



Measurement of Parathyroid Hormone Level after Total Thyroidectomy in Prediction of Hypocalcaemia

Gobinda Chandra Saha¹, Mohammad Ziaur Rahman², Md. Shoeb-Ur-Rashid³,
Chhamita Sultana Chhanda⁴, Debashis Dey⁵

Article information

Received: 28-02-2022

Accepted: 15-06-2022

Cite this article:

Saha GC, Rahman MZ, Rashid MSU, Chhanda CS, Dey D. Measurement of Parathyroid Hormone Level after Total Thyroidectomy in Prediction of Hypocalcaemia. *Sir Salimullah Med Coll J* 2022; 30: 103-107

Key words:

Parathyroid dysfunction, symptomatic hypocalcemia, total thyroidectomy, parathormone (PTH), serum calcium level.

Abstract:

Background: Parathyroid dysfunction leading to symptomatic hypocalcemia is not uncommon following a total or completion thyroidectomy and is often associated with significant patient morbidity and a prolonged hospital stay.

Objectives: To investigate whether postoperative parathyroid hormone level is a parameter to identify hypocalcaemia after total thyroidectomy.

Methods: This prospective longitudinal study was carried out with variety of thyroid disorders with indication of total thyroidectomy at BSMMU. Total 103 patient were selected following the inclusion and exclusion criteria. The routine clinical assessment and the preoperative laboratory investigations of the study population were performed before operation. Preoperative and postoperative levels of serum PTH and serum calcium level were measured.

Results: Immediate post-operative period 17(16.50%) patients PTH level were low (<14 pg/ml). The mean PTH in immediate post-operative was 36.79±21.71 pg/ml. Regarding the distribution of the study patients by serum calcium, it was observed that 20.39% patients belonged to low (<8 mg/dl) serum calcium. The mean serum calcium level was 8.47±1.19 (mg/dl) with ranged from 2.1 to 10.6 (mg/dl). Among the study population 11 patient developed symptomatic hypocalcemia. Most 72.7% the patient, symptomatic hypocalcemia developed after 48 hours of operation.

Conclusion: Hypocalcaemia after total or completion thyroidectomy is not uncommon in our population. If we measure a single parathyroid hormone level in postoperative period that can reflect early result and help to take necessary measure to avoid hypocalcaemic effect. Low intraoperative PTH levels during thyroid surgery are therefore a feasible predictor of postoperative hypocalcemia.

Introduction:

Post thyroidectomy hypocalcemia is a common complication that may be transient in 10–50% of patients or permanent in 0.5-10.6% of patients.¹ Hypocalcemia typically at around 24-48h post operative but may be as delayed as 4th post-operative day.² Patient have to be observed for this time period prior to discharge in order to prevent the development of clinically significant hypocalcemia, and this significantly lengthens hospital stay.³ Despite recent developments in surgical technique

and every effort of surgeons to preserve as many parathyroid glands as possible, early postoperative hypocalcemia and hypoparathyroidism still remain a great challenge, so prediction of hypocalcemia after total thyroidectomy is important for early treatment in order to avoid troublesome symptoms and ensure safe discharge.

Because of its relatively slow decline, measuring plasma calcium levels just after thyroid surgery is of little value in predicting the onset of subsequent hypocalcemia or symptoms. The search for early

1. Professor and Head of the Department, Department of Surgery, Sir Salimullah Medical College, Dhaka, Bangladesh.
2. MS (Resident), Department of General Surgery, Bangabandhu Sheikh Mujib Medical University Shahbagh, Dhaka, Bangladesh.
3. Junior consultant, Department of Burn & Plastic Surgery, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh.
4. MD (Resident), Department of Anesthesia, Dhaka Medical College, Dhaka, Bangladesh.
5. Assistant professor, Department of Surgery, Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh.

Address of Correspondence: Prof. Dr. Gobinda Chandra Saha, Head of The Department of Surgery, Sir Salimullah Medical College, Dhaka, Bangladesh. Phone: +8801819134530; E-mail:prof.gcs@gmail.com ORCID: 000-0001-7194-1770

risk factors predicting hypocalcemia has focused interest on the post-operative monitoring of parathormone (PTH) because of its short half-life ranging from 2 to 5 minutes.⁴ Measurement of total serum calcium is less expensive, but it may be inaccurate because of post-operative haemodilution and it poorly predicts symptomatic hypocalcemia.⁵

To predict post-thyroidectomy hypocalcemia, the use of post-operative serum PTH was recommended with a sensitivity ranging from 64% to 100% and a specificity ranging from 72% to 100%.⁶ One-hour post-operative PTH drop to 70% or more had a negative predictive value of 97%.⁷ Comparing pre-operative to 10 minute post-operative PTH percent change, patients with a greater than 75% decrease are likely to have hypocalcemia with sensitivity of 100%.⁸ There is no consensus regarding what is considered the gold standard for testing of hypocalcemia complicating thyroid surgery.

The purpose of this study was to evaluate whether PTH level within one hour was a reliable marker to identify those patients at risk of developing hypocalcemia. It may help in the identification, prevention, and treatment of hypocalcemia in patients after total thyroidectomy.

Material and Methods:

This prospective longitudinal study was carried out at the General Surgery and Otolaryngology Department of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, from September 2018 to August 2019. A total of 103 patients with a variety of thyroid disorders with an indication of total thyroidectomy were selected in this study.

Inclusion criteria: 1. Thyroid disorders with an indication of total thyroidectomy, irrespective of cause (Benign/Malignant). 2. Both genders.

Exclusion criteria: 1. A patient who has previously undergone neck surgery (other than thyroid surgery). 2. Patients who had previously taken exogenous calcium or vitamin D prior to surgery. 3. Any patients with an underlying parathyroid disorder or renal impairment in addition to their thyroid condition should be evaluated.

Study Procedure: Blood samples were collected from a peripheral vein in the preoperative period, immediate post-operative, 24 hours, 48 hours, and 72 hours after surgery and sent to the laboratory for further processing. In the laboratory, the blood samples were allowed to clot, and then centrifuged at 3,500 rpm for 5 minutes for the separation of serum. Then the serum was frozen at -40°C until assessment. However, during the study, the surgeon

monitored, assessed, and managed the patients. The eventual discharge of the patients was based on regular calcium level measurement at 24 hours, 48 hours, and 72 hours after surgery and observation for clinical symptoms of hypocalcemia. Statistical analysis was carried out using the Statistical Package for Social Sciences version 22.0 for Windows. The data was expressed in tables and charts.

Result:

The mean age was 41.72 ± 12.12 years, with a range of 7 to 80 years, and 38 (36.89%) patients were between the ages of 41 and 50. Male to female ratio was 1:3.29. The mean preoperative PTH level was 45.41 ± 15.56 pg/ml and ranged from 0.8 to 98 pg/ml. In 39 (38%) patients Preoperative serum PTH levels ranged from 35 to 49 pg/ml. Among 103 patients, 11(10.67%) patients were symptomatic hypocalcemia.

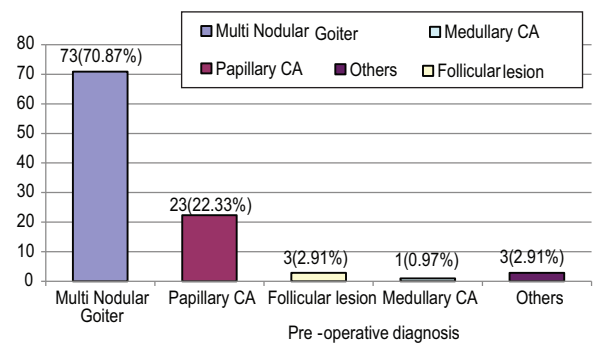


Fig.-1: Pre-operative diagnosis of the study populations (n=103).

Among the study population, 73 (70.87%) patients had multi-nodular goiter, followed by 23 (22.33%) in papillary CA, 3 (2.91%) in follicular lesion, 1 (0.97%) in medulla CA, and 3 (2.91%) in others.

Table I. Distribution of the study populations by PTH immediate postoperative period. (n=103)

PTH level (pg/ml)	Number of Patients	Percentage
Low <14	17	16.50
Normal 14-74	78	75.73
High >74	8	7.77
Mean \pm SD	36.79 \pm 21.71	
Range (min-max)	0.2-111.3 -	

PTH was low (14 pg/ml) immediately after surgery in 17 (16.50%) patients. The mean PTH within 1 hour of operation was 36.79 ± 21.71 pg/ml and ranged from 0.2 to 111.3 pg/ml

Table II: Comparison of PTH between Pre-Operative and post operatively (n=103).

Pre-Operative PTH Level (Mean \pm SD)	Immediate post-operative (Mean \pm SD)	P value
45.41 \pm 15.56 (pg/ml)	36.79 \pm 21.71 (pg/ml)	0.001 ^s
	24 H after thyroidectomy(Mean \pm SD)	
	38.27 \pm 18.71 (pg/ml)	0.001 ^s
	48 H after thyroidectomy(Mean \pm SD)	
	41.41 \pm 17.6 (pg/ml)	0.001 ^s

P-value reached from paired t-test.

Pre-operatively, the mean PTH level was 45.41 \pm 15.56 pg/ml. The mean PTH levels were 36.79 \pm 21.71 pg/ml immediately after surgery, 38.27 \pm 18.71 pg/ml 24 hours later, and 41.41 \pm 17.6 pg/ml 48 hours later, respectively. The difference was statistically significant (p<0.05).

Table III: Comparison of Serum Calcium Level between Pre-Operative and post operatively (n=103).

Pre-Operative (Mean \pm SD)	Immediate post-operative (Mean \pm SD)	P value
8.87 \pm 0.56 (mg/dl)	8.65 \pm 0.86(mg/dl)	0.032 ^s
	24 H after thyroidectomy (Mean \pm SD)	P value
	8.86 \pm 0.68(mg/dl)	0.864 ^{ns}
	48 H after thyroidectomy (Mean \pm SD)	P value
	8.78 \pm 0.71(mg/dl)	0.305 ^{ns}
	72 H after thyroidectomy (Mean \pm SD)	
	8.76 \pm 0.79(mg/dl)	0.246 ^{ns}

P-value reached from paired t-test

Pre-operatively, the mean calcium level was 8.87 \pm 0.56 mg/dl. Immediate, 24 hours, 48 hours, and 72 hours after operation, the mean calcium levels were 8.65 \pm 0.86 mg/dl, 8.86 \pm 0.68 mg/dl, 8.78 \pm 0.71 mg/dl and 8.76 \pm 0.79 mg/dl, respectively. Only the immediate postoperative value was statistically significant. (p<0.05).

Table IV: Distribution of the study populations by immediate post-operative serum calcium (n=103)

Serum Calcium (mg/dl)	Number of Patients	Percentage
Low <8	21	20.39
Normal 8-10	81	78.64
High >10	1	0.97
Mean \pm SD	8.47 \pm 1.193	
Range (min-max)	2.1-10.6	

It was observed that 21(20.39%) patients belonged to low (<8 mg/dl) serum calcium, 81(78.64%) was normal and 1(0.97%) was high serum calcium level. The mean serum calcium level was 8.47 \pm 1.19 (mg/dl) with ranged from 2.1 to 10.6 (mg/dl).

Table V: Distribution of the study populations by symptomatic hypocalcemia developing time (n=11)

Developing time of hypocalcemia	Number of Patients	Percentage
After 24 hours of total thyroidectomy	1	9.1
After 48 hours of total thyroidectomy	8	72.7
After 72 hours of total thyroidectomy	2	18.2

Total symptomatic hypocalcaemic patients were 11. Hypocalcaemia developed in 1 (9.1%) during the first 24 hours after total thyroidectomy. 8 (72.7%) were developed after 48 hours of total thyroidectomy, and 2 (18.2%) were developed after 48 hours of total thyroidectomy.

Discussion:

Post thyroidectomy hypocalcemia is a common complication that may be transient in 10–50% of patients or permanent in 0.5–10.6% of patients. So patients have to be observed for this time period prior to discharge in order to prevent the development of clinically significant hypocalcemia, which would significantly lengthen hospital stay. Despite recent developments in surgical technique and every effort by surgeons to preserve as many parathyroid glands as possible, early postoperative hypocalcemia and hypoparathyroidism still remain a great challenge.

In this study, a total of 103 cases were evaluated. The mean age was 41.72 ± 12.12 years, ranging from 13–18 years. In another study by Lo et al. (2002) the median age was reported at 42 years, which is closer to this study.⁸ McHenry et al. (1994) mean age of the study was 45.5 ± 11.8 which is to some extent higher than this study.⁹ Islam et al. (2012) reported that the mean age was 39 ± 13.18 with a range of 15 to 75 years, which is similar to our study.¹⁰

Among the study population, 73(70.78%) patients were found benign (MNG) and 30 (29.22%) patients were treated for malignant disease. The result is similar to Quiros et al. (2005)¹¹

In our study, the pre-operative mean value of PTH was 45.41 ± 15.56 pg/ml and immediately after operation, the mean PTH level was 36.79 ± 21.70 pg/ml, which was statistically significant ($P=0.001$). Mehrvarz et al. (2014) found that the mean PTH was 96.23 ± 53.54 pg/ml before surgery; the difference was significant, which is consistent with the current study.¹²

In this study, it was discovered that PTH levels of 17 (16.50%) patients were lower than normal (14

pg/ml) in the immediate post-operative period. Islam et al. (2012) found intraoperative PTH was 15 pg/lm in 27 cases and > 15 pg/ml in 38 cases.¹⁰

In our study, 21 (20.39%) patients serum calcium level were below normal range. Among them symptomatic hypocalcaemia was found in 11 (10.67%). Le et al. (2014) reported that transient hypocalcaemia was found in 10–50% of patients, which is consistent with our study.¹ In our study, post-operative hypocalcaemia was discovered 24 hours, 48 hours, and 72 hours after surgery. Out of 11, 8 were found 48 hours after total thyroidectomy. It is similar to the study by Roh and Park (2006).¹³

Ghaheri et al. (2006) concluded that low PTH level correlated with post-operative hypocalcaemia.¹⁴ Proczko-Markuszczyńska et al. (2010) PTH levels were assessed and a strong correlation was found between PTH levels measured in the immediate post-operative period and the development of hypocalcaemia. (pearson coefficient $r= 0.73$, $P<0.05$).¹⁵ In our present study, PTH was statistically significant ($P<0.05$) in the post-operative group. Immediate post-operative PTH levels were assessed and a significant correlation was found between immediate post-operative PTH levels and the development of hypocalcaemia after 24 hours and 48 hours of total thyroidectomy.

Conclusion:

Concomitant parathyroid hormone (PTH) and serum calcium measurements are evaluated in predicting hypocalcemia after total thyroidectomy. It can be inferred that postoperative hypocalcemia is a common complication of total thyroidectomy. Parathyroid hormone (PTH) levels assessed in pre-operative, immediate post-operative, and 24 hours after total thyroidectomy were assessed to predict

the development of hypocalcemia.

Limitations: Purposive sampling was done. Only the biochemical value of total calcium was measured, but if an ionized calcium value could be detected, that would be more authentic. It was a center study. If a multicentric study was done, it would be a more representative population-based study.

Conflict of interest: none.

References:

1. Le TN, Kerr PD, Sutherland DE, et al. Validation of 1-hour post-thyroidectomy parathyroid hormone level in predicting hypocalcemia. *J of Otolaryngol - Head & Neck Surg* 43, 5 (2014). doi.org/10.1186/1916-0216-43-5.
2. Roh JL, Park CI. Routine oral calcium and vitamin D supplements for prevention of hypocalcemia after total thyroidectomy. *Am J Surg.* 2006 Nov;192(5):675-8. doi: 10.1016/j.amjsurg.2006.03.010. PMID: 17071205.
3. Sarkar A, Jana S, Basak B, Gayen GC, Sit S, Sarkar A. Evaluation of clinically significant hypocalcemia after total thyroidectomy: a prospective study. *International Journal of Current Research and Review*, 2014; 6(23), p.5.
4. Lombardi CP, Raffaelli M, Princi P, Dobrinja C, Carrozza C, Di Stasio E, D'Amore A, Zuppi C, Bellantone R. Parathyroid hormone levels 4 hours after surgery do not accurately predict post-thyroidectomy hypocalcemia. *Surgery.* 2006 Dec;140(6):1016-23; discussion 1023-5. doi: 10.1016/j.surg.2006.08.009. Epub 2006 Nov 1. PMID: 17188152.
5. Lindblom P, Westerdahl J, Bergenfelz A. Low parathyroid hormone levels after thyroid surgery: a feasible predictor of hypocalcemia. *Surgery.* 2002 May;131(5):515-20. doi: 10.1067/msy.2002.123005. PMID: 12019404.
6. Kwon Y-H, Lee KE, Kwon H, Choi JY, Koo DH, Kim E, Youn YK. Preoperative parathyroid hormone level as a predictive factor for post-thyroidectomy hypoparathyroidism. *Korean Journal of Clinical Oncology.* 2013; 9(1), pp.28-32.
7. Sands N, Young J, MacNamara E, Black MJ, Tamilia M, Hier MP, Payne RJ. Preoperative parathyroid hormone levels as a predictor of postthyroidectomy hypocalcemia. *Otolaryngol Head Neck Surg.* 2011 Apr;144(4):518-21. doi: 10.1177/0194599810395114. Epub 2011 Feb 18. PMID: 21493227.
8. Lo CY, Luk JM, Tam SC. Applicability of intraoperative parathyroid hormone assay during thyroidectomy. *Ann Surg.* 2002;236(5):564-569. doi:10.1097/00000658-200211000-00005
9. McHenry CR, Speroff T, Wentworth D, Murphy T. Risk factors for post-thyroidectomy hypocalcemia. *Surgery.* 1994 Oct;116(4) 641-7; discussion 647-8. PMID: 7940161.
10. Islam, M., Sultana, T., Paul, D., Huq, A., Chowdhury, A., Ferdous, C., & Ahmed, A. (2013). Intraoperative serum parathyroid hormone level is an indicator of hypocalcaemia in total thyroidectomy patients. *Bangladesh Medical Research Council Bulletin*, 38(3), 84–89. doi.org/10.3329/bmrcb.v38i3.14331
11. Quiros RM, Pesce CE, Wilhelm SM, Djuricin G, Prinz RA. Intraoperative parathyroid hormone levels in thyroid surgery are predictive of postoperative hypoparathyroidism and need for vitamin D supplementation. *Am J Surg.* 2005 Mar;189(3):306-9. doi: 10.1016/j.amjsurg.2005.01.006. PMID: 15792756.
12. Mehrvarz S, Mohebbi HA, Kalantar Motamedi MH, Khatami SM, Rezaie R, Rasouli HR. Parathyroid hormone measurement in prediction of hypocalcaemia following thyroidectomy. *J Coll Physicians Surg Pak.* 2014 Feb;24(2):82-7. doi: 02.2014/JCPSP.8287. PubMed PMID: 24490999.
13. Roh JL, Park CI. Routine oral calcium and vitamin D supplements for prevention of hypocalcemia after total thyroidectomy. *Am J Surg.* 2006 Nov;192(5):675-8. doi: 10.1016/j.amjsurg.2006.03.010. PMID: 17071205.
14. Ghaheri BA, Liebler SL, Andersen PE, Schuff KG, Samuels MH, Klein RF et al. Perioperative parathyroid hormone levels in thyroid surgery. *Laryngoscope.* 2006 Apr;116(4):518-521. doi.org/10.1097/01.MLG.0000202617.63668.CC
15. Proczko-Markuszevska M, Kobiela J, Stefaniak T, Łachiński A, Ćeledziński Z. Postoperative PTH measurement as a predictor of hypocalcaemia after thyroidectomy. *Polish Journal of Surgery*, 2010;.82(1), pp.24-28.