


# Postoperative Serum Calcium

## as a marker for Hypocalcemia after Thyroidectomy

*Calcio sérico posoperatorio como marcador de hipocalcemia después de tiroidectomía*

 Muhammad Qasim Qazaal, F.I.C.M.S. F.A.C.S., Lecturer, Department of Surgery, College of Medicine, Al-Iraqia University

 Firas Fadhil Fayyadh, F.I.C.M.S. F.A.C.S., Lecturer, Department of Surgery, College of Medicine, Al-Iraqia University/ [firasfadhil20202020@gmail.com](mailto:firasfadhil20202020@gmail.com)

 Solafa Rabi Salih, F.I.B.O.C., Lecturer, Department of Gynecology and Obstetrics, College of Medicine, Al-Iraqia University/ [solafarabi@gmail.com](mailto:solafarabi@gmail.com)

Corresponding author: Dr. Muhammad Qasim Qazaal. Email: [muhammadqasim30103010@yahoo.com](mailto:muhammadqasim30103010@yahoo.com)

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### Abstract

**Objectives:** The present study aimed to determine the incidence of hypocalcemia (temporary and permanent) following total thyroidectomy and to assess whether or not its clinical and biochemical features could be used as predictive markers for postoperative hypocalcemia. **Methods:** A total of 144 patients who undergo a total thyroidectomy were constitute the base of such prospective study. Serum calcium were measured in addition to details of the operation including the pathology and complications were recorded. **Results:** The rate of hypocalcemia was identified in 70 patients (48.61%), among them, 62 patients (43.05%) were found to developed temporary hypocalcemia and only 8 patients (5.55) identified to developed a permanent hypocalcemia. Temporary hypocalcemia was significantly more common among patient who had a toxic goiter. The mean of serum calcium levels that measured at 6 hours and 24 hours postoperatively were significantly different among study's groups of hypocalcemia (normo-calcemia, temporary and permanent hypocalcemia). **Conclusion:** The serum calcium levels that measured six hours and 24 hours post thyroidectomy are useful as predictive marker for developing hypocalcemia.

**Keyword:** Hypocalcemia, Thyroidectomy, serum calcium, post-operation.

### Resumen

**Objetivos:** El presente estudio tuvo como objetivo determinar la incidencia de hipocalcemia (temporal y permanente) después de la tiroidectomía total y evaluar si sus características clínicas y bioquímicas podrían usarse como marcadores predictivos de hipocalcemia posoperatoria. **Métodos:** Un total de 144 pacientes a los que se les realizó una tiroidectomía total constituyeron la base de dicho estudio prospectivo. Se midió el calcio sérico además de los detalles de la operación, incluida la patología y se registraron las complicaciones. **Resultados:** Se identificó la tasa de hipocalcemia en 70 pacientes (48,61%), entre ellos, 62 pacientes (43,05%) desarrollaron hipocalcemia temporal y solo 8 pacientes (5,55) identificados desarrollaron hipocalcemia permanente. La hipocalcemia temporal fue significativamente más común entre los pacientes que tenían un bocio tóxico. La media de los niveles de calcio sérico medidos a las 6 horas y a las 24 horas del posoperatorio fueron significativamente diferentes entre los grupos de hipocalcemia del estudio (normocalcemia, hipocalcemia temporal y permanente). **Conclusión:** Los niveles de calcio sérico medidos seis y 24 horas después de la tiroidectomía son útiles como marcador predictivo para el desarrollo de hipocalcemia.

**Palabra clave:** hipocalcemia, tiroidectomía, calcio sérico, posoperatorio.

### Introduction

Postoperative hypocalcemia is one of the most common complications following thyroid surgery with a wide variety of incidences ranging from 0.5% up to more than 75%<sup>1,2</sup>.

There are several causes suggested for developing hypocalcemia postoperatively, including hemodilution or upsurged

urinary excretion of calcium that is attributed to surgical stress, releasing of calcitonin secondary to the manipulation of thyroid gland, dysfunction of the parathyroid glands through direct injury, devascularization or even by removal<sup>3,4</sup>, or through what is known a hungry bone syndrome "toxic thyroid osteodystrophy"<sup>5-9</sup>.

Although postoperative hypocalcemia is multifactorial in nature, the thyroid lobectomy is solely plausibly related to such complication<sup>5,10</sup>, usually following the total thyroidectomy. Therefore, there is a potential risk for parathyroid injury compared to other types of thyroid surgery.

It has been demonstrated that, the majority of post-thyroidectomy hypocalcemia cases are temporary, and lasting a few months to return back to normal value. Nevertheless, few cases were found to persist behind such period and considered as permanent cases<sup>1,6,11</sup>. Moreover, the cut-off time period between temporary and permanent hypocalcemia are considered between 6 months to one year<sup>6,12</sup>.

Several pieces of literature have examined many factors that might be considered predictors for the development of post-thyroidectomy hypocalcemia involving the determination of parathyroids intra-operatively with various techniques of dissection<sup>1,6,12,13</sup>. The present study aimed to determine the incidence of hypocalcemia (temporary and permanent) following total thyroidectomy and assess whether its clinical and biochemical features could be used as predictive markers for postoperative hypocalcemia.

## Subject and method

In this prospective study, data were collected from all 144 patients undergone total thyroidectomy at Al-Karakh private hospital during period from 2017 to 2020.

The blood sample from each patient was drawn and serum calcium was measured at 6 hours and 24 hours after surgery, and any more measurements for consecutive days when required. Whether the existence of clinical manifestation of hypocalcemia or not was also recorded. According to our hospital laboratory, the normal range of corrected serum calcium was ranged from 2.2 to 2.7 mmol/l. In the present study, the criteria considered for defining hypocalcemia was based on corrected value of serum calcium with or without clinical manifestation; as a corrected serum calcium of  $<2.0$  mmol/l was considered hypocalcemia regardless clinically asymptomatic or if the corrected serum calcium of  $<2.2$  mmol/l with the presence of one or more of clinical manifestations was also considered hypocalcemia. With including each patient even with just a single measure of serum calcium below such normal range, no cases of hypocalcemia were excluded from current study.

Details regarding surgical procedure, pathology of goiter, and any consequence complications were recorded beside patients' demographics characteristics. Type and duration of calcium and vit. D therapies prescribed for the patients was documented, where those who requiring calcium replacement therapy were treated for 4 weeks period and then assessed and re-assessed their serum calcium levels in week period in the private clinic. Thereafter, when the patient became clinically hypocalcemia following cessation an exogenous calcium, their supplements were resumed, and their levels of serum calcium and parathyroid hormone were measured

on three months post-operatively. Moreover, the definition of permanent hypocalcemia was considered according to the requirement for calcium therapy with or without vit. D supplement for period of more than 6 months post-operatively.

Ethical Approval from Ethical Committee in the Department of Family and Community Medicine at the College of Medicine at Al-Iraqia University was obtained added to official permission from Al-Karakh private hospital. Other ethical prerequisites including participation's written consent with their right for refusal and confidentiality were ensured.

Data were entered and analyzed using SPSS version 26 and STATISTICA version12 with standard approaches of frequencies and percentages. One Way ANOVA test and Chi-squared test were used to assess the associations between quantitative and categorical variables respectively. A  $P$  value of  $<0.05$  was been considered a significance level for any test throughout the study.

## Results

A total 144 patients were enrolled in the study after inclusion and exclusion criteria, their age was ranged from 18 to 56 years with mean of  $40.64 \pm 7.390$  years old. Female patients were dominant (74.3%), and more than half of them identified to have a toxic goiter (59.0%) and only 12.5% of them reported to have a complication like vocal cord palsy. Moreover, significant differences were found among study's groups regarding pathology, as patients who have toxic goiter were more likely to develop hypocalcemia particularly the temporary one than those who have either non-toxic goiter or malignancy did so ( $\chi^2$ : 16.975, df: 4,  $P < 0.05$ ). No significant differences were observed regarding other patients' characteristics among study's groups including age, gender and complications ( $P > 0.05$ ) (Table 1).

**Table 1. Patients' characteristic among study's groups (n= 144)**

Patients' Characteristics	N (%)	Study's' Groups		
		Normo-calcemia (N= 74)	Temporary hypocalcemia (N= 62)	Permanent hypocalcemia (N= 8)
		N (%)	N (%)	N (%)
Mean ± SD	40.64 ± 7.390	42.59± 4.131	38.06± 9.758	42.50± 2.204
Significance*			$F: 0.846, P = 0.703$	
<b>Gender</b>				
Female	107 (74.3)	50 (46.7)	52 (48.6)	5 (4.7)
Male	37 (25.7)	24 (64.9)	10 (27.0)	3 (8.1)
Significance**			$\chi^2: 5.315, df: 2, P = 0.070$	
			<b>Pathology</b>	
Toxic goiter	85 (59.0)	33 (38.8)	48 (56.5)	4 (4.7)
Non-toxic goiter	13 (9.0)	7 (53.8)	5 (38.5)	1 (7.7)
Malignancy	46 (31.9)	34 (73.9)	9 (19.6)	3 (6.5)
Significance**			$\chi^2: 16.975, df: 4, P = 0.002$	
			<b>Complications</b>	
No	126 (87.5)	64 (50.8)	56 (44.4)	6 (4.8)
Yes	18 (12.5)	10 (55.6)	6 (33.3)	2 (11.1)
Significance**			$\chi^2: 1.664, df: 2, P = 0.435$	

\*: One Way ANOVA test, \*\*: Chi-square test.

Furthermore, significant differences were observed between serum calcium measured postoperatively and the development of hypocalcemia, as the mean of serum calcium measured at six hours postoperatively was significantly lower in those who developed permanent hypocalcemia than that found in those who either have temporary hypocalcemia or those without hypocalcemia (1.9588±0.09463 vs. 2.0542±0.06086 and 2.4203±0.14256) respectively. Similarly, the mean of serum calcium measured 24 hours postoperatively was significantly lower in those who developed permanent hypocalcemia than in those with temporary hypocalcemia and normo-calcemia (1.8638±0.5579 vs. 1.8960±0.7303 and 2.4209±0.14451) respectively ( $F:25.498, df: 55, P<0.001$ ).

## Discussion

Out of 144 patient undergone thyroidectomy, the rates of temporary and permanent hypocalcemia were 43.05% and 5.5% respectively, and these rates were in consistent with what were reported by other studies<sup>1,2,5</sup>.

In this study, toxic goiter was found to significantly associate with the development of temporary hypocalcemia following surgery, which appeared to be bloodier and required more diathermy for hemostasis. Such finding is similar to Pflaiderer *et al.* study<sup>1</sup> that pathology was significantly associated with the development of post-operated hypocalcemia. No significant differences were identified regarding patients' age, sex, and complications among study's groups of either temporary, permanent or no hypocalcemia, and these finding are supported by other studies<sup>1,12</sup>. Controversy, Prim *et al.*, Nourel-dine *et al.* and Del Rio *et al.* studies<sup>3,14,15</sup> revealed that post-

operative hypocalcemia was significantly dominant in female patients rather than males patients, and such differences could be attributed to differences in applied study methods.

The most interesting findings was the differences in serum calcium levels measured postoperatively and the development of hypocalcemia, as the calcium levels have been dropped between the 6 hours and 24 hours post-operatively in the temporary group and more dramatically in permanent group whilst it remains approximately unaltered in normo-calcemic group. From this perspective, this study could speculate that such progressive decline in the calcium levels post-operatively is important marker and suggesting its usefulness in predicting the development of hypocalcemia at early as possible in order to prevent potential consequences. These findings are endorsed by other literature concluded that calcium levels following thyroidectomy could be used as predictor for development of hypocalcemia<sup>1,13,16-19</sup>.

## Conclusion

The serum calcium levels that measured six hours and 24 hours post-thyroidectomy could be used as predictive marker for developing hypocalcemia particularly a permanent one. Furthermore, patients who had a toxic goiter are at the increased risk of developing temporary hypocalcaemia.

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