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## Comparative study of preoperative versus postoperative parathormone hormone level to predict hypocalcemia earlier after near total thyroidectomy

General Surgery

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### ABSTRACT

**Background:** Hypocalcemia due to hypoparathyroidism is the most common complication of thyroid surgery. Postoperative hypocalcemia caused by deficiency in parathormone hormone is resulted by inhibition of bone resorption, a reduction in the renal biosynthesis of 1-25- dihydroxy cholecalciferol and decreased alimentary calcium absorption.

**Objective:** To assess the role of parathormone level postoperative in prediction of hypocalcemia earlier after near total thyroidectomy in comparison to preoperative values.

**Methodology:** This is an interventional prospective study that was carried out on (30) patients aged from 21 to 55 years old. As regard sex, there were 4 males (13.3%) and 26 females (86.7%) who underwent near total thyroidectomy with follow up of 24 hours preoperative and 24 hours postoperative of serum parathyroid hormone (PTH) level, serum total and ionized calcium levels and serum vitamin D levels.

**Results:** Monitoring of parathyroid hormone (PTH) level in the first 24 hours post operative revealed that 4 patients (13.3%) of the studied cases developed post-operative hypocalcemia with post operative hypoparathyroidism. Mean postoperative values of total calcium, ionized calcium and PTH were lower than preoperative values. However, there is no difference between values of PO4 and vitamin D in postoperative and preoperative.

**Conclusion:** Determination of PTH levels in the first 24 hours postoperative is an important method for early detection of post operative hypocalcemia whether temporary or permanent even if no clinical manifestations appeared. Subsequently, aids the early treatment of the condition and early discharge of the patients.

JRAM 2024; 5 (2): 142- 147

**Keywords:** Near total thyroidectomy; Parathyroid hormone (PTH); Post operative hypocalcemia.

**Submission Date:** 22 July 2024

**Acceptance Date:** 9 September 2024

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**Please cite this article as:** Eisa TKM, Abdel-razik MA, Ibrahim ZA. Comparative study of preoperative versus postoperative parathormone hormone level to predict hypocalcemia earlier after near total thyroidectomy. JRAM 2024; 5 (2): 142- 147. DOI: 10.21608/jram.2024.304497.1256

### INTRODUCTION

Thyroidectomy is considered one of the most frequently performed surgical procedures all over the globe. However numerous Complications may follow thyroidectomy <sup>[1]</sup>.

Transient hypocalcemia due to hypoparathyroidism is the most common complication of thyroid surgery. Postoperative hypocalcemia caused by deficiency in parathormone hormone is resulted by inhibition of bone resorption, a reduction in the renal biosynthesis of 1-25- dihydroxy cholecalciferol and decreased alimentary calcium absorption <sup>[2]</sup>. Postoperative hypocalcemia that was reported after thyroid surgery has incidence that

ranges from 30% to 50% of patients <sup>[3]</sup>. Hypocalcemia is caused by the surgical manipulation of the parathyroid glands and/or affection of their blood supply. In most of the cases, hypocalcemia that occur after thyroidectomy is temporary, and only in 2% of all cases permanent symptoms were reported. Hypocalcemia that lasts up to 6 months postoperative is considered transient or temporary and has been found in 3-5% of cases, however, in up to 2% of the patients, postoperative hypoparathyroidism may last longer than 6 months and is then considered permanent <sup>[4]</sup>. Hypocalcemia can be fatal, and symptoms may not render evident clinically until one to two days after the surgery. And hence patients are routinely

followed up with serum calcium level post operative before discharge for the prompt intervention if indicated [5].

Serial measurements of calcium and parathormone hormone (PTH) levels are used to identify the most accurately relevant time point after thyroidectomy to obtain blood samples; The 4- and 6-hour time points were of the highest predictive value for hypocalcemia (sensitivity 94%, specificity 100%) [6].

## PATIENTS AND METHODS

This is an interventional prospective study that was conducted at Al-Zahraa university hospital, including (30) patients with minimum age of 21 years and maximum age of 55 years. As regard sex, there were 4 males (13.3%) and 26 females (86.7%) (Table 1) who underwent, total thyroidectomy with follow up of 24 hours, postoperative. Informed oral and written consents were taken from all the subjects who accepted to be a part of this study. All the personal data and medical information of all patients were assured by confidentiality.

**Inclusion criteria:** Patients who underwent thyroidectomy were included of age groups that range from 18 to 50 years old, Goiters due to benign thyroid lesions, controlled toxic goiter, Patient with early differentiated thyroid carcinoma, Patients with normal serum levels of calcium, parathormone hormone and vitamin D.

**Exclusion criteria:** Completion hemithyroidectomy, Patients with concomitant primary hyperparathyroidism, Patients who received calcium supplementation, Pre-existing hypocalcemia, Patients with previous auto transplantation of parathyroid glands, Patient with thyroiditis, Patient with undifferentiated thyroid cancer,

Patient with multiple endocrine neoplasm syndrome (MEN).

## Ethical approval

All patients were completely informed about the procedure and all possible complications as well as the follow up tests and willingly accepted to participate. All patients` data were used only for research purposes with complete confidentiality.

## Operative technique

All patients underwent near total thyroidectomy where removal of the entire thyroid gland was done with preservation of the small tissue related to parathyroid glands and recurrent laryngeal nerve. Proper antisepsis, patient positioning after general anesthesia were carried out, collar incision, elevation of skin flaps, opening of deep fascia and splitting of strap muscles to expose the gland. Gland dissection lobe flowing lobe through ligation and dissection of middle, superior and inferior thyroid vessels subsequently was carried. Recurrent laryngeal nerve (RLN) should be identified during the entire operation time and be properly visualized. Tension over RLN should be avoided during medial retraction of thyroid lobe. Identification is through anatomical position as it lies superior-medially passing posterior to the inferior thyroid artery (figure 1). Critical care should be taken during ligation of inferior thyroid artery and dissection of the lower pole to not compromise the blood supply of parathyroid glands. Also at least two parathyroid glands should be visualized and preserved during the procedure along with the small adjacent tissue of the thyroid gland to carry out near total thyroidectomy (figure 2). Absolute hemostasis, drain insertion and closure in layers. All patients were followed postoperative clinically for any possible manifestations of hypocalcemia and biochemically with serum levels of parathyroid hormone, total and ionized calcium levels.

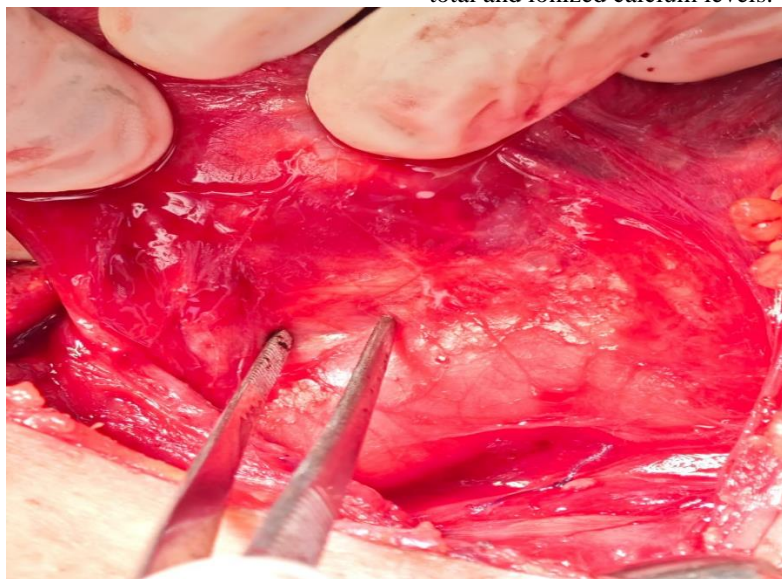


Figure (1): Identification of recurrent laryngeal nerve intraoperative.

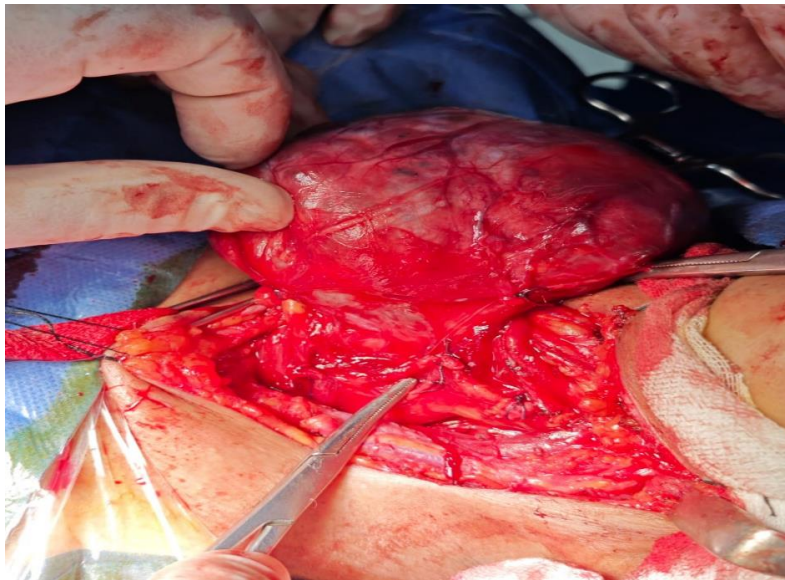


Figure (2): Identification of parathyroid glands intraoperative

**Statistical analysis:**

Statistical Program for Social Science (SPSS) version 24 was used in data analysis. Frequency and percentage were used for qualitative data. Quantitative data were expressed as mean ± Standard deviation **SD. Probability (P-value)** < 0.05 was considered significant. While P-value > 0.05 was considered insignificant.

**RESULTS**

Tables (2) and (3) showed that mean values of calcium, ionized calcium and PTH were lower and more

statistically significant in postoperative than preoperative values. However, there is no statistical significance between values of PO4 and vitamin D in postoperative values. Table (4) showed that the incidence rate of post operative hypoparathyroidism and subsequently hypocalcemia was 13.3 % of cases (4 patients) with showing that postoperative calcium level decline is directly related to the level of PTH level decline with a positive correlation. In all patients when hypoparathyroidism was found, hypocalcemia was noted. Despite normal preoperative PTH.

Table (1): Description of demographic data in studied patients

Variable		Studied patients n = 30
Sex	Male	4 (13.3%)
	Female	26 (86.7%)
Age (years)	Mean ±SD	34.3 ± 8.7
	Range	21 – 55

SD: Standard deviation

Table (2): Description of pre-operative laboratory data in studied patients (n = 30)

Laboratory data	Range	Mean ± SD
TSH	0.7- 5	2.9 ± 1.4
FT3	0.7 - 4.56	2.2 ± 0.9
FT4	0.6 - 2.1	1.2 ± 0.4
Total Ca	9 - 11	9.9 ± 0.6
Ionized Ca	3.5 - 5	4.5 ± 0.4
PTH	17- 19.5	18.5 ± 0.8
PO4	3.5 - 4.5	3.9 ± 0.3
Vitamin D	19 - 46	29.6 ± 7.3 <sup>2</sup>

TSH: Thyroid stimulating hormone, FT3: Free T3, FT4: Free T4, PTH: Parathormone hormone, PO4: Phosphorous, SD: standard deviation

**Table (3): Comparisons of pre-operative and post-operative studied laboratory data**

Labs		Pre-op (N = 30)	Post-op (N = 30)	Stat. test	p-value
<b>Total Calcium</b>	Mean ± SD	9.9 ± 0.6	9.2 ± 1.2	t =2.9	0.007*
<b>Ionized Calcium</b>	Mean ± SD	4.5 ± 0.4	4.3 ± 0.5	t =3.8	0.001*
<b>PTH</b>	Mean ± SD	18.5 ± 0.8	17.7 ± 1.9	t =2.6	0.013*
<b>PO4</b>	Mean ± SD	3.9 ± 0.3	3.9 ± 0.3	t =0.0	1.0
<b>Vitamin D</b>	Mean ± SD	29.6 ±7.3	29.9 ± 7.2	t =0.12	0.904

PTH: Parathormone hormone, PO4: Phosphorous, SD: standard deviation, Pre-op: Preoperative, Post-op: Postoperative, \* Statistically significant p-value (<0.05).

**Table (4): Comparisons of pre-operative and post-operative calcium and parathyroid gland status**

Status of		Pre-operative n= 30 no. (%)	Post-operative n = 30 no. (%)
<b>Ca status</b>	<b>Normal</b>	30 (100%)	26 (86.7%)
	<b>Hypocalcemia</b>	0 (0%)	4 (13.3%)
<b>Parathyroid status</b>	<b>Normal</b>	30 (100%)	26 (86.7%)
	<b>Hypoparathyroidism</b>	0 (0%)	4 (13.3%)

## DISCUSSION

Hypocalcemia that occurs after thyroid surgery is one of the major challenges when the most skilled surgeons try to avoid it. when severe it can lead to serious complications, and requires parenteral supplementation if calcium to alleviate the symptoms [7].

Lethal hypocalcemia can be evident 24–48 h after surgery. Despite spontaneous recovery in most patients, with permanent damage of parathyroid glands; hypoparathyroidism will be permanent [8].

There is significant relationship between the incidence of postoperative hypoparathyroidism and the extent of resection during surgery. Patients who underwent near-total thyroidectomy developed hypoparathyroidism in (9%) of cases in comparison to patients who underwent total thyroidectomy (26%) and that was reported in a prospective study in 2021. In this study, it is emphasized that near-total thyroidectomy may be preferable in benign thyroid diseases in order to reduce the complication of hypoparathyroidism which is nearly concurrent with current results. [9].

Monitoring of PTH and calcium levels, 24 hours after total thyroidectomy, was found to be useful in prediction hypoparathyroidism with high sensitivity, specificity and positive predictive value [2]. Several studies report this ratio to be between 1.6% and 40% and rates of permanent hypocalcemia after thyroid surgery are reported to be 0.6 to 4.7% in various studies [10].

Similar results were noted in current research all underwent near total thyroidectomy prospectively followed up with serum PTH, total and ionized calcium postoperative. hypoparathyroidism and

hypocalcemia was noted in 13.3 % of cases (4 cases of 30) and in all cases with post operative decrease in PTH levels hypocalcemia was noted. The aim of this study is not to determine whether hypocalcemia is temporary or permanent it is only to detect incidence of hypocalcemia at laboratory level without necessarily clinical manifestations; So, monitoring of PTH level in the first 24 hours post operative was found strongly suggestive of the development of postoperative hypocalcemia. The study has some limitations: first of all, it is single center study. Moreover, small sample size. Therefore, more studies included more cases from multiple centers will be conducted in the future.

## CONCLUSION

Determination of PTH levels in the first 24 hours postoperative is an important method for early detection of post operative hypocalcemia whether temporary or permanent even if no clinical manifestations appeared Subsequently, aids the early treatment of the condition and early discharge of the patients. Near total thyroidectomy is the preferred procedure in benign thyroid diseases due to lower incidence rates of post-operative complications. More studies with bigger samples and longer periods of follow up to confirm the results and determine the chronicity of hypocalcemia post operative are recommended.

**Financial support:** This work was not funded from any governmental or non-governmental agencies.

**Conflict of interest declaration:** The authors declared that there is no direct or indirect conflict of interest.

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## الملخص العربي

دراسة مقارنة بين مستوى هرمون الغدة الجار درقية في الدم قبل وبعد عملية استئصال الغدة الدرقية وعلاقته بالاكتشاف المبكر لانخفاض مستوى الكالسيوم في الدم بعد العملية  
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### الملخص:

**الخلفية:** يعتبر انخفاض مستوى الكالسيوم في الدم نتيجة انخفاض مستوى هرمون الباراثورمون (هرمون الغدة الجار درقية) من المضاعفات الأكثر شيوعاً لجراحة استئصال الغدة الدرقية حيث يؤدي نقص هرمون الباراثورمون إلى تثبيط امتصاص العظام وانخفاض التخليق الكلوي لثنائي هيدروكسيولات الكوليكالسيفيرول وهو ما يؤدي بدوره إلى انخفاض الامتصاص الغذائي للكالسيوم.

**الهدف:** تهدف هذه الدراسة إلى تقييم دور قياس مستوى هرمون الغدة الجار درقية في الدم بعد جراحة استئصال الغدة الدرقية في الاكتشاف المبكر لانخفاض مستوى الكالسيوم في الدم مقارنة بالقيم قبل الجراحة.

**الطرق:** شارك في هذه الدراسة ثلاثون مريض تتراوح أعمارهم ما بين واحد وعشرين إلى خمس وخمسين عام من بينهم 4 ذكور و 26 أنثى جميعهم خضعوا لاستئصال الغدة الدرقية وتمت متابعة مستويات الكالسيوم الكلي والمتأين وهرمون الباراثورمون وفيتامين د بعد أربع وعشرون ساعة من العملية.

**النتائج:** كشفت مراقبة مستوى هرمون الغدة الجار درقية (PTH) في الـ 24 ساعة الأولى بعد العملية الجراحية أن 4 مرضى (13.3%) من الحالات المدروسة أصيبوا بانخفاض الكالسيوم في الدم بعد الجراحة مع قصور وظائف الغدة الجار الدرقية. كانت القيم المتوسطة بعد الجراحة للكالسيوم الكلي والكالسيوم المتأين وهرمون الغدة الجار درقية (PTH) أقل من قيم ما قبل الجراحة. ومع ذلك، لا يوجد فرق بين قيم الفوسفات (PO4) وفيتامين د في فترة ما بعد الجراحة أو قبلها.

**الاستنتاجات:** يعد تحديد مستوى هرمون الغدة الجار درقية (PTH) خلال الـ 24 ساعة الأولى بعد العملية الجراحية طريقة مهمة للكشف المبكر عن نقص كلس الدم بعد العملية الجراحية سواء كان مؤقتاً أو دائماً حتى لو لم تظهر أي مظاهر سريرية. ويساعد بعد ذلك على العلاج المبكر للحالة والخروج المبكر للمرضى.

**الكلمات المفتاحية:** استئصال الغدة الدرقية, انخفاض مستوى الكالسيوم في الدم, هرمون الباراثورمون.

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