

Role of Preoperative Vit D Administration in Decrease Incidence of Post Thyroidectomy Hypocalcemia

Mohammed Safwat Shahin¹, Salah Eldin Shaltout¹, Mohamed Ramadan Ahmed², Mahmoud Refaat²

¹Maxillofacial Surgery Department, ²General Surgery Department, Faculty of Medicine, Assuit University, Egypt

Corresponding author: Mohamed Ramadan Ahmed, Email: mhmdrmdn1994@gmail.com

Mobile: 01024529525

ABSTRACT

Background: Thyroid disorders are less common in men and can present at any age. According to reports, the majority of goiter treatments is thyroid surgery.

Aim and objectives: This research's primary objective was to compare the incidence of post thyroidectomy hypocalcemia among patients who received vitamin D preoperatively in comparison to the patients who didn't receive, provided that whole included patients have preoperative normal both serum calcium and vitamin D levels.

Subjects and methods: 100 patients who had complete thyroidectomy at Assiut University Hospital's General Surgery Department between October 2019 and January 2021 for toxic, nontoxic goiters, or malignant thyroid pathology. The individuals that were enrolled in the study varied in age from 25 to 60. Group A who received vit D before operation. Group B who received placebo.

Results postoperative calcium level was substantially reduced among the control group in comparison to the study group (7.10 ± 1.81 vs. 8.15 ± 0.58 (mg/dl)). In case of the study group, there was no statistically substantial variation between pre-and postoperative calcium level (8.27 ± 0.29 vs. 8.15 ± 0.58 (mg/dl)) but in case of control group, there was substantial drop in serum calcium (8.23 ± 0.27 vs. 7.10 ± 1.81).

Conclusion: Our work demonstrates that thyroidectomy without preoperative vitamin D supplementation might result in postoperative hypocalcemia in patients of all ages. Vitamin D supplements used before surgery may halt postoperative hypocalcemia, enabling a safe and quick release from the hospital. In the end, this will increase patient happiness and result in considerable cost savings.

Keywords: Preoperative vit D, Decrease incidence, Post thyroidectomy hypocalcemia.

INTRODUCTION

Thyroid disorders are less common in men and can present at any age. According to reports, the majority of goiter therapy is thyroid surgery⁽¹⁾.

Symptoms of dyspnea, orthopnea, and dysphagia are more commonly associated with substernal goiter⁽²⁾. Tachycardia, exophthalmos and heat intolerance are more commonly associated with toxic goiter⁽³⁾. The surgical therapy of goiter may be accomplished by lobectomy, partial thyroidectomy, near-total thyroidectomy, or complete thyroidectomy⁽⁴⁾. The gold standard therapy for thyroid carcinoma, multi-nodular goiter, and grave's disease is a total thyroidectomy⁽⁵⁾, however there is a chance of postoperative complications (transient or permanent hypocalcemia and recurrent laryngeal nerve paralysis)⁽⁶⁾. Although there are few postoperative problems after a subtotal thyroidectomy, recurrence rates might reach 28%⁽⁷⁾. When compared to complete thyroidectomy, near-total thyroidectomy has lower recurrence and complication rates, making it a safe treatment choice for a variety of benign thyroid conditions^(8,9).

THE AIM OF THE STUDY

This research's primary objective was to compare the incidence of post thyroidectomy hypocalcemia among patients who received vitamin D preoperatively in comparison to the patients who didn't receive, provided that whole included patients have preoperative normal both serum calcium and vitamin D levels.

PATIENTS AND METHODS

In our study: Between October 2019 and January 2021, 100 patients were hospitalized to the General Surgery Department at Assiut University Hospital for complete thyroidectomies for toxic, nontoxic goiters, or malignant thyroid pathology. The patients were selected for the study one by one. The study included patients from both sexes and their age ranged from 25 to 60.

Inclusion criteria: The patients included were indicated for total thyroidectomy with normal preoperative serum calcium value and preoperative vitamin D value.

Exclusion Criteria: patients were not indicated for total thyroidectomy, low preoperative serum calcium value, low preoperative serum vitamin D value, patients with renal impairment and patients with hyper or hypoparathyroidism.

Patients were divided into two groups: Group A who received vit D before operation. Group B who received placebo.

24 hours before surgery, participants in group A received 200,000 IU of intramuscular vitamin D. Group 2 served as the control.

Serum calcium values were assessed 24 hours after a thyroid operation and after the procedure.

Patient assessment: History: detailed history was taken including personal, past and family history. Patient complaints varied from accidentally discovered neck

swelling, compression manifestations including dyspnea or dysphagia, toxic manifestation including tachycardia or weight loss and others had malignancy related symptoms including cachexia or diarrhea.

Examination: neck swelling that moves with deglutition. The consistency was either firm, firm to hard or hard. Auscultation could detect bruit.

Laboratory investigations: including: CBC – serum calcium – testing for kidney function – testing for thyroid function; T3 – T4 – TSH – vitamin D level.

Imaging: neck ultrasound (US) was a mainstay radiological examination for all cases included. In cases of malignant thyroid mass; CT neck – CT chest – Abdominal US might be indicated.

Preoperative fitness was done for whole patients. Patients with cardiac problems had echocardiography done.

Patients who were excluded for low preoperative calcium or vitamin D levels: They were cancelled from the study, had their surgery was postponed until calcium and vitamin D supplementations were given and blood levels were corrected.

Surgical Technique:

Thyroidectomy

Step 1: Positioning to Draping: Patient were maintained in a supine posture with full neck extension maintained by a sand bag below the interscapular area and a silicone gel or sheath beneath the occipital region after general anesthetic and endotracheal intubation. The edema was more pronounced and the surgical landmarks were more obvious with neck extension.



Fig 1: Positioning for thyroidectomy

Step 2: proper incision of a skin crease: If no subsequent neck treatment was planned, the incision in thyroid surgeries remained constant. The traditional low collar transverse skin crease incision was sufficient for a complete thyroidectomy. The skin crease or Langerhans' line incision was situated along the natural skin fold, which is 1.5–2 cm above the sternal notch or costoclavicular joints. When the neck was stretched, it looked like skin markings or grooves. It reached the anterior margins of the sternocleidomastoid muscle on both sides laterally. Sometimes with big masses incision

size might be expanded further laterally. If a unilateral or bilateral neck dissection was intended, the "J" or "U" shaped incision on the opposite side might be prolonged to the mastoid tip.

Step 3: Subplatysmal flap raising: After creating a suitable transverse incision through the skin and subcutaneous platysmal muscle, the flap was raised slightly above the top border of the thyroid cartilage during dissection by using skin hooks. Silk sutures might be used to secure the subplatysmal flap to the sheets to allow for continuous exposure.

Step 4: Deep cervical fascia was being cut through, causing muscle contractions and division. After elevating the subplatysmal flap, the strap muscles might be seen continuing laterally entrapping the sternocleidomastoid muscles on both sides inside the investing layer of deep cervical fascia. Electrocautery was used to incise the investing layer of the deep cervical fascia in the midline vertically, without cutting or incising any muscles during the whole length of exposure. Strap muscles might be retracted laterally after being cut loose areolar tissue in the middle.

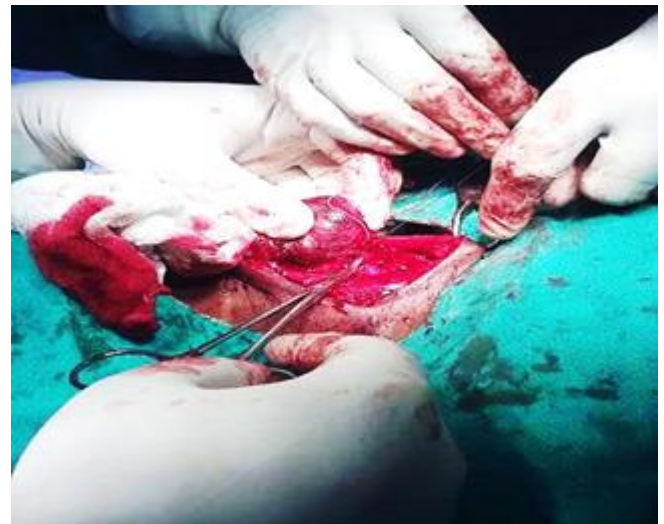


Fig 2: Operative view in thyroidectomy

Step 5: Middle Thyroid Vein Dissection: In contrast to superior and inferior pedicles, the middle thyroid vein, a branch of the IJV, is a weak structure that is not supported by any arteries. The middle thyroid vein was cut in two places by ligating sutures. Dissection was performed before the superior lobe.

Step 6: Management of Superior Pedicle: In order to protect the external laryngeal nerve, the superior pedicle was traditionally cut close to the gland. The superior thyroid artery and vein were separated by sutures and tied together.

Step 7: Identification of the Parathyroid Glands and Recurrent Laryngeal Nerve:

The recurrent laryngeal nerve crosses the trachea in a straight line before turning to the larynx. It

appeared oblique anteromedially in its course on medial rotation of the thyroid lobes. Identification of the superior and inferior parathyroid glands was necessary in order to prevent their avulsion or devascularization during dissection.

Due to the variable locations of these glands, particularly inferior parathyroid glands (PGs), which share an embryological ancestry with the thymus, parathyroid identification was challenging. PGs have a significant degree of location diversity, which often goes unnoticed. These might be ectopic in places including the intrathyroid, parapharynx, or upper mediastinum. Its light brown to tan hue, which is related to their fat content, vascularity, and proportion of oxyphil cells inside the glands, necessitated multiple methods of identification. Color may confuse with fat lobules, however if the surrounding fat tissue was not covering it up, a distinct hilar vessel might be seen.

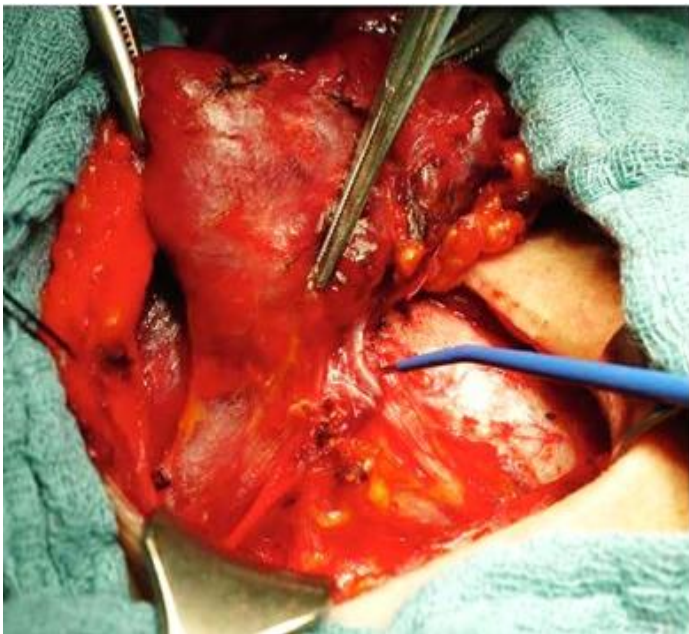


Fig 3: Identification is the enemy of complication.

Step 8: Management of Lower Thyroid Vessels. The ITA was split and ligated close to the gland capsule. This lessens parathyroid gland devascularization.

Step 9: Thyroid Dissection from Bed

The thyroid gland was removed from the tracheal bed once both poles have been dissected. Bipolar cautery made it simple to treat small tracheal veins, but failure to do so is a key contributor to postoperative reactive bleeding.

Step 10: then, the process was repeated on the other side.

Step 11: Hemostasis was extremely important.

Step 12: Neck dissection: in cases of malignant goiter

Step 13: Drain placement.

Step 14: Wound closure.



Fig 4: The lobe was lifted by gland forceps



Fig 5: Neck dissection in papillary thyroid cancer.



Fig 6: A rare case of huge ulcerating medullary thyroid cancer.

Ethical Approval:

The study was approved by the Ethics Board of the Assuit University. Participants were informed about surgery, its steps and its complications, and an informed written consent was taken from each participant in the study. This work has been carried out in accordance with The Code of Ethics of the

World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

SPSS was employed to gather and analyze the data (Version 20 of the Statistical Package for the Social Sciences, IBM; Armonk, New York). While nominal data were reported as frequency (percentage), continuous data were given as mean ± SD (range). To compare the nominal data of the groups under study, the Chi²-test was utilized. Utilizing the Student t test, the continuous variables of the two groups were compared.

To compare data which are not normally Mann-Whitney test) paired t-test to compare research group because samples are normally distributed and Wilcoxon signed-rank test to compare control group because samples are not normally distributed.

Since the level of confidence was maintained at 95%, a P value of <0.05 was termed substantial.

RESULTS

100 patients were included in the study: 50 patients in each group. Both groups had insignificant differences as regard baseline data (Table 1).

Table 1: Baseline data of included patients

| | Research group (n= 50) | Control group (n= 50) | P value |
|-------------------------|------------------------|-----------------------|---------|
| Age (years) | 40.25 ± 11.47 | 38.49 ± 11.53 | 0.44 |
| Sex | | | 0.60 |
| Male | 9 (18%) | 11 (22%) | |
| Female | 41 (82%) | 39 (78%) | |
| Residence | | | 0.41 |
| Rural | 28 (56%) | 32 (64%) | |
| Urban | 22 (44%) | 18 (36%) | |
| Diabetes mellitus | 3 (6%) | 5 (10%) | 0.46 |
| Hypertension | 4 (8%) | 5 (10%) | 0.73 |
| Ischemic heart disease | 3 (6%) | 2 (4%) | 0.65 |
| Family history | 5 (10%) | 4 (8%) | 0.73 |
| Toxic manifestations | 17 (34%) | 14 (28%) | 0.52 |
| Antithyroid medications | 15 (30%) | 14 (28%) | 0.83 |

Data were presented as frequency (%) and mean ± SD.

Both groups had insignificant differences as regard baseline thyroid function tests and other laboratory data (Table 2).

Table 2: Laboratory data and neck U/S at baseline for the patients

| | Research group (n= 50) | Control group (n= 50) | Mann-Whitney test | P value |
|--|------------------------|-----------------------|-------------------|---------|
| | | | | |

| | | | | |
|--------------------------|--------------|--------------|-------|------|
| Hemoglobin level (mg/dl) | 13.95 ± 1.41 | 13.85 ± 1.30 | 0.379 | 0.71 |
| Creatinine (mg/dl) | 1.03 ± 0.05 | 1.04 ± 0.04 | 1.08 | 0.27 |
| TSH (µu/ml) | 4.28 ± 1.00 | 4.36 ± 1.00 | 0.231 | 0.81 |
| Free T3 (pg/ml) | 1.03 ± 0.18 | 0.99 ± 0.17 | 0.492 | 0.59 |
| Free T4 (ng/dl) | 0.63 ± 0.11 | 0.59 ± 0.12 | 0.656 | 0.51 |
| Calcium (mg/dl) | 8.27 ± 0.29 | 8.23 ± 0.27 | 0.696 | 0.48 |

Data were presented as mean ± SD

The difference between the 2 studied groups was not significant as regard causes for thyroidectomy and histopathology (Table 3).

Table 3: Causes of thyroidectomy and histopathology among enrolled patients

| | Research group (n= 50) | Control group (n= 50) | P value |
|-------------------------|------------------------|-----------------------|---------|
| Causes of thyroidectomy | 35 (70%) | 34 (68%) | |
| Multinodular goiter | 14 (28%) | 15 (30%) | 0.98 |
| Toxic goiter | 1 (2%) | 1 (2%) | |
| Thyroid tumors | | | |

Data were presented as frequency (%)

Frequency of hypocalcemia was substantially greater among the control group in comparison to the research group. Also, postoperative calcium value was substantially reduced among the control group in comparison to the research group (Table 4).

Table 4: Postoperative complications and calcium level among enrolled patients

| | Research group (n= 50) | Control group (n= 50) | Mann-Whitney test | P value |
|-------------------------------|------------------------|-----------------------|-------------------|---------|
| Injury of RLN | 3 (6%) | 1 (2%) | 1.042 | 0.31 |
| Hoarseness of the voice | 5 (10%) | 8 (16%) | 0.796 | 0.37 |
| Hypocalcemia | 3 (6%) | 14 (28%) | 8.486 | 0.003 |
| Postoperative calcium (mg/dl) | 8.15 ± 0.58 | 7.10 ± 1.81 | 3.756 | < 0.001 |

Data were presented as frequency (%) and mean ± SD, RLN: recurrent laryngeal nerve

In case of research group, there was insignificant difference between pre- and postoperative calcium level but in case of control group, there was substantial reduction in serum calcium (Table 5).

Table 5: Pre- and postoperative calcium level

| | Research group (n= 50) | Control group (n= 50) |
|--|------------------------|-----------------------|
| | | |

| Calcium (mg/dl) | | |
|-----------------|-------------|----------------|
| Postoperative | 8.27 ± 0.29 | 8.23 ± 0.27 |
| Preoperative | 8.15 ± 0.58 | 7.10 ± 1.81 |
| <i>P</i> value | 0.194 | < 0.001 |
| | t = 1.152* | t = 4.146** |

Data were presented as mean ± SD

*Paired t-test

** Wilcoxon signed-rank test

DISCUSSION

Control of postoperative complications and minimizing the hospital stay are the most challenging issues that surgeons face all over the world ⁽¹⁰⁾.

Postoperative hypocalcemia after complete thyroidectomy is a frequent consequence. Clinical symptoms of hypocalcemia include perioral and peripheral paresthesias, muscular spasms, disorientation, and/or carpopedal spasm or tetany ⁽¹¹⁾.

Regarding our research: in comparison between baseline data variations among patients age, sex, residence, chronic illness as: diabetes and hypertension, positive or negative family history of thyroid diseases, toxic manifestations and antithyroid drugs administration, they were all of no significance in decreasing incidence of hypocalcemia.

Along with our study, the study done by **Biswas**, ⁽⁹⁾ on tetany after thyroidectomy had noticed that there wasn't relationship between gender and hypocalcemia: among 60 patients including 40 females, tetany occurred in 3 female patients to only one male patient.

Clinical evaluation of the variability between the clinical manifestations: Local thyroid evaluation and general related vital data e.g, blood pressure and pulse rate showed no correlation with the study aim. As stated by **Kurukahvecioglu**, ⁽⁶⁾ the same argument was supported by the role of supplementing oral calcium and vitamin D in the protection of hypocalcemia after thyroid surgery.

Following postoperative complications, only serum calcium level was markedly affected. Administration of vit D preoperatively in group A showed excellent role in decreasing incidence of post thyroidectomy hypocalcemia. Only 3 patients (6%) received vit D preoperatively had developed hypocalcemia, but 14 patients (28%) with no preoperative vit D administration had.

According to earlier research, thyroid surgery patients who take vitamin D supplements don't get hypocalcemia. ⁽¹²⁾

In addition, **Bellantone** ⁽¹³⁾ showed that vitamin D supplementation substantially increased blood calcium concentrations, which reduced the prevalence of hypocalcemia. 8% of the patients who received vit D developed postoperative hypocalcemia in comparison to 22% in the other group. This study was not confined only to the first postoperative 24 hours, but

the second and the third postoperative days were included.

In accordance with research by **Baldassarre**, ⁽¹⁴⁾ 5.5 percent of thyroidectomy patients had hypocalcemia. According to our research, administering preoperative vitamin D supplements may lower the likelihood of hypocalcemia after total thyroidectomy by 16%. In fact, this therapy prevented a substantial drop in serum calcium values.

It has been shown by **Roh and Park**, ⁽¹⁵⁾ that vitamin D supplementation lessens the likelihood and even the intensity of hypocalcemia after complete thyroidectomy.

In a meta-analysis, **Sanabria et al.** ⁽¹⁶⁾ assessed four randomized clinical studies. They discovered that vitamin D supplementation reduced the frequency of hypocalcemia symptoms after thyroid surgery.

The primary preventative strategy is sparingly dissecting the parathyroid glands during operation. Additionally, parathyroid autotransplantation has been shown to stop chronic hyperparathyroidism following complete, subtotal, or completion thyroidectomy for malignant or benign thyroid disorders. ⁽¹⁷⁾

Abboud et al. ⁽¹⁸⁾ conducted a retrospective analysis comprising 252 complete thyroidectomy patients. They discovered that regular vitamin D administration and routine autotransplantation of at least one parathyroid gland following complete thyroidectomy effectively decreased symptoms of hypocalcemia and lifelong hyperparathyroidism.

CONCLUSION

Our work demonstrates that thyroidectomy without preoperative vitamin D supplementation might result in postoperative hypocalcemia in patients of all ages. Vitamin D supplements used before surgery may halt postoperative hypocalcemia, enabling a safe and quick release from the hospital. In the end, this will increase patient happiness and result in considerable cost savings. Additionally, because surgical hypocalcemia lengthens hospital stays, doing this will result in a shorter overall stay.

Declarations:

Consent for Publication: I confirm that all authors accept the manuscript for submission

Availability of data and material: Available

Competing interests: None

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Conflicts of Interest: The authors declare no conflicts of interest regarding the publication of this paper.

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