



ORIGINAL ARTICLE

Decreased level of pre-operative vitamin D in a patient who is undergoing total thyroidectomy is an early indicator of post-operative hypocalcemia.

Hadia Wali¹, Shayan Shahid Ansari², Syed Mohammad Usama³, Syed Usman Mahmud⁴

Article Citation: Wali H, Ansari SS, Usama SM, Mahmud SU. Decreased level of pre-operative vitamin D in a patient who is undergoing total thyroidectomy is an early indicator of post-operative hypocalcemia. Professional Med J 2024; 31(01):18-22.
<https://doi.org/10.29309/TPMJ/2024.31.01.7746>

ABSTRACT... Objective: To investigate the viability of utilizing preoperative serum vitamin D levels as a predictor of postoperative transient hypocalcemia in patients who were undergoing total thyroidectomy in our population. **Study Design:** Prospective Observational study. **Setting:** Shifa International Hospital Islamabad, Pakistan. **Period:** 1st July 2020 to 30th June 2022. **Material & Methods:** All the data was collected prospectively. Patients are divided into two groups depending on the pre-operative vitamin D levels. The preoperative vitamin D levels are checked on the day of admission before the surgery. After the surgery, their post-operative serum calcium levels are checked at 6 hours, 24 hours and 48 hours. Intact PTH levels are also checked after the surgery and correlation of transient hypocalcemia with intact PTH levels is also checked. **Results:** Our results strongly predict that serum Vitamin D levels and intact parathyroid hormone (PTH) levels are diagnostic indicators of transient hypocalcemia in post thyroidectomy patients. **Conclusion:** Our study shows: Pre-operative vitamin D is an early indicator of hypocalcemia in post-thyroidectomy patients. Serum intact parathyroid hormone levels is an early indicator of hypocalcemia in post-thyroidectomy patients.

Key words: Diagnostic, Parathyroid, Thyroidectomy, Transient Hypocalcemia, Vitamin-D.

INTRODUCTION

It is well established that total thyroidectomy is the definitive therapeutic strategy for patients with multinodular goiter causing compressive symptoms, suspicious thyroid nodules, hyperthyroid refractory to medical management.¹ The complications that occur significantly after thyroid surgery are transient hypocalcemia, recurrent laryngeal nerve palsy, and hematoma formation.

The rate of transient hypocalcemia following thyroidectomy is 27.4%, while the incidence of permanent hypocalcemia after thyroidectomy is 12.1%, according to a report from the British Association of Endocrine and Thyroid Surgeons.²

Postoperative hypoparathyroidism is the result of damage to the parathyroid glands that occurs as a consequence of complete thyroidectomy. This damage may occur as a result of accidental

excision, direct damage, or devascularization.³ According to the findings of one study that involved 143 patients, 49% of patients experienced hypocalcemia in the first 24 hours following surgery, while 63.6% of patients experienced it 48 hours after surgery.⁴

Hypocalcemia has repercussions not only for the health of patients but also for the financial costs of medical care, which rises as a result of a prolonged postoperative hospital stay. Hypocalcemia can be asymptomatic or it may have wide variety of clinical presentations.⁵ Other clinical presentations include tetany, paresthesia, Chvostek's sign (neuromuscular excitability), and psychiatric manifestations (anxiety, and depression).⁶

In addition, vitamin D has a crucial role in calcium homeostasis. There has been equivocal evidence

1. MBBS, Post Graduate Trainee ENT, Shifa International Hospital, Islamabad.
2. MBBS, FRCS, Consultant ENT Shifa International Hospital, Islamabad.
3. MBBS, Medical Officer, Shifa International Hospital, Islamabad.
4. MBBS, Medical Officer, Shifa International Hospital, Islamabad.

Correspondence Address:

Dr. Hadia Wali
Department of ENT
Shifa International Hospital, Islamabad.
hadia.wali.khan@gmail.com

Article received on: 13/07/2023

Accepted for publication: 03/10/2023

regarding the influence of preoperative vitamin D levels on post-operative hypocalcemia as shown in Table-I.

Study	Type	Number of Patients	Results
Talal Al-Khatib MD, et al. Dec 2014. ⁷	Retrospective cohort study	213	Positive predictor
Yuan Qin, et al. Feb 2021. ⁸	Meta-analysis	22,940	Positive predictor
Brian Hung-Hin Lang, et al. Jul 2013. ⁹	Cohort study	281	Not significant predictor
Carlos Segundo Paiva Soares, et al. Feb 2021. ¹⁰	Prospective study	47	Not significant predictor
Gurdeep Singh, et al. Apr 2021. ¹¹	Retrospective study	244	Not significant predictor

Table-I. Showing literature review with references.

In light of this, the primary purpose of our research was to investigate the viability of utilizing preoperative serum vitamin D levels as a predictor of postoperative transient hypocalcemia in patients who were undergoing total thyroidectomy in our population.

MATERIAL & METHODS

All the patients undergoing total thyroidectomy in the ENT Department of Shifa International Hospital, Islamabad from 1st July 2020 to 30th June 2022 by the same surgeon were included in our study. The indications of their surgery were recorded. The inclusion criteria is all the patients undergoing total thyroidectomy in the above two-year period. Whereas the exclusion criteria is the patients with chronic kidney diseases as it affects Vitamin D homeostasis.

All the data was collected prospectively after taking approval from the Institutional Review Board and Ethical committee under IRB No. 205-21.

Patients are divided into two groups depending on the pre-operative vitamin D levels. The 'group 1' has normal pre-operative vitamin D levels

whereas the 'group 2' has low pre-operative vitamin D levels.

The preoperative vitamin D levels are checked on the day of admission before the surgery. The normal vitamin D levels are 20-150ng/ml. The vitamin-D deficiency was defined as vitamin D levels below 20ng/ml.

After the surgery, their post-operative serum calcium levels are checked at 6 hours, 24 hours and 48 hours. The normal serum calcium levels are defined as 8.4 -10.2mg/dl. The level of serum calcium below 8.4mg/dl was considered deficient.

Intact PTH levels are also checked after the surgery and correlation of transient hypocalcemia with intact PTH levels is also checked. The normal value for intact parathyroid hormone lies between 15-65pg/ml.

Histological analysis of the thyroidectomy specimen is also recorded for any parathyroid tissue.

The analysis of the data is performed using IBM SPSS Statistics for Windows version 26. T-square test is utilized in the process of gathering descriptive statistics in order to evaluate the existence of any association between pre- and post-operative variables with the significance level set to 5%.

RESULTS

A total of 103 patients underwent total thyroidectomy over the period of two years at Shifa International Hospital, Islamabad. Indications of surgery are shown in Figure-1. Details of these patients are given in Table-II.

Our results strongly predict that serum Vitamin D levels and intact parathyroid hormone (PTH) levels are diagnostic indicators of transient hypocalcemia in post thyroidectomy patients.

Forty-five (45) patients developed transient hypocalcemia but none of our patients developed permanent hypocalcemia on 6 months follow-up. Histopathological analysis of these 45 patients

showed only one patient who had two parathyroid glands excised whereas other 44 patients did not have any parathyroid tissue in the histopathology specimen.

We also plotted graphs of patients with normal vitamin D levels against calcium levels the graph shows most of the patients above the line indicating normal calcium levels as below.

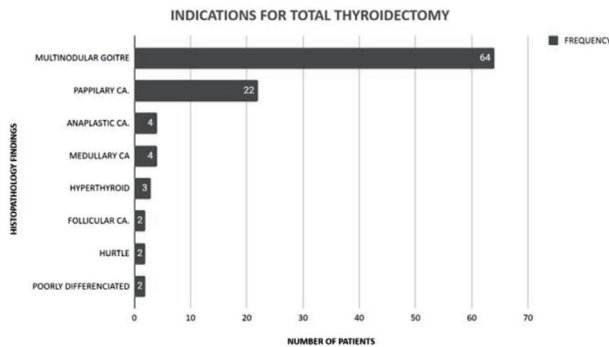


Figure-1. Indicators of total thyroidectomy.

Total patients (n)	103		
Age	Above 60: 37 Below 60: 66 Mean: 51 ± 16.9 Range: 13-88 years		
Gender	Male 23 (22%) Female 80 (78%)		
Vitamin D		Transient Hypocalcemia	P
	Group 1-Normal Vit D 50 pts	14 (28%)	>0.05
	Group 2-Low Vit D 53 pts	31 (58%)	
Parathyroid Hormone levels	Normal PTH levels 49 pts	6 (12%)	>0.05
	Low PTH levels 54 pts	39 (72%)	

Table-II. Demographic details and Vit-D levels

Figure-2. The scatter points representing the serum calcium with normal levels of Vitamin D. Red line indicates the cut off mark for normal value. Most patients were within normal range. Compare the fairly consistent results here with

the lack of uniformity in Figure-3

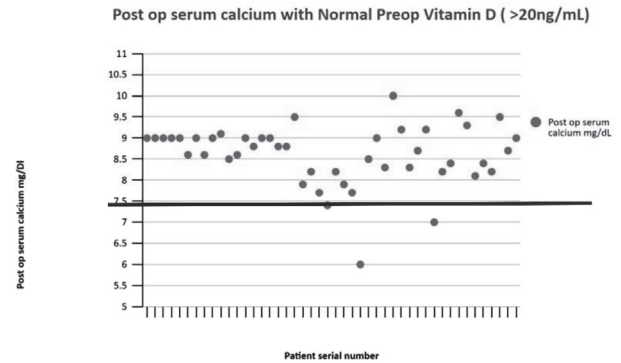


Figure-2. Pre-op serum calcium level.

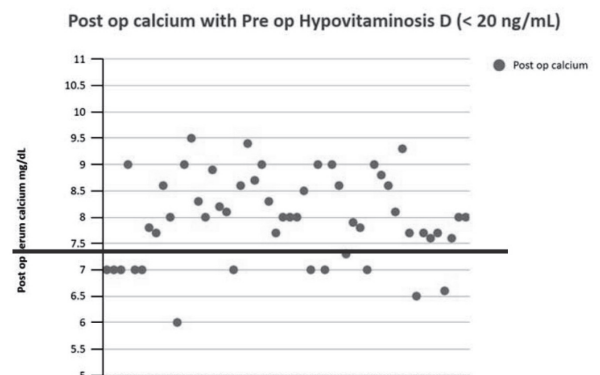


Figure-3. Post-operative serum calcium level.

Similarly plotted graphs of patients with low vitamin D levels against different calcium levels shows most of the patients below the line indicating normal calcium levels as below.

Figure-3. The most striking example of how pre existing low Vitamin D has a profound effect on serum calcium post surgery. Most patients were below the normal cut off mark as highlighted again with a red line

DISCUSSION

Hypocalcemia is an early complication after total thyroidectomy. Hypocalcemia can be transient or permanent. Causes of hypocalcemia after total thyroidectomy is thought to be multifactorial depending on surgical technique, disturbance to parathyroid hormone blood supply and iatrogenic damage to parathyroid gland, hyperthyroidism and number of identified parathyroid glands during surgery.¹²

Vitamin D plays a vital role in calcium metabolism by increasing absorption of calcium through

the gastrointestinal tract. A low level of vitamin D has a significant effect on calcium absorption and thus in hypocalcemia after total thyroidectomy. Hypocalcemia can be symptomatic or asymptomatic. It can manifest as palpitations, body aches, tetany, perioral or peripheral paresthesia. The study we conducted hypothesized that pre-operative values of vitamin D serves as a good indicator for post-operative hypocalcemia. Our data shows a significant relation between the two variables suggesting it serves as a good predictor.

Among complications associated with total thyroidectomy is iatrogenic injuries to the parathyroid gland. The parathyroid hormone (PTH) that has a vital role in calcium homeostasis. Due to its effect on calcium homeostasis we included PTH levels in our study. In the presence of PTH, vitamin D enhances renal and intestinal calcium resorption and bone demineralization.

Histopathology specimens served two purposes, first being diagnosis of thyroid tissue and secondly assessment for any parathyroid tissue damage. Most cases of damage to the parathyroid results in transient hypoparathyroidism and is self-resolving.¹³

Role of pre-operative vitamin D prediction for hypocalcemia will be beneficial if we want to supplement our patient with pre-operative prophylactic Vitamin D replacement as suggested by Mehreen et al.¹⁴

Our research is consistent with the pathophysiology of vitamin D involved in calcium absorption. This research opens up avenues in regards to the inclusion of dieticians and nutritionists.

CONCLUSION

Our study supports the following points:

- Pre-operative vitamin D is an early indicator of hypocalcemia in post-thyroidectomy patients.
- Serum intact parathyroid hormone levels is an early indicator of hypocalcemia in post-thyroidectomy patients.




Copyright© 03 Oct, 2023.

REFERENCES

1. Asban A, Anue A, Xie R, Chen H. **Increasing use of thyroidectomy as definitive treatment for hyperthyroidism.** Journal of Surgical Research. 2020 Feb 1; 246:435-41. DOI: 10.1016/j.jss.2019.09.020
2. Jamialahmadi T, Nematy M, Abdalla M, et al. **The predictive role of parathyroid hormone for nonalcoholic fatty liver disease following bariatric surgery.** J Nutr Metab. 2022; 2022:7319742. Published 2022 Feb 28. doi: 10.1155/2022/7319742
3. Calvo Espino P, Rivera Bautista JÁ, Artés Caselles M, et al. **Serum levels of intact parathyroid hormone on the first day after total thyroidectomy as predictor of permanent hypoparathyroidism.** Uso del valor de la hormona paratiroidea intacta en el primer día postoperatorio tras tiroidectomía total como predictor de hipoparatiroidismo permanente. Endocrinol Diabetes Nutr (Engl Ed). 2019; 66(3):195-201. doi: 10.1016/j.endinu.2018.08.006
4. Azadbakht M, Emadi-Jamali SM, Azadbakht S. **Hypocalcemia following total and subtotal thyroidectomy and associated factors.** Ann Med Surg (Lond). 2021; 66:102417. Published 2021 May 25. doi: 10.1016/j.amsu.2021.102417
5. Meesters K, Wassenberg T, Vanbesien J. **Hypocalcemia as a cause of complex febrile seizures in a toddler.** Case Rep Pediatr [Internet]. 2021 [cited 2022 Dec 27]; 2021:1798741. Available from: <https://pubmed.ncbi.nlm.nih.gov/34336337/DOI: 10.1155/2021/1798741>
6. Goyal A, Anastasopoulou C, Ngu M, Singh S. **Hypocalcemia.** In: StatPearls [Internet]. StatPearls Publishing 2023 Jan.
7. Al-Khatib T, Althubaiti AM, Althubaiti A, Mosli HH, Alwasiah RO, Badawood LM. **Severe vitamin D deficiency: A significant predictor of early hypocalcemia after total thyroidectomy.** Otolaryngol Head Neck Surg [Internet]. 2015; 152(3):424-31. doi.org/10.1177/0194599814561209
8. Qin Y, Sun W, Wang Z, Dong W, He L, Zhang T, et al. **A Meta-analysis of risk factors for transient and permanent Hypocalcemia after total thyroidectomy.** Front Oncol. 2020; 10. doi.org/10.3389/fonc.2020.614089
9. Lang BH, Wong KP, Cheung CY, Fong YK, Chan DK. **Hung Does preoperative 25-hydroxyvitamin D status significantly affect the calcium kinetics after total thyroidectomy?** World J Surg. 2013; 37:1592-8. DOI: 10.1007/s00268-013-2015-8

10. Soares CSP, Tagliarini JV, Mazeto GMFS. **Preoperative vitamin D level as a post-total thyroidectomy hypocalcemia predictor: A prospective study.** Braz J Otorhinolaryngol [Internet]. 2021 [cited 2022 Dec 27]; 87(1):85-9. Available from: <https://pubmed.ncbi.nlm.nih.gov/31492617/> DOI: 10.1016/j.bjorl.2019.07.001
11. Singh G, Irshaidat F, Lau C, Pedoeem A, Feng C, Fariduddin MM, et al. **Advancing the understanding of Vitamin D status in post-thyroidectomy hypocalcemia.** International Journal of Endocrinology. 2021; doi: 10.1155/2021/5598319
12. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4382813/>doi: 10.5152/UCD.2013.2438
13. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4466142/#:~:text=Iatrogenic%20injury%20of%20the%20parathyroid%20glands%20resulting%20in%20low%20postoperative,within%202%20months%20of%20surgery.https://www.ncbi.nlm.nih.gov/books/NBK499940/>
14. Mehreen Khan Bhattani, Mubarik Rehman, Moiz Ahmed, Humera Naz Altaf, Usama Khalid Choudry, Kamran Hakeem Khan, **Role of pre-operative vitamin D supplementation to reduce post-thyroidectomy hypocalcemia; Cohort study.** International Journal of Surgery. 72 (2019):7-8. doi.org/10.1016/j.ijsu.2019.08.035

AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Hadia Wali	Data collection, Manuscript writing, Editing, Result SPSS.	
2	Shayan Shahid Ansari	Main idea, Critical analysis, Editing, Proofreading.	
3	Syed Mohammad Usama	Data collection, Writing manuscript, Editing.	
4	Syed Usman Mahmud	Editing manuscript, SPSS	