

Para Thyroid Hormone Levels 1 Hour after Surgery as an Early Predictor of Post Thyroidectomy Hypocalcemia.

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ABSTRACT

Background: Parathyroid hypo function or dysfunction which leads on to hypocalcemia is one of the common complications after near total or total thyroidectomy. Hypocalcemia after thyroidectomy is one of the major deciding factors in delayed hospital discharge. It is associated with significant morbidity. Aim: To study the role of intact parathormone (PTH) levels 1 hour after surgery as a predictor of post-thyroidectomy hypocalcemia. **Methods:** Prospective study in Sivagangai Medical College and Hospital, with 34 patients who underwent near total or total thyroidectomy. IPTH level was measured postoperatively and compared with serum calcium level corrected for serum albumin at 24 hours post operatively. Sensitivity, specificity, positive predictive value, negative predictive value of iPTH-1 in predicting 24 hour post thyroidectomy hypocalcemia and eucalcemia was assessed. **Results:** 34 patients who underwent near total or total thyroidectomy of which 10 patients developed symptomatic and biochemical hypocalcemia. 9 out of 10 patients had low PTH-1. Sensitivity and specificity of PTH-1 in predicting incidence of hypocalcaemia at 24 hours is 90% and 100%. The positive predictive value and negative predictive value were 100% and 96% respectively. **Conclusion:** The findings of this study showed that for predicting patients at risk for developing post total or near total thyroidectomy symptomatic hypocalcaemia, by doing 1 hour post-operative serum intact PTH (value of <15 pg/ml) had a sensitivity of 90%. So it can be used as an effective screening test for early identification patients at risk of developing hypocalcemia after thyroidectomy.

Keywords: Thyroidectomy, post-operative hypocalcemia, parathyroid hormone, corrected serum calcium level.

INTRODUCTION

Total or near total thyroidectomy has been established as the preferred surgery for various thyroid disorders.^[1] Hypocalcemia due to parathyroid dysfunction is a common complication after thyroidectomy surgeries and is often associated with significant morbidity.^[2] Parathyroid hormone is most essential for regulating extracellular calcium level. Hypocalcemia is one of the major contributing factors in late hospital discharge after near total or total thyroidectomy and prevented surgeons from advising ambulatory thyroidectomy.^[3,4] Hypocalcemia after near total or total thyroidectomy may be transient with an incidence of 3-40% or permanent with an incidence of 0.4% -13.8%.^[5-7] Symptoms of hypocalcemia appear between 24 – 48 hours after surgery but it may appear as early as 6 hours postoperatively which also depends upon patient's vitamin D level, electrolyte level and biologically active parathyroid hormone.^[1] Intact parathyroid hormone secreted by parathyroid gland in response to serum ionized calcium levels.^[2] Parathyroid hormone is an 84 amino acid polypeptide and its release is under the control of feedback extracellular ionized calcium levels which in turn is mediated through cell surface calcium

receptors of the parathyroid gland.^[2] Half-life of parathyroid hormone is less than 5 minutes.^[8,9] During total or near total thyroidectomy, parathyroid gland is inadvertently resected or its vascular supply is compromised leading to hypocalcemia.^[2] When traumatic injury to parathyroid gland is recognized intra operatively, normal and devitalized gland can be auto transplanted in to sternocleidomastoid or brachioradialis muscle.^[2]

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Three approaches have been advocated in managing postoperative hypocalcemia serial calcium monitoring, routine calcium supplementation,^[1-3] (3) PTH directed supplementation.^[10] Serial calcium monitoring is widely adopted as it is widely available in all centers but its drawback is that patient need to stay in hospital for few days.^[10] Due to cost constraints for serial calcium monitoring, prolonged hospital stay and PTH directed supplementation; we need a reliable simple indicator to identify patients who are at risk for developing

symptomatic or biochemical hypocalcemia after near total or total thyroidectomy which would permit early prophylactic treatment. Decrease in iPTH level will mostly precede an impending hypocalcemia.^[11] It may serve as a reliable predictor of hypocalcemia in patients undergoing thyroid surgery.^[11] Since there is a time lag between hypo secretion of parathyroid hormone and development of symptomatic hypocalcemia, early treatment with calcium, calcitriol, magnesium can keep the high risk patients eucalcemic, thus avoiding the morbidity of hypocalcemia.^[2] Early prophylactic treatment with calcitriol will maintain the patient in eucalcemic state following thyroidectomy with hypoparathyroidism. On the other hand low risk patients can be spared from serial monitoring for calcium levels after thyroidectomy. Post thyroidectomy 1 hour parathyroid hormone level estimation helps in discharging the patient without fear of symptomatic hypocalcemia.^[2] This study correlates intact serum parathyroid hormone level at 1 hour after thyroidectomy with corrected serum calcium level at 24 hour after thyroidectomy and subsequent development of hypocalcemia.

Aim

To study the role of intact parathormone (PTH) levels 1 hour after surgery as a predictor of post-thyroidectomy hypocalcemia.

MATERIALS AND METHODS

This prospective study was done in Department of Surgery, Sivagangai Medical College and Hospital. 34 patients with benign or malignant thyroid disorder who underwent near total or total thyroidectomy were included in the study. Patients with previous thyroid operation or irradiation, concomitant parathyroid diseases, thyroid lobectomy, isthmectomy and hemithyroidectomy, patient already on calcium supplementation were excluded from the study. Pre-operative investigations confirming the diagnosis as thyroid swelling; and serum albumin, calcium levels and calculation of serum corrected calcium levels. Evaluation of clinical findings suggestive of hypocalcemia postoperatively (perioral numbness, paraesthesia, tetany, Chvostek's sign, trousseau's sign, seizures). Post-operative investigations including serum albumin, calcium levels, serum parathyroid hormone level at 1 hour after thyroidectomy and calculation of serum corrected calcium levels at 24 hours post-op. Following parameters considered for statistical analysis: age, gender, post-operative serum PTH level at 1 hour and post-operative serum corrected calcium level at 24 hours. All the cases will be followed up to discharge.

RESULTS

In our study out of 34 patients studied 20 patients were between 21 years to 40 years (58%) and 10 patients were in the age group of 41years to 50 years(29%). The mean age is 37.8 years and the median is 38.5 years. Age does not have any significant correlation with post-operative hypocalcemia. Multi nodular goiter is most commonly seen in females. In 34 patients, 30 were females and 4 were males and the male: female ratio comes to 1: 7.5. There is no statistically significant correlation between sex and occurrence of post-operative hypocalcemia. In 34 patients, 10 patients developed symptoms of hypocalcemia post operatively in first 24 hours. After treatment with calcium, calcitriol patients were followed up to discharge and all 10 patients were found to have relieved of their symptoms and there were no signs of hypocalcemia at discharge. [Table 1]

In 34 patients, 9 patients had low PTH level 1 hour after near total thyroidectomy or total thyroidectomy which accounts to about 26% of the total.[Table 2] 10 patients had low corrected serum calcium level after 24 hours of near total or total thyroidectomy which came to around 29% and 24 patients had normal corrected serum calcium level which came to around 71%. [Table 3] Out of 10 patients who had hypocalcemia biochemically and symptomatically, PTH value of 3 patients were in the range of 5-10pg/ml, 6 patients were in the range of 10-15pg/ml. [Table 4] Out of 10 patients who developed hypocalcemia, operative histopathology report of 2 patients was papillary carcinoma, 7 patients were Multinodular goiter, 1 patient had follicular carcinoma. In our study hypocalcemia was not statistically associated with post-operative histopathology. In our study of 34 patients, post operatively 10 patients had low corrected serum calcium level at 24 hours of which post operatively 9 patients had low PTH level at 1 hour. Sensitivity of PTH-1 in predicting incidence of hypocalcaemia at 24 hours is 90%. The specificity of PTH-1 less than 15pg/ml in predicting hypocalcemia at 24 hours postoperative is 100%.The positive predicative value and negative predictive value were 100% and 96% respectively. The correlation coefficient r measures the strength and direction of a linear relationship between two variables, i.e. PTH-1 hour and CSCL on a scatter plot. In our study r value is 0.844. Here the Variable PTH-1 hour and CSCL shows that strong positive linear ship it means if the variable PTH-1 hour increase the CSCL also increase and if the PTH-1 hour decreased the variable CSCL is also decreased.

Table 1: Distribution of Symptoms.

Hypocalcemia Symptoms	No. Of Patients	Percentage
Present	10	29%
Absent	24	71%

Table 2: Distribution of Post-Operative PTH Level At 1 Hour.

Pth Level 1 Hour Post Op	No. Of Patients	Percentage
Normal	25	74%
Low	9	26%

Table 3: Distribution of Post-Operative Corrected Serum Calcium Level (CSCL).

24 Hour Post Op CSCL	No. Of Patients	Percentage
Normal	24	71%
Low	10	29%

Table 4: Distribution of Range of PTH-1 Hour Who Had Hypocalcemia.

Pth -1 Hour	No. of Patients	Percentage
0-5pg/ml	0	0%
5-10 pg/ml	3	30%
10-15 pg/ml	6	60%

DISCUSSION

Hypocalcemia after thyroidectomy is the most common postoperative complication, with an incidence of 1% -50%.^[12,13] Despite advancement in thyroid surgery still post thyroidectomy hypocalcemia occurs as a result of hypoparathyroidism. In our study the mean age is 37.8 years and the median is 38.5 years. This is comparable to mean age of thyroid disorder (35.8 years) in a study conducted by Waleed Farag Ezzat et al.^[8] Dilberpareed et al.^[1] From our study we found that age did not have significant correlation with post-operative hypocalcemia. In our study the male: female ratio comes to 1: 7.5. This is comparable to male: female ratio (1:8.8) in a study conducted by Brian Hung-Hin Lang et al.^[10] Out of 10 patients who developed hypocalcemia postoperatively 2 were males and 8 were females. There was no statistically significant difference in the occurrence of hypocalcemia between male and females. In our study 10 patients out of 34 patients developed symptoms of hypocalcemia which was correlated with postoperative corrected serum calcium level. In our study for predicting patients at risk for developing post thyroidectomy symptomatic hypocalcaemia, a 1 hour postoperative serum intact PTH value of <15 pg/ml has Sensitivity of 90%, specificity 100%, positive predictive value and negative predictive value were 100% and 96% respectively comparable to study conducted by Dilberpareed et al.^[1] In our study r value is .844. Here the Variable PTH-1 hour and CSCL shows that strong positive linear ship it means if the variable PTH-1 hour increase the CSCL also increase and if the PTH-1 hour decreased the variable CSCL is also decreased. Hence there is a strong correlation between PTH-I hour after thyroidectomy in predicting post-operative hypocalcemia. Various studies have been done all over the world to determine the methods that would predict

development of post thyroidectomy hypocalcaemia. In a study conducted by Maria Teresa Julian et al.^[14] (2013) corrected serum calcium level and iPTH were measured before and at 24 hours and 6 months after surgery. They concluded that iPTH level >5.8pg/ml 24 hours after total thyroidectomy predicts normal parathyroid function in long term. In a study conducted by DilberPareed K et al. (2015), they compared iPTH 1 hour after completion of total thyroidectomy with serum calcium at 6, 24 and 48 hours post operatively and concluded that iPTH-1 value of 15pg/ml has a sensitivity of 91.65% and specificity of 93.76% for predicting patients at risk for developing post thyroidectomy symptomatic hypocalcemia.^[1] AwadAlQahatani et al. compared iPTH level 1 hour, 6hour and 24hour post operatively and ionized calcium. Sensitivity and specificity of iPTH-1 in predicting 24 hours hypocalcemia was 89% and 100% respectively.^[2] Study conducted in 2006 by Marcin et al,^[15] in which 3 blood samples for iPTH were taken in each patient preoperatively –baseline, at end of surgery-skin closure, and at 4 hour post operatively for predicting post thyroidectomy hypocalcaemia. It was concluded that iPTH serum level less than 10 pg/ml at 4 hour postoperative had the highest accuracy in predicting serum calcium level below 2 mmol/l after total thyroidectomy. Study conducted by Celestino et al^[16] in which iPTH was measured preoperatively , at end of surgical procedure and at 2,4,6,24, and 48 hours after the surgery. It was concluded that a single iPTH level below the normal range (<10pg/ml) between 4 and 6 hours after the operation correctly predicted postoperative hypocalcaemia (sensitivity 94% and specificity100%). Another study was done by Graff et al,^[17] in which a single early postoperative intact PTH measurement 6-18 hours after surgery was found to be the most cost effective screening tool for hypocalcaemia. But even greater specificity can be achieved by combining those findings with a serum calcium measurement taken 6 hours postoperatively. Roderick et al,^[18] did a study where iPTH was measured intraoperatively after the removal of both lobes of thyroid. Its sensitivity for predicting post thyroidectomy hypocalcaemia was found to be 78.57%. Since patients can develop symptoms of hypocalcaemia as early as 6 hours after thyroidectomy, it would be desirable to identify at risk patients very clearly in the postoperative period (within 2 hours) so that early supplementation of oral/parenteral calcium is possible to prevent the development of symptoms. Intraoperative I PTH has a low sensitivity (75-80%). Valerie et al,^[19] conducted a study where intact PTH measured at 1 hour postoperatively had a sensitivity of 96% in predicting patients developing hypocalcaemia after thyroidectomy. In our study, the percentage of hypocalcemic patients is about 29% at 24 hours post-operative and sensitivity and specificity of

predicting post-operative hypocalcemia by doing PTH-1 hour after thyroidectomy was 96% and 100% respectively. Early recognition of patients at risk of hypocalcemia would allow for prophylactic treatment thus preventing the development of symptomatic hypocalcemia. On the other hand patient not at risk of hypocalcemia can be discharged early without fear of patient turning back with symptoms of hypocalcemia. Early calcium monitoring in the postoperative period is a poor predictor of subsequent symptomatic hypocalcemia. Other approach is the assay of PTH in early postoperative period which is based on the fact that PTH has a short half-life of less than 5 minutes, thus allowing detection of its fall early in the perioperative period. Patients with PTH-1 hour post thyroidectomy within normal range and who are asymptomatic can be discharged safely without need for further calcium monitoring. If it is less than normal, patients can be started on calcium and calcitriol treatment early in postoperative period.

CONCLUSION

Based on our observation in our study we conclude that iPTH-1 level is predictive of symptomatic hypocalcemia 24 hours after near total or total thyroidectomy. So iPTH-1 assay can be used as an effective screening test for early identification of patients at risk of developing symptomatic or biochemical hypocalcemia after thyroidectomy, so that it could prompt prophylactic administration of calcitriol in patient at risk and allow for safe and timely discharge of patients who are normocalcemic.

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