Impact of Vitamin D rates on risk of post-thyroidectomy hypocalcemia

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Abstract:

Hypocalcemia is a common postoperative complication of thyroidectomy, with an incidence reported in the literature ranging from 1.6% to 50%, depending on the surgical team and technique. Its etiology may involve parathyroid gland injury due to devascularization or trauma, as well as the release of calcitonin triggered by thyroid manipulation. In addition to these factors, preoperative vitamin D levels may influence the risk of developing postoperative hypocalcemia.

This study aimed to evaluate the relationship between preoperative vitamin D levels and the incidence of postoperative hypocalcemia following thyroidectomy. We conducted a prospective observational cross-sectional study in 2019, involving 42 patients who underwent thyroidectomy. Serum vitamin D levels were assessed preoperatively, while serum calcium levels were measured on postoperative days 1 and 2. Patients were categorized into three groups based on vitamin D status: deficiency, insufficiency, and normal levels. Postoperative calcium levels were then compared across these groups using appropriate statistical tests. The comparison of vitamin D status and postoperative calcium levels, treated as qualitative variables, using Fisher's exact test, revealed a statistically significant association ($p = 0.02$). This finding suggests that patients with vitamin D deficiency are more likely to develop postoperative hypocalcemia.

Preoperative vitamin D deficiency is significantly associated with an increased risk of postoperative hypocalcemia. These results support the importance of assessing and correcting vitamin D levels prior to thyroidectomy to reduce the likelihood of this complication.

Keywords: Hypocalcemia, Thyroidectomy, Vitamin D

Introduction:

Thyroidectomy is a routine surgery frequently done to treat some thyroid issues. It has multiple indications such as nodular goiter, thyroid carcinomas and graves' disease. And like all types of surgery, thyroidectomy has a potential risk of complications, of which we site postoperative hypocalcemia[1].

In this context, hypocalcemia is defined by a blood rate of calcium less than 80 mg/l (2 mmol/l). this complication is often transitory, but dangerous. Its pathophysiology could be explained by a sufferance of parathyroid glands during the intervention, also the release of calcitonin due to the manipulation of thyroid could be responsible of lowering calcium rates. Nevertheless, vitamin D deficiency has been identified as an independent risk factor of postoperative hypocalcemia[2].

By this study, we aim to study the causality between Vitamin deficiency and the risk of hypocalcemia. So, we realized this cross-sectional study on 42 patients who undergone a thyroidectomy surgery in the department of laryngology of the Avicenna military hospital. Our hypothesis is that the deficiency in vitamin D may predict a potentialpostoperative hypocalcemia after a thyroidectomy.

Methods:

Our study is an epidemiological cross-sectional analysis conducted between 2017 and 2019 in the ENT department of Avicenna Military Hospital in Marrakech, Morocco. We prospectively included 42 patients who were scheduled for thyroidectomy. Eligible participants were those with indications for thyroidectomy and normal preoperative levels of thyroid hormones and parathyroid hormone (PTH). Patients with abnormal levels of PTH, thyroid hormones, or renal dysfunction were excluded. There were no restrictions based on age or gender.

Preoperative vitamin D levels were measured from blood samples collected prior to surgery. Patients were then categorized into three groups based on vitamin D status according to the GRIO (Groupe de Recherche et d'Information sur l'Ostéoporose) classification: vitamin D sufficiency, insufficiency, and deficiency.

Postoperative calcium levels were measured on days 1 and 2 following surgery. Hypocalcemia was defined as a calcium level below 80 mg/L (2 mmol/L) during this period. Based on these values, patients were divided into two groups: those with hypocalcemia and those with normocalcemia.

All data were initially recorded in Excel spreadsheets and later analyzed using SPSS version 22. We first compared calcium levels (as a quantitative variable) across the three vitamin D groups using ANOVA. Calcium was then analyzed as a qualitative variable using Fisher's exact test. In addition to vitamin D, other variables such as age and gender were assessed to perform multivariate analysis via logistic regression.

Results:

The study included 42 patients aged between 18 and 76 years, with a median age of 47.5 years [IQR: 39.75–57]. The majority were female (83.3%).

According to the GRIO classification, 25 patients (59.5%) had vitamin D insufficiency, 11 patients (26.2%) had vitamin D deficiency, and 6 patients had sufficient vitamin D levels.

Postoperative hypocalcemia was observed in 50% of patients. Both clinical and subclinical cases were included. The comparison of preoperative and postoperative calcium levels showed a statistically significant decrease ($p < 0.05$).

We analyzed the influence of age, gender, and vitamin D status on postoperative hypocalcemia. Comparing the mean age between patients with and without hypocalcemia revealed no significant difference ($p = 0.475$), suggesting that age had no impact on hypocalcemia risk. Similarly, no significant difference was found between male and female patients in terms of postoperative calcium levels ($p = 0.403$).

However, when comparing vitamin D status and postoperative calcium levels as categorical variables using Fisher's exact test, a statistically significant association was found ($p = 0.02$).

In multivariate analysis using logistic regression, the only factor significantly associated with postoperative hypocalcemia was vitamin D status.

Variables		N=42
Age (in years)		47.5 [39.75;57]
Gender	Male patients	7 (16.7%)
	Female patients	35 (83.3%)
Rate of vitamin D (nmol/l)		20.76 [14.02; 36.02]
Calcemia (in mmol/l)	Preoperative	2.28 [2.19; 2.36]
	Postoperative	2.16 [1.86; 2.26]
Vitamin D	deficiency	25 (59.5%)
	Insufficiency	11 (26.2%)
	sufficiency	6 (14.3%)
Calcemia (qualitative)	Normocalcemia	21 (50 %)
	Hypocalcemia	21 (50%)

Discussion:

Transient hypocalcemia following thyroidectomy is not attributable to a single specific cause; rather, it is multifactorial. Potential contributing factors include devascularization or trauma to the parathyroid glands and calcitonin release triggered by manipulation of the thyroid gland. To minimize the influence of these factors in our study, we adopted a surgical approach that emphasized the identification and preservation of parathyroid gland vascularization [3,4].

In our series, the primary indication for thyroidectomy was multinodular goiter, representing 81% of cases. Similar to the recommendations of other authors, we advocate for total thyroidectomy in cases of multinodular goiter instead of lobectomy to reduce the risk of recurrence in cases of malignancy and to avoid the need for surgical completion. This risk-benefit balance favors total thyroidectomy in terms of both intraoperative and postoperative morbidity. Other indications in our cohort included endemic goiter (5%), thyroid carcinoma (12%), and Graves' disease. According to the literature, multinodular goiter is the leading indication for thyroidectomy, with reported frequencies ranging from 19% to 70%, followed by endemic goiter, Graves' disease, and finally thyroid carcinomas [5,6].

Ultrasound imaging was systematically performed to evaluate thyroid gland characteristics and to classify nodules according to the EU-TIRADS classification. Although not mandatory, ultrasound plays a key role in pretherapeutic assessment and in identifying associations between nodules and thyroiditis. The EU-TIRADS classification is especially useful in refining the indications for thyroidectomy in nodular goiter, as only 5–6% of thyroid nodules are ultimately found to be malignant [7–10].

Comparison of postoperative calcium levels among groups stratified by vitamin D status showed that patients with vitamin D deficiency were more likely to develop postoperative hypocalcemia. This complication was transient and resolved with calcium supplementation. Patients with vitamin D insufficiency had a lower incidence of hypocalcemia than those with deficiency. In a study of 368 patients, Dottini et al. found no significant association between preoperative vitamin D levels and the risk of postoperative hypocalcemia. In contrast, Benmasour et al. reported a higher incidence of hypocalcemia in vitamin D–deficient patients ($p = 0.009$). These findings were supported by Erbil et al., who identified vitamin D deficiency as a predictive factor for postoperative hypocalcemia. Similarly, Kirkby-Bott et al. confirmed this correlation in their cohort [2,11–13].

Our study was limited by a relatively small sample size, primarily due to the lack of patient consent in our setting. Moreover, recruitment for thyroidectomy was limited, as the management strategy in our department often favors a conservative "wait-and-see" approach. The EU-TIRADS classification of nodular goiter among included patients was as follows: 10% were EU-TIRADS 5, 33% EU-TIRADS 4, and 57% EU-TIRADS 3. Many authors advocate for a similar conservative approach to avoid exposing patients to surgical risks and lifelong thyroid hormone replacement when unnecessary [14].

Conclusion:

This cross-sectional study found that patients with vitamin D deficiency are more likely to develop postoperative hypocalcemia following thyroidectomy. However, our findings are preliminary and should be confirmed by larger studies with more robust statistical power. Such research could lead to the development of clinical recommendations regarding preoperative vitamin D supplementation before thyroidectomy.

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