



## HYPOCALCEMIA AND VITAMIN D LEVELS PRE-OPERATIVE AND POST-THYROIDECTOMY

### General Surgery

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### ABSTRACT

**Background:** Transient hypocalcemia is a frequent complication after total thyroidectomy. Routine postoperative administration of vitamin D and calcium can reduce the incidence of symptomatic postoperative hypocalcemia. It has been hypothesized that there is a relationship between underlying vitamin D deficiency and the risk of post-operative hypocalcemia.

**Methods:** We performed a cross-sectional review on 50 thyroidectomies from SLIMS hospital. Pre-operative vitamin D levels and post-operative calcium level were obtained. The incidence of hypocalcemic symptoms was studied. Biochemical hypocalcemia was defined as any single post-operative corrected calcium level  $< 8.0$  mg/dl (to convert to millimoles per liter, multiply by 0.25).

**Results and Discussion :** There was a significant differentiation between mean of vitamin D levels in hypocalcemic group and normocalcemic group. The results of this study indicate that routine pre and post TT calcium and Vitamin D supplementation can significantly reduce post operative hypocalcemia.

**Conclusion:** We, therefore, suggest the same in the prevention of post TT hypocalcemia, which ultimately can also decrease prolonged hospitalization of patients and costs associated with multiple blood sampling. Patient with lower vitamin D levels should benefit from a screening for post-operative hypocalcemia. Pre-operative vitamin D levels appear to have a significant effect on the risk of post-thyroidectomy hypocalcemia.

### KEYWORDS

Thyroidectomy, Vitamin D levels; Hypocalcemia; Hypoparathyroidism

### INTRODUCTION:

A high prevalence of Vitamin D deficiency has been demonstrated in some North Indian states but now coming to south India also, [11] and is a known risk factor for postoperative hypocalcemia after TT (1-3). To prevent postoperative hypocalcemia, routine Vitamin D supplementation as a standard protocol merits consideration. Although routine postoperative oral calcium and Vitamin D supplementation has been shown to prevent the development of hypocalcemia after TT and facilitate an early discharge (4), the role of preoperative supplementation has seldom been tested. (5) We hypothesize that a 1-week preoperative Vitamin D and calcium supplementation to a cohort of patients belonging to an area endemic to Vitamin D deficiency, continued 1 week into postoperative period, would reduce the rates of hypocalcemia and associated morbidity.

Hypocalcemia as a result of hypoparathyroidism is the most common postoperative complication of thyroidectomy. Hypoparathyroidism is considered to be transient if recovery occurs within days, weeks or a few months; or permanent when calcium levels do not return to normal within six months after surgery (6-7). Transient hypoparathyroidism is seen in 0.3 to 49% of the patients undergoing thyroidectomy, whereas permanent hypoparathyroidism is less likely and has been reported in up to 13% of the cases (8). Most thyroid surgeons provide calcium supplementation based on postoperative calcium, parathyroid hormone (PTH) serum levels, or presence of symptoms, whereas others routinely prescribe calcium and vitamin D supplementation after thyroidectomy to prevent hypocalcemia symptoms. In a randomized study involving 143 patients undergoing total thyroidectomy, it was demonstrated that patients with PTH levels  $> 10$  pg/ml on the first postoperative day could be safely discharged without routine calcium supplementation. The active form of vitamin D, i.e. calcitriol (1,25 dihydroxyvitamin D<sub>3</sub>), is the preferred option because of its potency and rapid onset of action. To evaluate whether preoperative vitamin D deficiency was a risk factor for postoperative symptomatic hypocalcemia in patients in South India

### MATERIAL AND METHODS:

This longitudinal, cross-sectional study included patients with total thyroidectomy at SLIMS Hospital, Bharath University. The study protocol was approved by IEC. The procedure was explained completely to the guardians, and written informed consents were

obtained before their participation. Typical diagnoses of patients in this hospital include retrosternal goiter, multinodular goiter, thyroid cancers, and/or other severe thyroidal illness. A total of 50 patients were admitted to the hospital for thyroidectomy during the study period. 50 patients met eligibility criteria and enrolled. We used pre-operative serum vitamin D level and early ( $< 24$  hours) post-operative measurements of s-Ca levels. s-Ca  $< 8$  mg/dl ( $< 2$  mmol/l) 24 hours after surgery were considered post-operative hypocalcemia. During hospitalization days, s-Ca and hypocalcemic symptoms (paresthesia, tetany, showestoc, and terusu) were checked. Due to the fact that these symptoms may correspond to other reasons else hypocalcemia that is prone to remit within few days after surgery assessment for s-Ca was done on discharge. The threshold of 8 for s-Ca was selected according to the results of many studies in western and eastern countries. Age, sex, and fetal medical problems were asked. S-Ca before operation was measured. Based on s-Ca, 24 hours after surgery prevalence of post-thyroidectomy hypocalcemia was measured. The potential risk factors for post-thyroidectomy hypocalcemia were investigated and compared between the two groups (before operation and after operation) using Pearson's chi-squared test (corrected by Fisher Exact for small samples). The level of significance was set throughout the study at  $P \leq 0.050$ . Data entry was carried out on Microsoft Excel. Data analysis was performed using the software SPSS 11.0 version.

### RESULTS :

At the first assessment at admission, 50 patients were included in our sample. In case of s-Ca, two groups created; one group had s-Ca  $\geq 8$  [no hypocalcemic group = 50 (100)] and one group had s-Ca  $< 8$  [hypocalcemic group = 0 (0)] and the average s-Ca was 8.62 [standard deviation (SD) = 0.56]. At 24 hours after surgery 40(80), patient had s-Ca  $\geq 8$  and 10 (20) persons had s-Ca  $< 8$  and the average s-Ca was 8.21 (SD = 0.58). There is no significant differentiation between men and women who had hypocalcemia ( $P = 0.510$ ) and who had pre-operative vitamin D deficiency ( $P = 0.540$ ).

### DISCUSSION:

Hypocalcemia is one of the most common postoperative complications following thyroid surgery in clinical practice. The occurrence of hypocalcemia is mainly attributed to hypoparathyroidism when parathyroid glands are devascularized, injured, or dissected during the surgery. Preoperative oral calcium and Vitamin D

supplementation continued into the postoperative period after TT significantly reduced laboratory and symptomatic hypocalcemia. Moreover, the need for intravenous calcium administration due to carpedal spasm was completely eliminated in the supplemented group while four patients of the control group required the same. Although the improvement in calcemia at all tested post-TT time points was modest, it did not reach statistical significance. This may be explained by the small sample size and it would be constructive to include more patients in each group to elicit statistically significant results. Hence, our study suggests the role of routine pre- and post-operative oral calcium and Vitamin D supplements in decreasing the incidence and severity of hypocalcemia after TT although it does not completely eliminate the occurrence of postoperative hypocalcemia.

The literature is replete with studies evaluating the effect of post-TT calcium and Vitamin D supplementation on hypocalcemia. Moore (10) administered calcium at a dosage of 5 g/day to patients after bilateral thyroid resection and found that only 4 of 124 patients developed hypocalcemia and one required administration of intravenous calcium. Hence, he recommended prophylactic use of oral calcium

to reduce the risk of hypocalcemic crisis and increase the likelihood of early hospital discharge. However, pre-TT serum calcium was the only independent association of 24 h post-TT hypocalcemia. It is likely that low normal calcium levels were the result of Vitamin D deficiency, which itself has been shown to be one of the factors associated with post-TT hypocalcemia.(11)

The idea central to the inception and implementation of this study was the simplicity of its design and thus its applicability to resource-poor settings where iPTH and 25-hydroxy Vitamin D tests are not routinely available. Although iPTH testing has been shown to stratify patients into high- and low-risk for hypocalcemia and expedite an early discharge after TT,(12-13) its role in prevention of hypocalcemia is not clear. We consider iPTH measurement to be of limited utility in evaluating the efficacy of routine perioperative calcium and Vitamin D supplementation for prevention of hypocalcemia.

Our results have shown that the early oral supplementations for asymptomatic hypocalcaemia with calcium and vitamin D supplements adjust the serum calcium and level above 2 mmol/L, in our postoperative patients, compared to laboratory reference values (2.2–2.6 mmol/liter). While vitamin D level varied significantly in comparison between pre- and postoperative to reach the normal level 60–108 pmol/L. This may be explained by the adjustment of parathyroid hormone (PTH). The 3 main calcium-regulating hormones are PTH, vitamin D and calcitonin through their specific effects on the bowel, kidneys and skeleton. Inadequate vitamin D levels lead to a reduction in gastrointestinal calcium absorption up to 50%, resulting in only 10–15% of dietary intestinal calcium being absorbed. It is likely that low normal calcium level was the result of vitamin D deficiency, which itself has been shown to be one of the factors associated with postoperative hypocalcemia (14).

In our study, the risk of longer hospitalization was increased in hypocalcemic state patient, contrarily to the findings of other studies where showed no relationship (15). In many other studies, a positive lower vitamin D levels has been confirmed to be a risk factor for longer hospitalization (16), and then we included them from our study. In our study, the prevalence of pre-operative vitamin D deficiency is around 41% which is considered close to the prevalence found in the sample of the study done by Griffin et al. (17). The high rate of vitamin D deficiency in our sample can be justified by the fact that high prevalence of vitamin D deficiencies in Zahedan that was matched with some studies (18).

Our results found that postoperative serum calcium level was associated with preoperative calcium level and nature of thyroid function. Nevertheless, preoperative vitamin D3 was low and increased significantly postoperative to reach the laboratory reference values 30 d after thyroidectomy. However, preoperative serum calcium was the only independent association of postoperative hypocalcemia. However, the effect of preoperative calcium and vitamin D has seldom been tested. The results showed that the incidence of symptomatic hypocalcemia had been 6% and that of laboratory hypocalcemia had been 10%.

## CONCLUSION:

The results of this study indicate that routine pre and post TT calcium and Vitamin D supplementation can significantly reduce post operative hypocalcemia. We, therefore, suggest the same in the prevention of post TT hypocalcemia, which ultimately can also decrease prolonged hospitalization of patients and costs associated with multiple blood sampling. Patient with lower vitamin D levels should benefit from a screening for post-operative hypocalcemia.

**Table:1. Comparison of the characteristics of patients between the two groups 24hrs after surgery**

Parameters	S.Ca>8%	S.Ca<8%	Pvalue
No	40 (80)	10(20)	
Mean age	37.32 ± 4.98	36.38 ± 4.98	0.548
Sex Male	11	3	0.801
Female	30	7	
Vit D Deficiency			
No	29	0	<0.001
Yes	12	10 (100)	

S.Ca:Serum calcium.

**Table:2. Comparison of the Mean of vitamin D level between the two groups**

Parameters	S.Ca		Pvalue	OR (95%)
	>8	<8		
N	40	10	0.001	1.83 (1.38 -2.45)
Mean of Vit D level	38.33 ± 10.24	12.36 ±6.0		

Significance threshold  $p \leq 0.050$ , OR: Odds Ratio, CI:Confidential Interval

**Table:3. Comparison of the prevalence of PPP at D4L**

Parameters	S.Ca		Pvalue
	>8	<8	
N	40	10	0.001
Length of Hospitalization	1.0 ±0.0	2.24 ± 0.42	

Significance threshold  $p \leq 0.050$ , PPD:Prevalence of Postpartum depression, S.Ca:Serum calcium.

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