



Incidence and Risk Factors of Post-Thyroidectomy Hypocalcemia in a Tertiary Referral Hospital in Eastern Libya: A Retrospective Cohort Study

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نسبة الحدوث وعوامل الخطر للإصابة بنقص كالسيوم الدم بعد استئصال الغدة الدرقية في مستشفى
مرجعي بشرق ليبيا: دراسة حشدية استرجاعية

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Received: June 15, 2026

Accepted: August 22, 2026

Published: September 18, 2026

Abstract:

Postoperative hypocalcemia remains the most frequent and challenging complication following thyroidectomy, leading to prolonged hospital stays, increased healthcare costs, and patient morbidity. However, regional data from Libya remain scarce. This retrospective cohort study aimed to evaluate the incidence of temporary and permanent hypocalcemia and to identify independent clinical and surgical risk factors among 75 consecutive adult patients who underwent total, near-total, or revision thyroidectomy at Benghazi Medical Center. Data collection encompassed patient demographics, surgical extent, retrosternal extension, histopathological diagnoses, and serial serum calcium levels. The overall incidence of temporary post-thyroidectomy hypocalcemia was 50.0%, while permanent hypocalcemia occurred in 3.7% of long-term cases. A statistically significant reduction was observed between preoperative (8.99 ± 1.15 mg/dL) and postoperative serum calcium levels (8.04 ± 1.19 mg/dL; $p < 0.0001$). Multivariable logistic regression analysis identified female gender as the sole independent predictor of temporary hypocalcemia (Adjusted Odds Ratio [aOR] = 5.64; 95% Confidence Interval: 1.05–30.30; $p = 0.044$), whereas age, surgical extent, and retrosternal extension showed no statistically significant association. Given that transient hypocalcemia affects half of the patients, routine perioperative calcium monitoring, proactive vitamin D optimization, and meticulous surgical preservation of the parathyroid glands are strongly recommended to improve clinical outcomes in regional tertiary care centers.

Keywords: Thyroidectomy; Hypocalcemia; Parathyroid Gland; Endocrine Surgery; Risk Factors.

المخلص

يُعد نقص كالسيوم الدم التالي للجراحة من أكثر المضاعفات شيوعاً وتحدياً بعد عمليات استئصال الغدة الدرقية، مما يتسبب في إطالة فترة الإقامة بالمستشفى، وزيادة التكاليف الصحية، وارتفاع معدلات اعتلال المرضى. ومع ذلك، لا تزال البيانات الإقليمية المتاحة في ليبيا شحيحة. هدفت هذه الدراسة الحشدية الاسترجاعية إلى تقييم معدلات حدوث نقص كالسيوم الدم المؤقت والدائم، وتحديد عوامل الخطر السريرية والجراحية المستقلة، وذلك من خلال مراجعة 75 مريضاً بالغاً خضعوا لجراحات استئصال الغدة الدرقية الكلي، أو شبه الكلي، أو المنهجي بمركز بنغازي الطبي. شمل جمع البيانات الخصائص الديموغرافية للمرضى، ومدى اتساع التدخل الجراحي، والامتداد خلف عظمة القس، والتشخيصات النسيجية المرضية، ومستويات الكالسيوم المتسلسلة في المصل. أظهرت النتائج أن المعدل الإجمالي لحدوث نقص كالسيوم الدم المؤقت بلغ 50.0%، بينما بلغ معدل نقص كالسيوم الدم الدائم 3.7% من الحالات المتابعة على المدى الطويل. كما لوحظ انخفاض ذو دلالة إحصائية ملحوظ بين مستويات الكالسيوم قبل الجراحة (8.99 ± 1.15 مغم/ديسيلتر) وبعدها (8.04 ± 1.19 مغم/ديسيلتر؛ قيمة $p < 0.0001$). وأثبت تحليل الانحطاط اللوجستي المتعدد أن جنس الإناث يمثل المؤشر المستقل الوحيد لخطر الإصابة بنقص كالسيوم الدم المؤقت (نسبة الرجحان المعدلة = 5.64؛ فاصل الثقة 95%: 1.05–30.30؛ قيمة $p = 0.044$)، في حين لم تُظهر العمر أو نطاق الجراحة أو الامتداد خلف القس ارتباطاً ذا دلالة إحصائية. ونظراً لأن نقص كالسيوم الدم المؤقت يطال نصف المرضى، تُوصي الدراسة بشدة بضرورة المراقبة الروتينية لمستويات الكالسيوم المحيطة بالجراحة، والتحسين الاستباقي لمستويات فيتامين د، والحرص الدقيق على الحفاظ جراحياً على الغدة الجار درقية لتحسين النتائج السريرية في مراكز الرعاية الثلاثية الإقليمية.

الكلمات المفتاحية: استئصال الغدة الدرقية؛ نقص كالسيوم الدم؛ الغدة الجار درقية؛ جراحة الغدة الصماء؛ عوامل الخطر.

Introduction

Thyroidectomy is one of the most frequently performed endocrine surgical procedures worldwide for both benign goiters and malignant thyroid neoplasms. Despite substantial advancements in surgical technology, capsular dissection techniques, and energy devices, postoperative hypocalcemia resulting from transient or permanent hypoparathyroidism remains the most prevalent complication [1]. Hypocalcemia can manifest as circumoral paresthesia, carpopedal spasm, Chvostek's sign, Trousseau's sign, or severe cardiac arrhythmias, severely impairing patient recovery and prolonging hospitalization [2].

The etiology of post-thyroidectomy hypocalcemia is multifactorial, including mechanical trauma, accidental devascularization, or unintended excision of the parathyroid glands during surgery, as well as hungry bone syndrome in patients with hyperthyroidism [3]. Internationally reported rates of transient hypocalcemia vary widely from 15% to 50%, whereas permanent hypocalcemia occurs in 1% to 4% of surgical cases [4].

In Libya, thyroid disorders represent a major healthcare burden, with a high volume of complex, giant, and retrosternal goiters presenting to tertiary hospitals. However, published epidemiological and surgical outcome data from Eastern Libya are limited. Benghazi Medical Center (BMC) serves as the primary tertiary referral facility for a

catchment population exceeding two million people in Eastern Libya. Evaluating the local incidence and clinical determinants of post-thyroidectomy hypocalcemia is imperative for refining clinical management guidelines, optimizing preoperative counseling, and reducing post-surgical complications. This study aims to investigate the rate of temporary and permanent hypocalcemia following thyroidectomy at Benghazi Medical Center and to identify key patient- and procedure-related risk factors associated with this outcome.

Material and methods

Study Design and Patient Selection

A retrospective observational cohort study was conducted evaluating consecutive patients who underwent total, near-total, or completion (redo) thyroidectomy at the Department of Surgery, Benghazi Medical Center, Benghazi, Libya. Patient clinical charts, surgical registries, and laboratory electronic databases were comprehensively reviewed.

Ethical approval was obtained from the institutional review board of Benghazi Medical Center.

Preoperative and Operative Protocols

Preoperative workup included clinical evaluation, thyroid ultrasound (USS), fine-needle aspiration cytology (FNAC) when indicated, baseline serum calcium, and vocal cord mobility assessment. Operations were executed under general anesthesia by standard capsular dissection techniques. Surgical interventions were categorized as Total Thyroidectomy, Near-Total Thyroidectomy, and Redo/Revision Thyroidectomy.

Outcome Measures and Definitions

The primary study endpoint was temporary post-thyroidectomy hypocalcemia, defined as a postoperative total serum calcium level < 8.0 mg/dL or the presence of symptomatic clinical hypocalcemia requiring intravenous or oral calcium/vitamin D supplementation within 24 to 72 hours postoperatively, resolving within 6 months. Permanent hypocalcemia was defined as persistent dependency on calcium supplementation beyond 6 months postoperatively.

Statistical Analysis

Data analysis was performed using Python (v3.10) with pandas, scipy.stats, and statsmodels libraries. Continuous variables were expressed as Mean $\pm$ Standard Deviation (SD) and compared using independent sample two tailed t-tests or paired t-tests (pre- vs. post-operative values). Categorical variables were expressed as frequencies and percentages and analyzed using Pearson's Chi-square (χ^2) test or Fisher's exact test. A multivariable logistic regression model was constructed including age, gender, preoperative serum calcium, surgical extent, and retrosternal extension to identify independent risk factors. Adjusted Odds Ratios (aOR) with 95% Confidence Intervals (CI) were reported. Statistical significance was set at $p < 0.05$.

Results

Baseline Demographic and Clinical Characteristics

A total of 75 patients were analyzed. The cohort exhibited a strong female preponderance, with 62 females (83.8%) and 12 males (16.2%) (Female:Male ratio

5.17:1). The mean age was 45.66 ± 13.58 years (range: 17 to 75 years). Retrosternal goiter extension was present in 16 patients (21.6%).

Surgical procedures performed consisted of Total Thyroidectomy in 50 patients (67.6%), Near-Total Thyroidectomy in 20 patients (27.0%), and Redo/Revision Thyroidectomy in 4 patients (5.4%). Histopathological examination revealed benign lesions (Multinodular Goiter, Colloid Goiter, Parathyroid Adenoma) in 67 patients (89.3%) and malignant neoplasms (Papillary Thyroid Carcinoma) in 8 patients (10.7%). Table 1 summarizes the baseline clinical characteristics.

Table 1: Baseline Clinical and Surgical Characteristics of the Patient Cohort (N = 75)

Variable	Category / Parameter	Overall Value
Age (years)	Mean $\pm$ SD (Range)	45.66 ± 13.58 (17 – 75)
Gender, n (%)	Female	62 (83.8%)
	Male	12 (16.2%)
Retrosternal Extension, n (%)	Present (Yes)	16 (21.6%)
	Absent (No)	57 (78.4%)
Type of Operation, n (%)	Total Thyroidectomy	50 (67.6%)
	Near-Total Thyroidectomy	20 (27.0%)
	Redo / Revision Thyroidectomy	4 (5.4%)
Histopathology, n (%)	Benign Disease	67 (89.3%)
	Malignant Neoplasm	8 (10.7%)
Preoperative Calcium (mg/dL)	Mean $\pm$ SD	8.99 ± 1.15
Postoperative Calcium (mg/dL)	Mean $\pm$ SD	8.04 ± 1.19

Incidence of Hypocalcemia

The overall incidence of temporary post-thyroidectomy hypocalcemia was 50.0% (36 out of 72 patients with complete follow-up). A highly statistically significant paired reduction was documented between preoperative serum calcium levels (Mean: 8.99 ± 1.15 mg/dL) and postoperative serum calcium levels (Mean: 8.04 ± 1.19 mg/dL), representing an average post-surgical calcium drop of 0.90 mg/dL (paired t-test, $p < 0.0001$). Permanent hypocalcemia was observed in 1 case (3.7% of long-term recorded cases).

Risk Factor Analysis

Univariate cross tabulation and t-test analyses revealed that female gender was significantly associated with a higher rate of temporary hypocalcemia compared to male patients (55.7% [34/61] vs. 16.7% [2/12]; Pearson $\chi^2 = 4.66$, $p = 0.0309$). Patients who developed temporary hypocalcemia had lower preoperative serum calcium levels (8.74 ± 1.42 mg/dL) compared to those who remained normocalcemic (9.24 ± 0.71 mg/dL), approaching statistical significance ($t = -1.86$, $p = 0.0667$). Postoperative calcium was markedly lower in the hypocalcemic group (7.20 ± 0.96 mg/dL vs. 9.02 ± 0.40 mg/dL; $p < 0.0001$).

Age (46.06 ± 11.87 vs. 46.03 ± 14.67 years; $p = 0.9928$), retrosternal extension (56.3% vs. 46.4%; $p = 0.6821$), extent of thyroidectomy (Total: 53.1%, Near-total: 40.0%, Redo: 50.0%; $p = 0.6156$), and malignancy status (Malignant: 62.5% vs. Benign: 50.0%; $p = 0.5208$) did not demonstrate statistically significant univariate associations. Table 2 details the univariate associations.

Table 2: Univariate Analysis of Predictors for Temporary Post-Thyroidectomy Hypocalcemia

Variable	Category	Hypocalcemia n (%)	Normocalcemia n (%)	p-value
Gender	Female (n=61)	34 (55.7%)	27 (44.3%)	0.0309*
	Male (n=12)	2 (16.7%)	10 (83.3%)	--
Retrosternal Extension	Present (n=16)	9 (56.3%)	7 (43.8%)	0.6821
	Absent (n=56)	26 (46.4%)	30 (53.6%)	--
Type of Operation	Total Thyroidectomy (n=49)	26 (53.1%)	23 (46.9%)	0.6156
	Near-Total Thyroidectomy (n=20)	8 (40.0%)	12 (60.0%)	
	Redo Thyroidectomy (n=4)	2 (50.0%)	2 (50.0%)	
Pathology	Malignant (n=8)	5 (62.5%)	3 (37.5%)	0.5208
	Benign (n=64)	31 (48.4%)	33 (51.6%)	--
Mean Age (years)	Continuous	46.06 ± 11.87	46.03 ± 14.67	0.9928
Pre-op Calcium (mg/ dL)	Continuous	8.74 ± 1.42	9.24 ± 0.71	0.0667

Multivariable Logistic Regression Analysis

In the multivariable logistic regression model incorporating gender, age, preoperative serum calcium, retrosternal extension, and surgical extent, female gender remained the sole independent predictor of temporary hypocalcemia (Adjusted Odds Ratio [aOR] = 5.64; 95% Confidence Interval [CI]: 1.05 – 30.30; $p = 0.044$). Preoperative serum calcium exhibited an inverse trend with hypocalcemia risk (aOR = 0.51 per 1 mg/dL increase, 95% CI: 0.22 – 1.20; $p = 0.126$), indicating a protective effect for higher baseline calcium levels, though not reaching statistical significance. Results are summarized in Table 3.

Table 3: Multivariable Logistic Regression Analysis for Independent Risk Factors of Temporary Hypocalcemia

Variable	Beta Coeff.	Std. Error	Adjusted OR	95% CI	P-value
Female Gender	1.731	0.857	5.64	1.05 – 30.30	0.044*
Preoperative Calcium (mg/dL)	-0.667	0.435	0.51	0.22 – 1.20	0.126
Total Thyroidectomy	0.581	0.563	1.79	0.59 – 5.39	0.302
Age (per year)	0.012	0.021	1.01	0.97 – 1.06	0.579
Retrosternal Extension	-0.006	0.653	0.99	0.28 – 3.58	0.992

Discussion

Postoperative hypocalcemia represents a major surgical challenge following thyroid resection. In this study conducted at Benghazi Medical Center, we identified a temporary hypocalcemia incidence of 50.0% and a permanent hypocalcemia rate of 3.7%. Furthermore, female gender was identified as a powerful independent risk factor, conferring a more than fivefold increase in the likelihood of developing transient hypocalcemia postoperatively (aOR = 5.64).

The observed 50.0% rate of transient hypocalcemia at BMC lies at the higher end of global literature estimates, which typically range between 19% and 50% [5,6]. Several factors peculiar to referral tertiary centers in developing healthcare systems may explain this elevated rate. First, patients in Libya frequently present with advanced, long-standing multinodular goiters or giant retrosternal extensions, necessitating extensive capsular dissection and increasing the likelihood of inadvertent parathyroid injury or devascularization [7]. Second, endemic vitamin D deficiency is highly prevalent in North African populations, particularly among women, owing to dietary habits, limited sun exposure, and clothing practices [8]. Pre-existing subclinical vitamin D deficiency impairs intestinal calcium absorption and exacerbates postoperative hungry bone syndrome following thyroidectomy [9].

The strong predisposition of female patients to post-thyroidectomy hypocalcemia observed in our cohort aligns with international findings reported by Thomusch et al. and Erbil et al. [10,11]. Estrogen fluctuations, lower baseline bone density, and higher

rates of unmanaged vitamin D insufficiency among females are hypothesized physiological drivers [12].

Although total thyroidectomy demonstrated a higher nominal rate of hypocalcemia compared to near-total thyroidectomy in our univariate analysis (53.1% vs. 40.0%), the difference was not statistically significant in the multivariable model (aOR = 1.79, $p = 0.302$). This supports the growing international surgical consensus that total thyroidectomy can be performed safely when meticulous capsular dissection is executed, preserving the posterior capsule and parathyroid vascular supply [13].

Clinical Implications for Surgical Practice at Benghazi Medical Center:

- **Preoperative Screening:** Routine measurement of 25-hydroxyvitamin D and total serum calcium should be incorporated into the standard preoperative protocol for all patients scheduled for total thyroidectomy.
- **Prophylactic Supplementation:** Routine short-term oral calcium (1–2 g/day) and active Vitamin D (calcitriol 0.5–1.0 mcg/day) should be considered postoperatively, especially in female patients and those with large goiters.
- **Parathyroid Autotransplantation:** Immediate autotransplantation of inadvertently devascularized or excised parathyroid tissue into the sternocleidomastoid muscle should be routinely practiced.

Study Limitations

This study has several limitations inherent to its retrospective design. Serum intact parathyroid hormone (iPTH) levels were not routinely drawn for all patients due to resource constraints, limiting our ability to correlate serum calcium directly with parathyroid hormone dynamics. Additionally, serum vitamin D levels were not systematically recorded in the retrospective charts. Despite these limitations, this study represents one of the few detailed clinical audits on post-thyroidectomy outcomes from Eastern Libya, providing actionable baseline data for regional surgical quality improvement.

Conclusion

Transient hypocalcemia affects half of the patients undergoing thyroid excision at Benghazi Medical Center, with female gender serving as an independent predictor of risk. Establishing standardized perioperative calcium management protocols, routine preoperative Vitamin D optimization, and surgical techniques focused on parathyroid preservation are strongly recommended to reduce morbidity and optimize surgical outcomes in Libyan tertiary care centers.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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