

ORIGINAL ARTICLE

Correlation Between Pre-Operative Vitamin D Deficiency and Incidence of Hypocalcemia Following Total Thyroidectomy in Hyperthyroid PatientsGUL NAZ¹, MUHAMMAD RIZWAN², ZAHID RASHEED³, IMRAN ALI⁴, NATASHA KANWAL MIRZA⁵, MUHAMMAD KHURRAM JAMEEL⁶, FAWAD HAMEED⁷¹Senior Registrar Surgery, Ghulab Devi Hospital Lahore²Consultant General Surgeon, DHQ hospital, Jhelum³Registrar Surgery, Farooq Hospital Rawalpindi Branch, Rawalpindi⁴Consultant General Surgeon, THQ Hospital, Phalia⁵Women Medical Officer, DHQ hospital, Jhelum⁶Assistant Professor of Surgery, Azra Naheed Medical College, Lahore⁷Associate professor surgery, Azra Naheed Medical College, LahoreCorresponding author: Gul Naz, Email: gul_umdc@yahoo.com**ABSTRACT****Objective:** This study was designed to determine whether or not "hypocalcemia following complete thyroidectomy in hyperthyroid patients was associated with preoperative vitamin D insufficiency."**Methodology:** This research was carried out in the West Surgical Ward of Mayo Hospital in Lahore, Pakistan. Total 60 patients were included in the study. Patients were divided in two groups i.e. Vit-D deficient group "with vitamin D deficiency" and Vit-D sufficient group "without vitamin D deficiency". All the patients underwent total thyroidectomy preserving parathyroid glands performed by the same team of surgeons. Patients were assessed for signs and symptoms of hypocalcemia. Serum calcium was measured at day of surgery, post-operative day-1 and at the end of 2 weeks on follow up after surgery.**Results:** The mean of age in the Vit-D deficient group was 38.87±9.31 and in Vit-D sufficient group was 37.70±8.56. Majority of patients in the Vit-D deficient group were females (70.0%). In Vit-D deficient group, 13(43.3%) had hypocalcemia, while 5(16.7%) in Vit-D sufficient group (p-value 0.024).**Conclusion:** Pre-operative VDD "vitamin D deficiency" is linked with postoperative hypocalcemia increased occurrence after total thyroidectomy. There is a "positive correlation of preoperative vitamin D deficiency on postoperative hypocalcaemia after total thyroidectomy in patients of hyperthyroidism".**Keywords:** Hyperthyroid, Total Thyroidectomy, Hypocalcemia, Vitamin D deficiency**INTRODUCTION**

Disturbance of parathyroid glands may result in intermittent symptomatic hypocalcaemia or even chronic hypoparathyroidism and it is a well-known risk of complete thyroidectomy.⁽¹⁾ Thyroid surgeons have long been affected by this problem, which has led to changes in the surgical process, such as subtotal thyroidectomy to avoid disrupting the parathyroid glands and abandoning "central ligation of the inferior thyroid artery".⁽²⁾

Total thyroidectomy (TT) with suprascapular ligation of thyroid blood flow is now regularly practiced as the parathyroid glands blood supply has become better known.⁽³⁾ Aside from surgical procedure changes, there are a number of therapeutic practices that may help avoid symptomatic hypocalcemia that includes vitamin D and selective calcium supplements dependent on postoperative parathyroid hormone levels and serum calcium, also regular supplementation for all the patients without parathyroid hormone levels being measured in the post-operative phase.⁽⁴⁾

After TT, patients with hyperthyroidism have a significantly higher rate of symptomatic hypocalcaemia than patients with other thyroid diseases.⁽⁵⁾ Due to the thyrotoxic osteodystrophy increased bone hunger, lead to rise in calcitonin, ending up in iatrogenic hypocalcemia after surgery.⁽⁶⁾ Since TT is the preferred surgical procedure for treating multinodular toxic goitre and grave's disease, it's important to keep the chance of symptomatic hypocalcemia to a minimum.⁽⁷⁾ While some scholars have suggested that calcium be given to hyperthyroidism patients prior to surgery, no studies have been done to see if this affects patient outcomes.⁽⁸⁾

According to a review, the risk of this condition is lower among patients with sufficient or normal vitamin D as compared to those having vitamin D deficiency, a difference of 24% vs. 44%.⁽⁹⁾ In another study, post-operative hypocalcaemia without vitamin D deficiency as 16.1% and with vitamin D deficiency as 45.8%.⁽¹⁰⁾

Recently, a few studies have proposed that "25-hydroxycholecalciferol" (vitamin D3) deficiency can play a role in the development of hypocalcemia following thyroid surgery.^(10, 11) Prescription of vitamin D following thyroid surgery has been found to decrease the rate of hypocalcemia.^(11, 12) Since thyroidectomy, a

mixture of hydrochlorothiazide and calcitriol has also been proposed to reduce the chance of hypocalcemia.⁽¹²⁾

Also after the preservation of one or more parathyroids, the prevalence of intermittent hypocalcemia has been reported to be between 3% and 30% of patients.⁽¹³⁾ Permanent hypocalcemia, though much less common, is still reported in literature with an occurrence of about 2-4 percent.⁽¹⁴⁾

METHODOLOGY

This study was designed to determine whether or not "hypocalcemia following complete thyroidectomy in hyperthyroid patients was associated with preoperative vitamin D insufficiency." This research was carried out in the West Surgical Ward of Mayo Hospital in Lahore, Pakistan, using a cross-sectional design for comparison.

Duration of Study was Six months after the approval of synopsis in October 2020. With the sample size of 60 (30 in each group) was estimated by using level of significance 5% with 95% power of test and expected mean value of serum calcium as 0.99±0.10 mmol/L among vitamin D deficient Vit-D deficiency group and 1.06±0.06 mmol/L without vitamin D deficient group.⁽¹²⁾

In this study, we used a sampling method that did not rely on a random distribution of samples. Patients aged 20-55 Patients with diffuse and/or nodular goitre who have had success treating their hyperthyroidism with medication (anti-thyroid medicines and beta blockers) and who have had their 25-hydroxyvitamin D level documented prior to surgery. Patients who also have parathyroid disease, Thyroid cancer have a long history of necessitating a large lymph node dissection, therefore Prior to the study, patients' corrected blood calcium levels needed to be 8 mg/dl. Do you have a chronic condition and a history of taking calcium supplements before surgery? In the few instances where kidney problems and low albumin levels have been documented, Patients who have had a lobectomy or a subtotal thyroidectomy, Iatrogenic parathyroid damage during pregnancy or surgery.

Total 60 patients fulfilling the inclusion criteria were admitted from the Department of General Surgery at Mayo Hospital. The study was approved by the hospital ethical committee. From each

patient's informed consent form was also obtained before inclusion in the study.

The patients were randomly allocated into the two groups by computer generated method. Vit-D deficient group "with vitamin D deficiency" and Vit-D sufficient group "without vitamin D deficiency". All the patients underwent total thyroidectomy preserving parathyroid glands performed by the same team of surgeons.

Patients were assessed for signs and symptoms of Hypocalcemia. Serum calcium was measured at day of surgery, post-operative day-1 and at the end of 2 weeks on follow up after surgery. If symptoms or signs of hypocalcemia lasted, the therapy was continued until stable normalization of serum calcium. All the data was collected through a pre-designed proforma.

Analysis in SPSS v23.0 for quantitative data like age and serum calcium level presented by using Mean±S.D, while qualitative data like gender, sign and symptoms and hypocalcemia were presented as frequencies and percentages. Comparison of two groups i.e. vitamin D and non-vitamin D was done by applying chi-square and t-test.

RESULTS

In the Vit-D deficient group, there were 9 (30.0%) males and 21 (70.0%) females, while in Vit-D sufficient group, there were 14(46.7%) males and 16(53.3%) females. Total male in our study were 23(38.3%) and females were 37(61.7%). Mean age in the Vit-D deficient group was 38.87±9.31 years and in Vit-D sufficient group was 37.70±8.56 years. In the Vit-D deficient group, 13(43.3%) patients were in the 20-35 years age group, while 14(46.7%) and 3(10.0%) were in the 36-50 years and >50 years age groups respectively. In the Vit-D sufficient group, 15(50.0%) patients were in the 20-35 years age group, while 13(43.3%) and 2(6.7%) were in 36-50 years and >50 years age groups respectively.

Data analysis of . In the Vit-D deficient group, 13(43.3%) had hypocalcemia, while 5(16.7%) in Vit-D sufficient group, which is statistically significant with a p-value of 0.024.

Table 1: showing the mean values of vitamin D and PTH level in both groups

| Vitamin D | N | Mean | SD |
|------------------------|-------|-------|------|
| Vit-D deficient group | 30.00 | 15.27 | 2.48 |
| Vit-D sufficient group | 30.00 | 31.53 | 5.89 |
| PTH | N | Mean | SD |
| Vit-D deficient group | 30.00 | 30.33 | 6.24 |
| Vit-D sufficient group | 30.00 | 26.80 | 5.16 |

Table 2: showing the mean of serum calcium level in both groups

| Serum Calcium | | Pre-operative | Day 1 | After 2 weeks |
|------------------------|------|---------------|-------|---------------|
| | | Mean | 9.57 | 8.67 |
| Vit-D deficient group | SD | 0.50 | 0.52 | 0.46 |
| | Mean | 9.50 | 8.90 | 8.80 |
| Vit-D sufficient group | SD | 0.51 | 0.55 | 0.60 |

Table 3: Comparison of numbness in both groups

| | Groups | | Total |
|----------------|-----------------------|------------------------|-------|
| | Vit-D deficient group | Vit-D sufficient group | |
| Numbness | 12 (40.0%) | 12 (40.0%) | 24 |
| Tingling | 9 (30.0%) | 9 (30.0%) | 18 |
| Tetany | 9 (30.0%) | 8 (26.7%) | 17 |
| Trousseau sign | 13 (43.3%) | 7 (23.3%) | 20 |
| Chvostek sign | 13 (43.3%) | 10 (33.3%) | 23 |

Table 4: Comparison of Hypocalcemia in both groups

| Hypocalcemia | Groups | | Total | p-value |
|--------------|-----------------------|------------------------|--------|---------|
| | Vit-D deficient group | Vit-D sufficient group | | |
| Yes | 13 | 5 | 18 | 0.024 |
| | 43.3% | 16.7% | 30.0% | |
| No | 17 | 25 | 42 | |
| | 56.7% | 83.3% | 70.0% | |
| Total | 30 | 30 | 60 | |
| | 100.0% | 100.0% | 100.0% | |

DISCUSSION

This comparative cross-sectional analysis recruited 60 patients in order to show that preoperative vitamin D deficiency is linked to an elevated risk of hypocalcemia. In a study⁽¹²⁾ 2 male and 10 female were in Vit-D deficient group and 2 male with 16 female were in Vit-D sufficient group. The mean age in the Vit-D deficient group was 49 ± 15 and 47 ± 11 in Vit-D sufficient group. Mean vitamin D level in the Vit-D deficient group was 15.27 ± 2.48 and 31.53 ± 5.89 in the Vit-D sufficient group. Mean vitamin D level in the Vit-D deficient group was 16.8 ± 3.6 and 33 ± 9.7 in Vit-D sufficient group in another study⁽¹²⁾ results which match with the results of our study. Mean PTH level in the Vit-D deficient group was 30.33 ± 6.24 and 26.80 ± 5.16 in the Vit-D sufficient group. Mean PTH level in Vit-D deficient group was 35 ± 29 and 30 ± 30 in Vit-D sufficient group in a study⁽¹²⁾ which matched with the results of our study.

Mean serum calcium (pre-operative) in the Vit-D deficient group was 9.57 ± 0.50 and 9.50 ± 0.51 in the Vit-D sufficient group. Mean serum calcium (day 1) in the Vit-D deficient group was 8.67 ± 0.52 and 8.90 ± 0.55 in the Vit-D sufficient group. Mean serum calcium (after 2 weeks) in the Vit-D deficient group was 8.37 ± 0.46 and 8.80 ± 0.60 in the Vit-D sufficient group. The preoperative serum calcium level in the Vit-D deficient group was 9.1 ± 0.67 and 9.4 ± 0.42 in Vit-D sufficient group in a study⁽¹²⁾ which matched with the results of our study.

In another study⁽¹⁰⁾, the preoperative value of serum calcium was 9.3 ± 0.5 in the Vit-D deficient group and 9.52 ± 0.64 in the Vit-D sufficient group. Similar to our study results in this study find postoperative serum calcium was 8.4 ± 0.58 in Vit-D deficient group and 8.9 ± 0.5 in Vit-D sufficient group. In the Vit-D deficient group, 13 (43.3 %) had hypocalcemia, while 5 (16.7 %) in Vit-D sufficient group, which is statistically significant with a p-value of 0.024.

In a study, it was concluded that, the incidence of postoperative hypocalcemia was lower in without vitamin D deficiency group than in with vitamin D deficiency: 24% versus 44%.⁽⁹⁾ In another study, post-operative hypocalcaemia without vitamin D deficiency as 16.1% and with vitamin D deficiency as 45.8%.⁽¹⁰⁾ These findings matched with the results of our study findings.

Tripathi et al. found that vitamin D levels "less than 20 ng/ml" in patients were more likely to have postoperative hypocalcemia in a longitudinal sample of 35 patients.⁽¹⁰⁾ Al-Khatib and colleagues used multivariate analysis to find that VDD "identified as a serum 25-hydroxyvitamin D level of less than 25 nmol/l (10 ng/ml)" and "low PTH levels were independent predictors of postoperative hypocalcemia in 213 patients undergoing complete and completion thyroidectomy".⁽¹⁵⁾ Vitamin D was linked to not only postoperative hypocalcemia higher risk but also a longer median period of stay in a broader sample of 166 cumulative thyroidectomies from the United Kingdom "i.e.- 2 days vs. 1 day".⁽¹¹⁾ Vitamin D levels pre-operatively were indicative of the postoperative hypocalcemia, according to the meta-analysis of 115 retrospective studies published in 2014, but no impact on duration of stay was seen.⁽¹⁶⁾

It's difficult and highly theoretical to figure out how vitamin D deficiency could lead to increased post-operative morbidity and post-thyroidectomy hypocalcemia. The most plausible explanation for these findings is that they are due to temporary or long-term hypoparathyroidism, which is a well-known consequence of complete thyroidectomy.⁽¹⁷⁾

It has been shown that the synthesis of 1,25-dihydroxyvitamin D is restricted in patients with serious vitamin D deficiency due to a lack of substrate, and that there is a strong association between "serum 25-hydroxyvitamin D" and 1,25-dihydroxyvitamin D levels in these patients.⁽¹⁸⁾ In a study⁽¹²⁾ find a statistically significant and clinically relevant connection between VDD and the postoperative hypocalcemia, also VDD and a long stay in the hospital These observations matched that of our research.

CONCLUSION

Preoperative "vitamin D deficiency" is linked with postoperative hypocalcemia increased occurrence after total thyroidectomy. There is a "positive correlation of pre-operative vitamin D deficiency on postoperative hypocalcemia after total thyroidectomy in patients of hyperthyroidism".

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