

Research Article

Pre-closure parathyroid hormone assay in predicting post-operative hypocalcemia

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Received: 6 May 2014

Revised: 11 May 2014

Accepted: 23 May 2014

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ABSTRACT

Background: Transient asymptomatic hypocalcaemia occurs in most patients undergoing thyroidectomy. Symptom occurrence is variable and depends on the rate and decrement of the drop in ionized calcium. The objective was to find the sensitivity and specificity of pre-closure PTH in predicting post-operative hypocalcaemia.

Methods: This is a case control study done in department of surgery medical college Thiruvananthapuram. Study was designed as per the STARD guidelines. 40 patients who have undergone total thyroidectomy, near total thyroidectomy and completion thyroidectomy during one year study period with post-operative hypocalcemia and pre closure PTH value assayed were selected and compared with 100 patients without post-operative hypocalcemia. The data collected were analyzed and sensitivity and specificity of parathyroid hormones in predicting hypocalcaemia was calculated and ROC curve plotted.

Results: The sensitivity we found out was that pre-closure PTH assay in predicting hypocalcemia is 100% and specificity 96%. After analyzing the ROC curve we found out that if the lower value of pre-closure PTH is taken as 9.05 pg/ml the test has 100% sensitivity and specificity.

Conclusion: Pre closure PTH assay is an excellent investigation to predict post-operative hypocalcaemia in patients undergoing thyroidectomy.

Keywords: Post-operative, Pre closure Parathyroid Hormone assay, Hypocalcemia, Thyroidectomy sensitivity, specificity

INTRODUCTION

Hypocalcaemia is a feared complication after total thyroidectomy.¹ Transient asymptomatic hypocalcaemia occurs in most patients undergoing thyroidectomy. Acute symptomatic hypocalcaemia and or permanent hypocalcaemia were once quite common with thyroid surgery especially in patients having total thyroidectomy. Symptoms of acute postoperative hypocalcaemia usually develop from 1-7 days postoperatively. If untreated,

carpal pedal spasm, tetany and life threatening cardiac arrhythmias may occur.² Symptom occurrence is variable and depends on the rate and decrement of the drop in ionized calcium.

PTH regulates serum calcium levels through its effects on bone, kidney, and intestine. Normal total plasma calcium level ranges from 8.5 to 10.5 mg/dl. By assessing PTH values it is able to predict hypocalcemia.³

Aim

To find the sensitivity and specificity of pre-closure PTH in predicting post-operative hypocalcemia

METHODS

Study design

Case control study (based on STARD guidelines)

Study setting

Department of surgery Medical College Thiruvananthapuram

Study period

1 year

Study population

40 patients who have undergone different thyroidectomy procedures during one year study period with post-operative hypocalcemia, pre closure PTH value assayed and who satisfied definite inclusion and exclusion criteria were selected. 100 patients without post-operative hypocalcemia were selected randomly with definite inclusion and exclusion criteria for controls.

Inclusion criteria

- Patients' undergone total, near total or completion thyroidectomy
- Patients who had undergone pre-closure parathormone assay
- Patients who had undergone calcium monitoring in the first three post- operative days.
- Patients with no previous history of parathyroid disease, or hypocalcemia
- Surgeries done by the same surgeon

Exclusion criteria

- Patients not monitored with PTH and Calcium assays
- Previous history of any parathyroid disease
- Patients with medical renal disease
- Patients taking any oral calcium
- Intervention

The pre-closure PTH levels were obtained just before wound closure using the electrochemilumescence immunoassay. Ionized calcium (Ca²⁺) levels were assessed postoperatively and on postoperative day 1, day 2 and day 3. All patients were clinically evaluated for signs and symptoms of hypocalcemia. Patients who developed tetany were treated with intravenous calcium in addition to oral supplementation.

Ethical committee clearance was obtained from the institutional ethical committee

The observations and data collected were coded and fed into the computer using MS Excel and analyzed using SPSS V 19 with the assistance of a statistician. Descriptive statistics such as mean, standard deviation and percentage was used. To find association chi square test was used.

RESULTS

A total of 140 patients are taken for this study above the age of 13 years who underwent near total thyroidectomy, total thyroidectomy, completion thyroidectomy in department of general surgery medical college, Trivandrum during one year were studied.

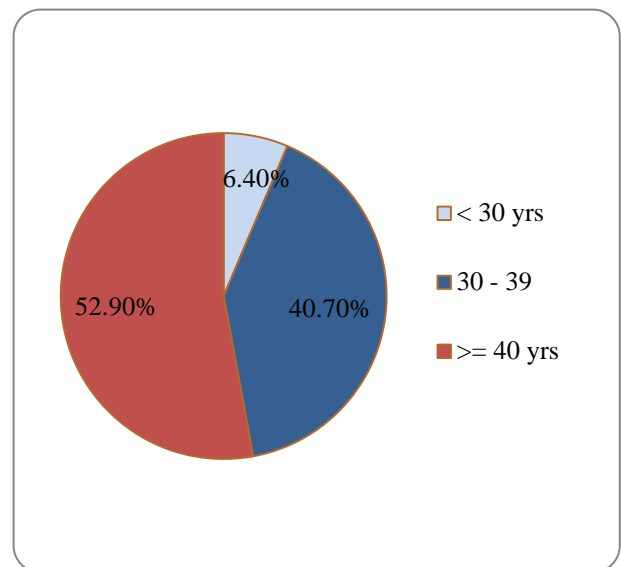


Figure 1: Distribution of age in study population.

There was female preponderance in the distribution of cases.

Table 1: Distribution of gender in the study population.

Gender	N (%)
Male	25 (17.90)
Female	115 (82.10)
Total	100

Table 2: Indication for thyroidectomy.

Indication for thyroidectomy	N (%)
Multi nodular goitre	84 (60)
Malignant	31 (22.10)
Thyroiditis	25 (17.90)
Total	100

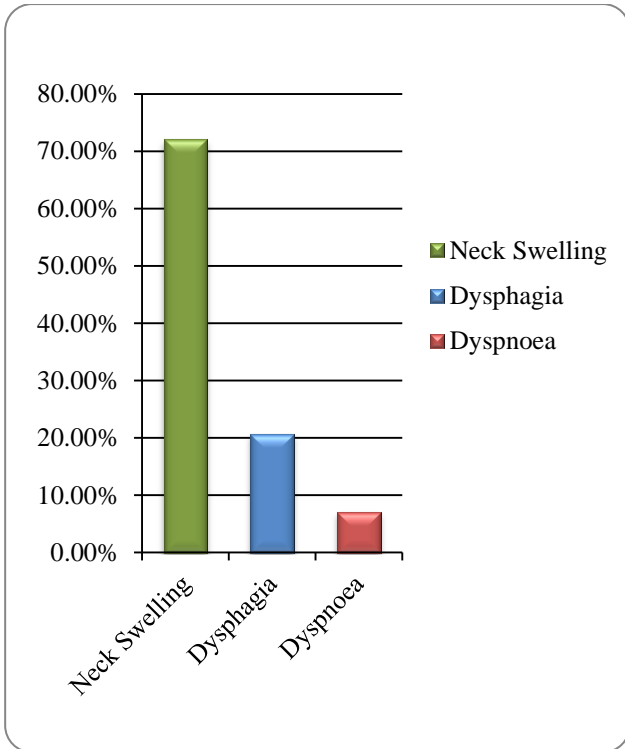


Figure 2: Presenting complaints.

Majority of patients presented with swelling in front of neck, followed by dysphagia and dyspnea.

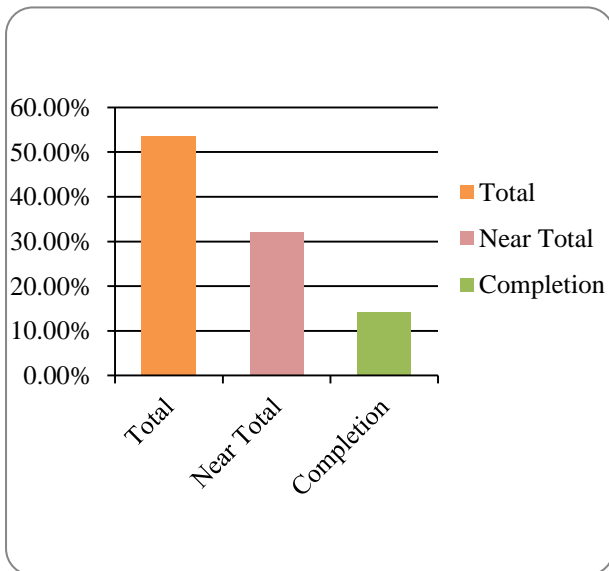


Figure 3: Type of thyroidectomy.

Table 3: Pre closure PTH levels (pg/ml).

Pre closure PTH Levels	N (%) (PTH levels)	N (%) (PTH levels)
Low	43 (30.70) (<10)	40 (28.60) (<9)
High	97 (69.30) (≥10)	100 (71.40) (≥9)
Total	100	100

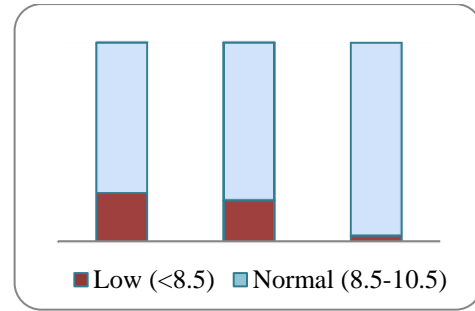


Figure 4: Post-operative calcium levels during first three post-operative days.

Table 4: Post-operative day on which hypocalcemic symptoms appeared.

Post-operative day on hypocalcemic symptoms appeared	N (%)
First day	16 (40.0)
Second day	20 (50.0)
Third day	4 (10.0)
Total	40 (100)

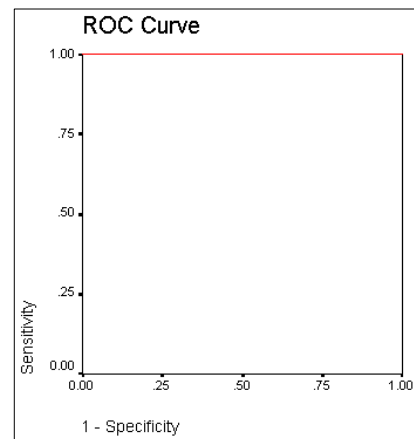


Figure 5: ROC curve to study sensitivity and specificity.

Table 5: Table with sensitivity and specificity.

Positive if ≥	Sensitivity	1 - Specificity	Specificity
8.25	1	0.15	0.85
8.55	1	0.13	0.88
8.75	1	0.10	0.90
8.85	1	0.05	0.95
9.05	1	0.00	1.00
9.25	0.99	0.00	1.00
9.40	0.98	0.00	1.00
9.85	0.97	0.00	1.00
10.50	0.96	0.00	1.00
10.95	0.94	0.00	1.00
11.15	0.93	0.00	1.00
11.55	0.92	0.00	1.00

Table 6: Post-operative calcium levels on first three post-operative days.

Pre closure PTH levels	Post-operative calcium levels - first day		Post-operative calcium levels - second day		Post-operative calcium levels - third day	
	Low (<8.5)	Normal (8.5-10.5)	Low (<8.5)	Normal (8.5-10.5)	Low (<8.5)	Normal (8.5-10.5)
Low (<10)	34	9	28	15	4	32
	100.0%	8.5%	96.6%	13.5%	57.14%	24.06%
Normal (10-54)		97	1	96	3	101
		91.5%	3.4%	86.5%	42.85%	75.93%
Total	34	106	29	111	7	133
Chi square	112.264; P <0.001		82.826; P <0.001		65.039; P <0.001	

Table 7: Relation between PTH levels and calcium levels.

Pre closure PTH levels	Hypocalcemia		Total	Pre closure PTH levels	Hypocalcemia		Total
	Absent	Present			Absent	Present	
Low (<10)	3	40	43	Low (<9)	40	40	
	3.00%	100.00%	30.70%		100%	28.6%	
Normal (10-54)	97		97	High (≥9)	100	100	
	97.00%		69.30%		100%	71.4%	
Total	100	40	140	Total	100	40	
Chi square	126.326; P <0.001			Chi square	126.239; P <0.001		

DISCUSSION

Thyroid disorders are a major endocrine disorders worldwide. It has been estimated that 42 million Indians are affected by thyroid disorders.⁴

Sex distribution

Thyroid disorders, both benign and malignant are found more commonly in females in this study. We included 140 patients for our study; only 25 patients (17.9%) were males. 115 patients (82.1%) were females. This shows that thyroid disorders are common in females. This is in accordance with previous studies.^{5,6}

Age distribution

In our study it shows that most of the patients were between the age group of 40 and above. This shows most of people who comes for thyroid surgery belongs to the middle and older aged group among the 140 patients 9 patients (6.4%) were less than 30 years, 57 patients (40.7%) were between 30- 39 years.

74 patients (52.9%) were greater than or equal to 40 years. Though we know that thyroid disorders can occur in any age group from neonates to old age the finding of our study may be due to the fact that the surgical management is opted more in case of elderly age groups.

Indication for thyroidectomy

Most common indication for thyroidectomy was multinodular goiter (60%). Next common indication we found was thyroiditis. 25 patients (17.9%) had history of thyroiditis which was found to be increasing in incidence in people of Kerala according to the current literature. 31 patients (22.1%) had history of malignant goiter. In a similar study in western India, multinodular goiter was 47.3%, uninodular 39%, diffuse in 13.7% hyperthyroidism in 14.6%.⁷

Types of thyroidectomy

Most common type of thyroidectomy done was total thyroidectomy. The reason for this may be most of the current literature supports doing total thyroidectomy for multinodular goiter patients as it decreases recurrence.

75 patients (53.6%) underwent total thyroidectomy, 45 patients (32.1%) underwent near total thyroidectomy. 20 patients (14.3%) underwent completion thyroidectomy. This was comparable to previous studies.⁷

Near total thyroidectomy is also practiced now days as it can decrease the incidence of hypothyroidism in thyroidectomy patients.

Completion thyroidectomy is done mainly for patients who found to have occult malignancy in the resected lobe

or histopathology report coming as follicular adenoma and in patients who had recurrence of MNG in the contralateral lobe.

Pre closure PTH levels

Pre closure PTH levels were being assessed by taking a peripheral blood sample just before closure of thyroidectomy wound. As PTH half-life is around 4 minutes if the parathyroid is destroyed the levels will surely fall before wound closure. We have taken two cut off value 10 and 9 pg/ml as the lower limit of PTH. The study showed that Pre closure PTH levels <10 pg/ml in 43 patients (30.7%) normal PTH in 97 patients (69.3%). Pre closure PTH levels <9 pg/dl in 40 patients (26.6%). 100 patients have pre closure PTH levels \geq 9 mg/dl.

The sensitivity we found out was pre-closure PTH assay in predicting hypocalcemia is 100% and sensitivity 96%. After analyzing the ROC curve we found out that if the lower value of pre-closure PTH is taken as 9.05 pg/ml the test has 100% sensitivity and specificity. P value (<0.0001) for the test is significant for both values i.e. <9 and <10 pg/dl.

In a previous study described in literature, sensitivity was 100% specificity was 71.7% with a positive predictive value of 55.2% and negative predictive value of 100% when Serum PTH value was assayed after one hr. of surgery cutoff of 16 pg/dl was taken to predict hypocalcemia.⁸

So if pre closure PTH assay is done in thyroidectomy patients we will be able to predict accurately which patients will develop hypocalcemia in the post op period with 100% specificity. With 96% sensitivity we will be able to predict who will not develop hypocalcemia. And if the lower limit of pre closure PTH levels is taken as 9.05 pg/ml we will be able to predict hypocalcemia with 100% sensitivity and specificity.

So we can accurately predict hypocalcemia in patients in post thyroidectomy patients.

CONCLUSION

Pre closure PTH assay is 100% specific and 96% sensitive in predicting post-operative hypocalcaemia.

Abbreviations

PTH - Para thyroid hormone

STARD - Standards for the reporting of diagnostic accuracy studies

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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DOI: 10.5455/2320-6012.ijrms20140834

Cite this article as: Viswanathan KV, Viswanathan M, Jithunath MR. Pre-closure parathyroid hormone assay in predicting post-operative hypocalcemia. Int J Res Med Sci 2014;2:920-4.