less than 8 pg/mL measured 1 hour after the surgery became hypocalcemic, and all patients with a PTH level greater than 9 pg/mL did not.<sup>9</sup> Lombardi et al, found greater precision with measurements taken at 4 and

6 hours, with an overall accuracy of 98%.<sup>10</sup> Al Dhari et al, defined recovery as a serum PTH  $\geq 10$  pg/mL in the absence of hypocalcemic symptoms.<sup>11</sup> However, Nawrot et al, defined recovery as cessation of calcium and calcitriol supplementation.<sup>12</sup> Higgins et al, demonstrated that 64% of those patients who subsequently required calcium supplementation had a decrease in PTH levels greater than 75% from baseline 20 minutes after surgery, and 74% of those who did not need calcium supplementation demonstrated a decrease of less than 75% from baseline.<sup>13</sup>

However, there were few limitations in our study which include; small sample size, open label, hospital based and single center study. Further studies evaluating this, overcoming the above limitations is highly desired.

## CONCLUSION

Estimating serum parathyroid hormone levels is an excellent early indicator of hypocalcemia following total thyroidectomy and helps in starting early prophylactic calcium supplementation therapy and thus reduces the incidence of further symptomatic hypocalcemia post-operatively.

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