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Incidence and Risk Factors of Postoperative Hypocalcaemia Following Total and Near-Total Thyroidectomy

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معدل الحدوث وعوامل الخطورة لنقص كالسيوم الدم بعد الاستئصال الكلي وشبه الكلي للغدة الدرقية

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Abstract

Thyroidectomy is a commonly performed surgical procedure for various thyroid diseases. Despite advances in surgical techniques, postoperative hypocalcaemia remains one of the most frequent complications, particularly following total thyroidectomy.

The aim of this study was to estimate the incidence of postoperative hypocalcaemia and to evaluate its characteristics and outcomes among patients undergoing thyroid surgery.

A descriptive retrospective study was conducted using thyroidectomy records from Benghazi Medical Center between 2010 and 2016. The study included patients operated on for non-toxic goiter, toxic goiter, recurrent goiter, Hashimoto's thyroiditis, thyroid malignancy, and Graves' disease. Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0.

A total of 74 patients were included in the study. Postoperative hypocalcaemia occurred in 27.7% of cases. The majority of patients were female, and hypocalcaemia was more common among women than men. Higher incidence rates were observed in patients who underwent total thyroidectomy and in those with retrosternal extension.

Postoperative hypocalcaemia remains a relatively common complication following thyroidectomy. Careful surgical technique and close postoperative monitoring of serum calcium levels are essential to reduce its incidence.

Keywords: Hypocalcaemia, Parathyroid glands, Postoperative complications, Serum calcium, Thyroidectomy.

الملخص

تُعد جراحة استئصال الغدة الدرقية من العمليات الشائعة لعلاج العديد من أمراض الغدة الدرقية. وعلى الرغم من التطور في التقنيات الجراحية، ما يزال نقص كالسيوم الدم بعد الجراحة من أكثر المضاعفات شيوعًا، خاصة بعد الاستئصال الكلي للغدة الدرقية.

هدفت هذه الدراسة إلى تقدير معدل حدوث نقص كالسيوم الدم بعد جراحة الغدة الدرقية، ودراسة خصائصه ونتائجه لدى المرضى الذين خضعوا لاستئصال كلي أو شبه كلي للغدة الدرقية.

أُجريت دراسة وصفية استعادية باستخدام سجلات المرضى الذين خضعوا لجراحة استئصال الغدة الدرقية في مركز بنغازي الطبي خلال الفترة من عام 2010 إلى عام 2016. شملت الدراسة حالات التضخم الدرقي غير السام، والتضخم الدرقي السام، والتضخم المتكرر، والتهاب الغدة الدرقية لهاشيموتو، والأورام الخبيثة، ومرض غريفز. تم تحليل البيانات باستخدام برنامج الحزمة الإحصائية للعلوم الاجتماعية (SPSS) الإصدار 23.0.

شملت الدراسة 74 مريضًا، وبلغ معدل حدوث نقص كالسيوم الدم بعد الجراحة 27.7%. كانت غالبية المرضى من الإناث، وكان نقص كالسيوم الدم أكثر شيوعًا بينهن مقارنة بالذكور. كما لوحظ ارتفاع معدل حدوث نقص كالسيوم الدم لدى المرضى الذين خضعوا لاستئصال كلي للغدة الدرقية، وكذلك في الحالات المصحوبة بامتداد خلف القص.

تُظهر نتائج هذه الدراسة أن نقص كالسيوم الدم بعد استئصال الغدة الدرقية يُعد من المضاعفات الشائعة نسبيًا، مما يستدعي التقييم الدقيق قبل الجراحة، والحفاظ على الغدد جار الدرقية أثناء العملية، والمتابعة الدقيقة لمستويات الكالسيوم بعد الجراحة.

الكلمات المفتاحية: استئصال الغدة الدرقية، الغدد جار الدرقية، كالسيوم الدم، نقص كالسيوم الدم، مضاعفات ما بعد الجراحة.

Introduction

Numerous complications may arise following surgical removal of the thyroid gland. These complications are usually related either to surgical technique or to postoperative metabolic disturbances. Although the overall incidence of complications is relatively low, some occur more frequently than others [1].

The primary complications associated with thyroid surgery include recurrent laryngeal nerve injury, postoperative bleeding, and parathyroid gland dysfunction. Hypoparathyroidism may result from inadvertent excision of the parathyroid glands, devascularization, or damage caused by capsular hematoma. Preservation of at least one parathyroid gland in situ with an adequate blood supply is essential to prevent this complication. Clinically, hypoparathyroidism manifests as hypocalcaemia, which is usually transient and resolves within the first postoperative weeks; however, in some cases, it may persist and become permanent [2].

Persistent hypocalcaemia is a recognized complication after thyroidectomy, occurring in approximately 8.6% of patients undergoing thyroid surgery. The highest incidence has been reported following total thyroidectomy for thyroid cancer (up to 28%) and thyrotoxicosis (23%), whereas the incidence is considerably lower following subtotal thyroidectomy and lobectomy [3,4].

The most common cause of postoperative hypoparathyroidism is injury to the parathyroid glands during thyroid surgery, particularly during total thyroidectomy and central neck dissection [5]. Transient postoperative reductions in serum calcium levels are not uncommon, making close monitoring of serum calcium and phosphorus levels essential during the postoperative period [6].

Significant hypocalcaemia has been defined as a total serum calcium level below 7.2 mg/dL or an ionized calcium level below 3.4 mg/dL. Clinical assessment combined with early postoperative calcium measurement is sufficient to identify most clinically significant cases [7].

Low postoperative parathyroid hormone levels have been shown to be a more reliable predictor of symptomatic hypocalcaemia than serum calcium levels measured on the first postoperative day [7]. Other causes of postoperative hypocalcaemia include increased calcitonin release due to intraoperative manipulation of the thyroid gland and rapid skeletal uptake of calcium in cases of thyrotoxic osteodystrophy, known as hungry bone syndrome [8].

Several risk factors for postoperative hypocalcaemia have been identified, including preoperative hypocalcaemia, younger age, elevated serum alkaline phosphatase levels, large goiter size, malignancy, and thyrotoxicosis [9].

Clinical symptoms of hypocalcaemia typically develop within 24 to 72 hours after surgery and include perioral numbness, tingling of the hands and feet, muscle cramps, and, in severe cases, seizures and laryngeal stridor if untreated [9].

Meticulous surgical dissection and preservation of the parathyroid glands remain the cornerstone of prevention. Parathyroid autotransplantation has also been increasingly utilized to reduce the risk of permanent hypoparathyroidism, with evidence suggesting an inverse relationship between the number of autotransplanted glands and the incidence of permanent hypoparathyroidism [10].

Normal serum calcium levels range between 8.5 and 10.5 mg/dL, and hypocalcaemia is defined as a decrease in serum calcium levels below this range [11].

Aims

The aims of this study were:

1. To estimate the incidence of postoperative hypocalcaemia among patients undergoing thyroid surgery based on postoperative serum calcium levels following total and near-total thyroidectomy.
2. To evaluate the characteristics and outcomes of postoperative hypocalcaemia in relation to patient demographics, type of surgery, and surgical indications.

Patients and Methods

Study Design

This was a descriptive retrospective study.

Study Setting

The study was conducted at Benghazi Medical Center and included thyroidectomy records from January 2010 to December 2016.

Inclusion Criteria

All patients who underwent thyroid surgery for non-toxic goiter, toxic goiter, recurrent goiter, Hashimoto's thyroiditis, thyroid malignancy, or Graves' disease were included in the study.

Ethical Considerations

Access to patient data was formally authorized. Patient confidentiality was strictly maintained, and all identifying information was excluded from data collection and analysis.

Study Population and Data Collection

The study population consisted of patients who underwent total or near-total thyroidectomy during the study period. Data were collected retrospectively from medical records and included patient age, sex, type of surgery, indication for surgery, presence of retrosternal extension, redo surgery, and postoperative serum calcium levels.

Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test or Fisher's exact test when appropriate. Continuous variables were analyzed using the Student's t-test or Mann–Whitney U test. A p-value of less than 0.05 was considered statistically significant.

Results

During the period from January 1, 2010, to December 31, 2016, a total of 74 patients underwent total or near-total thyroidectomy at Benghazi Medical Center. The majority of patients (73%) underwent total thyroidectomy.

The overall incidence of postoperative hypocalcaemia was 27.7%.

Demographic Characteristics

Of the 74 patients included in the study, 62 (83.8%) were female and 12 (16.2%) were male. Postoperative hypocalcaemia occurred more frequently among female patients compared with male patients. **See table 2**

Patient age ranged from 10 to 80 years. Most patients were between 30 and 50 years of age, and this age group demonstrated the highest incidence of postoperative hypocalcaemia. **See table 1**

Table (1): Age distribution of the cases

Age	No.	No.%	Hypocalcaemia	Hypocalcaemia %
10 – 20	4	5.4 %	0	0 %
21 – 30	6	8.1 %	2	2.7 %
31 - 40	18	24.3 %	5	6.75 %
41 – 50	20	27 %	6	8.10 %
51 – 60	13	17.5 %	3	4.05 %
61 -70	12	16.2 %	1	1.35 %
71 -80	1	1.35 %	0	0 %

Table (1): shows the highest age incidence was found to be in the fourth decade of life (20 patients) and next was in the third decade (18 patients), and much less incidence age above 70 years, the total number of all cases was 74.

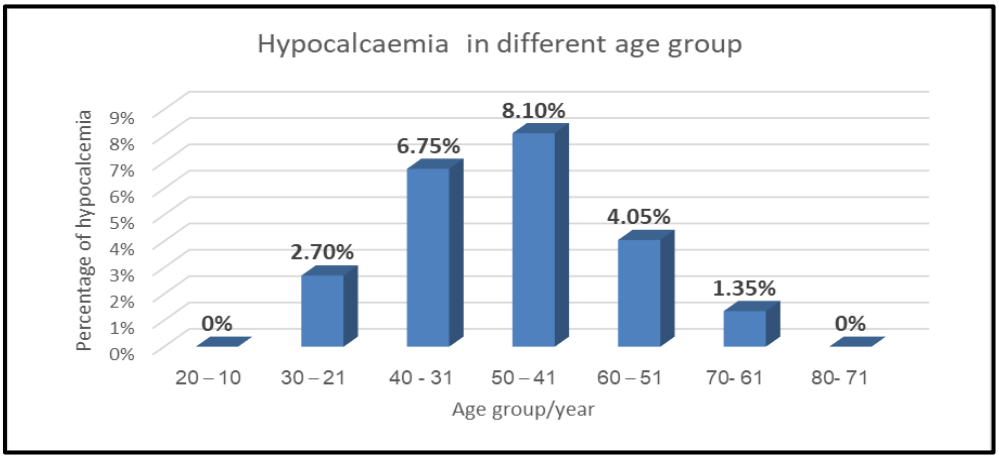

Figure (4): Hypocalcemia in different age group.

Table (2) Gender distribution**.**

Hypocalcemia	Male (n=12)		Female (n=62)	
	n	%	n	%
Yes	0	0%	17	22.9%
No	0	0%	57	77.0%

Table (2): shows that the incidence was much more common in Females (62 patients) than males (12 patients).the incidence of Hypocalcaemia more in female 22.9% than male 0%.

Postoperative Serum Calcium Levels

Postoperative serum calcium levels were within the normal range in 57 patients (77.0%), whereas 17 patients (22.9%) developed hypocalcaemia. **See table 3**

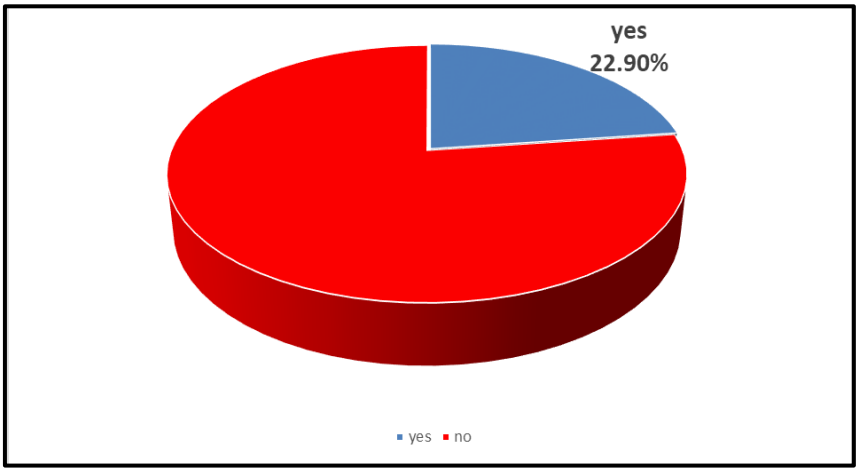

Figure (5): incidence of hypocalcemia among females

Table (3): Post-operative hypocalcaemia.

Serum calcium	No	%
Normal serum calcium	57	77.03%
Hypocalcaemia	17	22.9 %

This table show incidence of Post-operative Hypocalcaemia was 22.9% (17patient), and incidence of Post-operative normal serum calcium was 77.03% (57 patient).

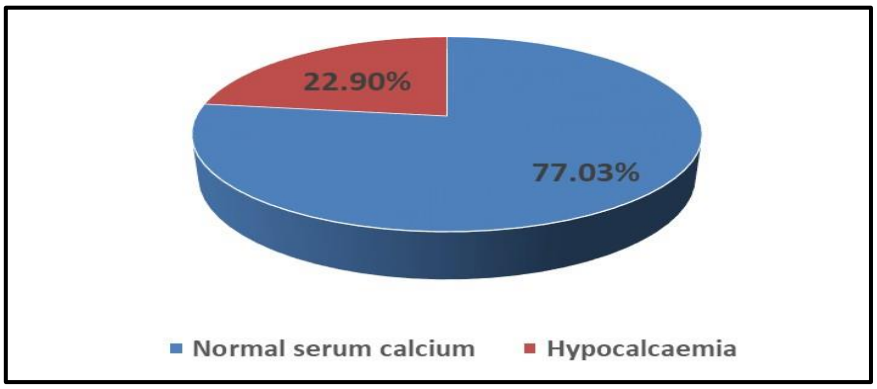

Figure (6): serum calcium level

Type of Surgery and Postoperative Hypocalcaemia

Postoperative hypocalcaemia was more common following total thyroidectomy. Among 54 patients who underwent total thyroidectomy, 15 patients (27.7%) developed hypocalcaemia. In contrast, hypocalcaemia occurred in only 2 of the 20 patients (10%) who underwent near-total thyroidectomy.

Redo surgery was associated with postoperative hypocalcaemia in 25% of cases. Patients with retrosternal extension showed the highest incidence of postoperative hypocalcaemia, occurring in 43.8% of cases. **See table 4**

Table (4): Types of operations.

Operation	No.	Post-operative hypocalcaemia	No.	Hypocalcaemia %
Total thyroidectomy	54	15	73	27.77
Near total	20	2	27	10
Redo surgery	4	1	5.4	25
Retrosternal extension	16	7	21.6	43.75

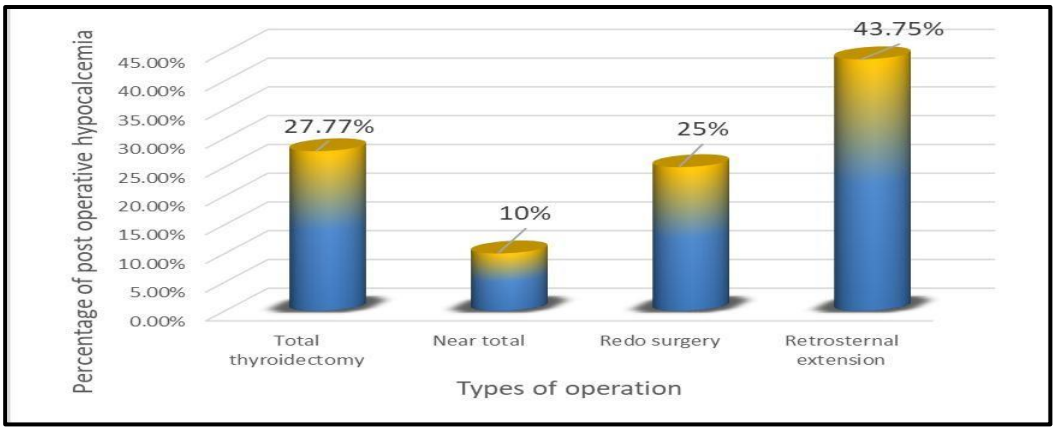

Figure (7): post-operative hypocalcemia

Indications for Surgery

The most common indication for surgery was non-toxic goiter, accounting for 51 cases (69%), with a postoperative hypocalcaemia rate of 29.4%. Thyroid malignancy accounted for 8 cases (10.8%), with postoperative hypocalcaemia observed in 37.5% of these patients.

Hypocalcaemia occurred in 33.3% of patients with toxic goiter and 25% of patients with recurrent goiter. No cases of postoperative hypocalcaemia were observed among patients with Graves' disease. Although Hashimoto's thyroiditis was represented by only one case, postoperative hypocalcaemia occurred in this patient. **See table 5**

Table (5): Indication of surgery.

Indication	No.	No.%	Post-operative hypocalcaemia	Hypocalcaemia %
Nontoxic goiter	51	69	15	29.4
Toxic goiter	3	4	1	33.33
Recurrent goiter	4	5.4	1	25
Gravis disease	7	9.45	0	0
Hashimoto's thyroiditis	1	1.35	1	100
Malignancy	8	10.8	3	37.5

Table 5 shows nontoxic goiter is commonest indication of surgery {51 case} incidence of hypocalcemia 29.4% then malignancy {8 case} incidence of hypocalcemia 10.8 .the lowest indication Hashimoto thyroiditis {1 case} but highest incidence of hypocalcemia 100%.

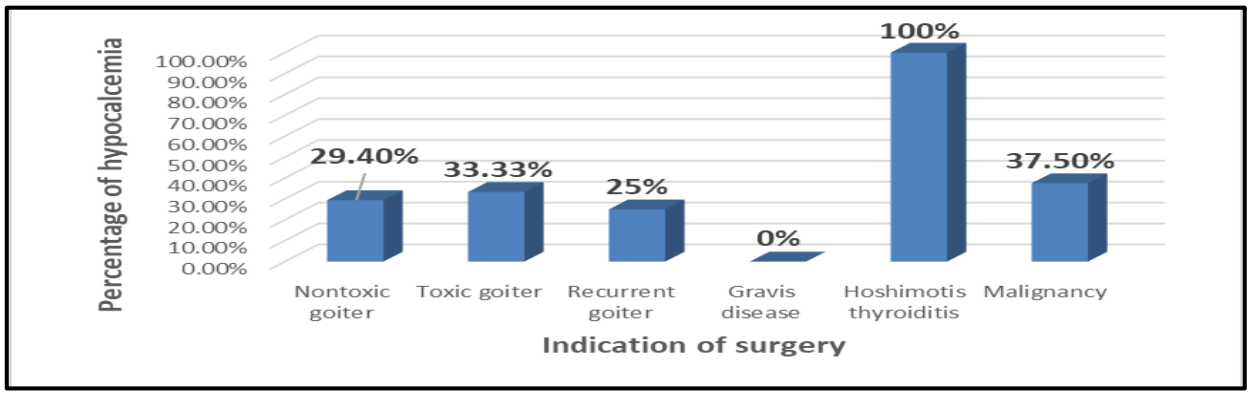

Figure (8): Percentage of hypocalcemia in different thyroid diseases.

Discussion

The present study aimed to estimate the incidence of postoperative hypocalcaemia following total and near-total thyroidectomy and to identify patients at increased risk of developing this complication. Early identification of high-risk patients is important to allow prompt treatment, prevent clinical manifestations of hypocalcaemia, and potentially reduce the length of hospital stay. In this retrospective study, postoperative hypocalcaemia was observed in 27.7% of patients. This incidence is relatively high but comparable to rates reported in previous studies, particularly after total thyroidectomy. Variations in reported incidence among different studies may be explained by differences in surgical techniques, extent of thyroid resection, definitions of hypocalcaemia, and postoperative monitoring protocols.

Female patients constituted the majority of the study population, and postoperative hypocalcaemia was more frequently observed among women than men. Similar findings have

been reported in other studies, although the underlying mechanism responsible for this gender difference remains unclear.

The incidence of postoperative hypocalcaemia was significantly higher following total thyroidectomy compared with near-total thyroidectomy. This finding supports existing evidence that the extent of surgery is a major risk factor for hypocalcaemia, most likely due to an increased risk of parathyroid gland injury or devascularization. In addition, patients with retrosternal extension demonstrated the highest incidence of postoperative hypocalcaemia, reflecting the technical difficulty of surgery in these cases.

Several approaches have been proposed to predict postoperative hypocalcaemia, including early postoperative measurement of serum calcium and parathyroid hormone levels. While some studies support the usefulness of early parathyroid hormone monitoring, its routine use may be limited by cost and availability, particularly in resource-limited settings. Serial serum calcium measurements remain a practical and widely accepted alternative.

The results of this study should be interpreted in light of certain limitations, including its retrospective design, relatively small sample size, and the absence of routine postoperative parathyroid hormone measurements. Despite these limitations, the study provides valuable data regarding the incidence and risk factors of postoperative hypocalcaemia in our surgical practice.

Conclusion

Postoperative hypocalcaemia remains a relatively common complication following thyroidectomy, particularly after total thyroidectomy and in cases associated with retrosternal extension. Female patients were more frequently affected than male patients. The findings of this study emphasize the importance of careful surgical technique and heightened awareness of risk factors associated with postoperative hypocalcaemia.

Recommendations

1. Meticulous identification and preservation of the parathyroid glands during thyroid surgery should be emphasized to minimize the risk of postoperative hypocalcaemia.
2. Routine postoperative monitoring of serum calcium levels is recommended, especially in patients undergoing total thyroidectomy or those with retrosternal extension.
3. Early identification of patients at high risk for hypocalcaemia may allow timely intervention and reduce postoperative complications and length of hospital stay.
4. Further prospective studies with larger sample sizes are recommended to better identify predictive factors and improve prevention strategies for postoperative hypocalcaemia.

Compliance with Ethical Standards

Ethical Approval

This study was conducted in accordance with the ethical standards of the institutional and national research committee. As this was a retrospective study based on medical record review, formal ethical approval was not required. Patient confidentiality was strictly maintained throughout the study.

Informed Consent

Informed consent was waived due to the retrospective nature of the study and the use of anonymized patient data.

Conflict of Interest

The authors declare that they have no conflict of interest.

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Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.