

Pre-operative Calcium and Vitamin D: The Solution of Post-operative Total Thyroidectomy Hypocalcemia

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ABSTRACT:

Introduction: Postoperative hypocalcemia is one of the most common complications of total thyroidectomy. Presence of postoperative symptomatic hypocalcemia is managed by calcium and vitamin D supplementation.

Aim of the work: To compare the frequency of transient hypocalcemia after vitamin D and calcium supplementation with the control group patients undergoing total thyroidectomy in Tobruk-Libya

Patients, Materials and Methods: It was a randomized controlled trial conducted at Surgery and Nutrition departments of Tobruk Medical Center, Libya, from January 2020 to July 2020. A total of 84 patients of both genders - between the age of 20-69 years and undergoing total thyroidectomy - were included in the study. Patients then were randomly distributed into two groups; Group 1 (n = 42) in which Vitamin D (200,000 IU) and calcium (1 gm) was given 24 hours pre-operatively. Group 2 (n = 42) was the control group.

Results: The mean age of the patients at group 1 is 34 years (range, 20–48 years) and at group 2 is 50.5 years (range, 32–69 years). Mean pre-operative calcium levels are 9.32 mg/dl in group 1 and 9.53 mg/dl in group 2. Hypocalcemia after total thyroidectomy was seen in 4 patients (9.5%) in group 1 as compared to 13 patients (30.9%) in group 2. There was a statistically significant difference among those who developed hypocalcemia in groups 1 & 2 (P = 0.0145). There is no significant association with gender and reason of thyroidectomy.

Conclusion: Postoperative hypocalcemia develops in all age groups in both males and females who undergo total thyroidectomy without preoperative calcium and vitamin D supplements. Postoperative hypocalcemic manifestations could be avoided by using preoperative vitamin D and calcium.

Keywords: Calcium; Vitamin D; Total thyroidectomy; Hypocalcemia.



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INTRODUCTION:

Thyroidectomy represents the surgical and often the curative treatment for some of the thyroid pathologies. The procedure involves the removal of the thyroid gland with the preservation of parathyroid glands. Even if the surgeon is experienced, sometimes, after surgery, the parathyroid glands are affected by vascular injuries, postoperative hematomas or the inadvertent removal of one or more parathyroid glands [1]. Parathyroid glands secrete parathormone (PTH) which regulates serum calcium level [2].

Postoperative hypocalcemia is one of the most common complications of total thyroidectomy [3,4]. The prevalence of this condition was reported to be 10% to 50% and 0.5% to 4.4% for transient and permanent hypocalcemia, respectively [5,6]. The major cause of hypocalcemia after thyroid surgery is acute hypoparathyroidism resulting from injury, devascularization, or inadvertent removal of the parathyroid glands during thyroidectomy [7,8]. Presence of postoperative symptomatic hypocalcemia is managed by calcium and vitamin D supplementation [9].

Most of the surgeons give calcium according to postoperative calcium level, parathyroid hormone (PTH) level, or presence of symptoms. But other surgeons gives calcium and vitamin D as a routine after thyroidectomy to prevent symptoms of hypocalcemia [10,11].

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 [12]. The active form of vitamin D, i.e. calcitriol (1,25 dihydroxyvitamin D₃), is the preferred option because of its potency and rapid onset of action [13].

Symptoms of mildly hypocalcaemia such as perioral or acral paraesthesia, tingling, and carpopedal tetany can impose different degrees of pressure on patients' emotions [14]. Moreover, severe hypocalcaemia can cause life-threatening complications such as laryngospasm and cardiac

arrhythmias [15,16]. Many patients who experience symptoms of mild hypocalcaemia can be treated with oral calcium/vitamin D (VD) [17]. However, serious hypocalcaemic symptoms should be relieved by intravenous calcium supplementation as quickly as possible [18]. Moreover, intravenous calcium administration to patients with refractory hypocalcaemia is a major reason for prolonged hospitalization after thyroid surgery [19].

In Libya, many cases after total thyroidectomy presents with manifestations of hypocalcemia. So, we were able to collect group of 84 patients who had total thyroidectomy to compare the presence of transient hypocalcemia after vitamin D and calcium supplementation and the control group.

Patients, Materials and Methods:

It was a randomized controlled trial conducted at Surgery and Nutrition departments of Tobruk Medical Center, Libya, from January 2020 to July 2020. A total of 84 patients of both genders - between the age of 20-69 years and undergoing total thyroidectomy - were included in the study. Patients undergoing reoperation for thyroid disease, patients with chronic renal failure, preoperative hypocalcemia or hypercalcemia were excluded from the study.

Patients gave written informed consent before sharing in the study. After we took the consent, we started our research.

Patients then were randomly distributed into two groups; Group 1 (n = 42) in which Vitamin D (200,000 IU) and calcium (1 gm) was given 24 hours pre-operatively. Group 2 (n = 42) was the control group.

Serum calcium levels were estimated after total thyroidectomy. Total thyroidectomy was defined as complete removal of the thyroid gland with preservation of the parathyroid gland. Hypocalcemia was defined as a decrease in serum calcium level less than 8.5 mg/dl after thyroid surgery within one month.

Statistical Analysis:

The collected data were coded then entered and analyzed using the SPSS version 22 (Statistical package for social science).

Descriptive statistics was done for categorical variables by frequency and percentage, and for numerical variables in the form of mean and standard deviation (mean \pm SD).

Suitable statistical tests of significance were used: Chi-Square (χ^2) test for categorical data

P-values equal to or less than 0.05 were considered statistically significant.

RESULT:

The details of 84 patients selected for analyses are as follows. The mean age of the patients at group 1 is 34 years (range, 20–48 years) and at group 2 is 50.5 years (range, 32–69 years). Mean pre-operative calcium levels are 9.32 mg/dl in group 1 and 9.53 mg/dl in group 2 (Table 1).

| Variables | Group 1 (Mean) | Group 2 (Mean) |
|-----------------------------|----------------|----------------|
| Age (years) | 34 | 50.5 |
| Pre-operative calcium mg/dl | 9.32 | 9.53 |

Table (1): Mean age and pre-operative calcium levels in group 1 and group 2.

Hypocalcemia after total thyroidectomy was seen in 4 patients (9.5%) in group 1 as compared to 13 patients (30.9%) in group 2. There was a statistically significant difference among those who developed hypocalcemia in groups 1 & 2 ($P = 0.0145$) as shown in Table 2.

| Hypocalcemia | Group 1 n (%) | Group 2 n (%) | Total (n = 84) | Chi-square test |
|--------------|---------------|---------------|----------------|-----------------|
| Yes | 4 | 13 | 17 | $P=0.0145^*$ |
| No | 38 | 29 | 67 | |

*p-value ≤ 0.05 was considered significant.

Table (2): Frequency distribution of postoperative hypocalcemia after total thyroidectomy.

Relation of hypocalcemia with respect to gender and reason of thyroidectomy in group 1 and group 2 is shown in Table 3.

| Variables | Group 1 | | Group 1 | | Chi-square test |
|--------------------------------|--------------|---------------|--------------|---------------|-----------------|
| | Hypocalcemia | Normocalcemia | Hypocalcemia | Normocalcemia | |
| Gender | | | | | |
| Male (31 cases) | 1 | 12 | 4 | 14 | P=0.471 |
| Female (53 cases) | 3 | 26 | 9 | 15 | |
| Reason of Thyroidectomy | | | | | |
| Multinodular goiter (43 cases) | 2 | 19 | 7 | 15 | P=0.999 |
| Thyroid nodule (26 cases) | 1 | 12 | 4 | 9 | |
| Thyroid cancer (15 cases) | 1 | 7 | 2 | 5 | |

*p-value <0.05 was considered to be statistically significant.

Table 3: Relation of postoperative hypocalcemia with respect to gender and reason of thyroidectomy

DISCUSSION:

After thyroidectomy postoperative hypocalcemia is a common complication. Hypoparathyroidism with hypocalcemia is presented by paresthesias, muscle and carpopedal spasm with tetany. According to a study conducted by Baldassarre et al., the incidence of hypocalcemia after thyroidectomy was 5.5% [20].

In our study, combination of preoperative and postoperative oral calcium and vitamin D supplements can reduce the incidence of hypocalcemia after total thyroidectomy. So, this treatment avoids the decrease in serum calcium levels.

Hypocalcemia was seen in 4 patients (9.5%) in group 1 as compared to 13 patients (30.9%) in group 2. However, hypocalcemia was due to the accidental removal of parathyroid tissue, as confirmed by histological analysis.

Bellantone et al., found that 11% of patients receiving oral calcium developed hypocalcemia after total thyroidectomy but, 40% of patients that not receiving oral calcium developed the same clinical picture [21].

Although some studies report that vitamin D administration inhibits the secretion of intact parathyroid hormone (iPTH) by normally functioning parathyroid glands yet, others claim that iPTH secretion is not affected by vitamin D administration in the patients after thyroid surgery. So, vitamin D and calcium can be managed to total thyroidectomy patients [22].

Several strategies have been adopted for conserving calcium level after thyroidectomy. To decrease the symptoms of hypocalcemia, some surgeons prefer to prescribe oral calcium, whereas others prefer to treat patients with postoperative

hypocalcemia. Serum calcium level should be measured as a routine in postoperative period. Roh and Park proved that using of oral calcium and vitamin D decreases incidence and severity of hypocalcemia after total thyroidectomy [23].

The variable characteristics results and post-operative hypocalcemia in our results shows no significant association with gender and reason of thyroidectomy. However, there is significant association with number of patients and hypocalcemia. Unfortunately, there is no much studies to discuss with these results.

Limitations of the study:

Our study has some limitations. First, a small sample size was used to identify the role of calcium and vitamin D supplements in preoperative total thyroidectomy because of the short study period. Second, there is no follow-up documents of the patients and this study is designed and performed recently.

CONCLUSION:

Our study shows that postoperative hypocalcemia develops in all age groups in both males and females who undergo total thyroidectomy without preoperative calcium and vitamin D supplements. Postoperative hypocalcemic manifestations could be avoided by using preoperative vitamin D and calcium.

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