

Research Article

# Predictors of Postoperative Hypocalcemia, Recurrent Laryngeal Nerve Injury, and Hospital Stay Following Total Thyroidectomy with Central Neck Dissection

Ahmad Shah<sup>1</sup>, Mohammad Iqbal<sup>2</sup>, Asmatullah<sup>3</sup>, Habibullah<sup>4</sup>, Bashir Ahmed<sup>5</sup>, Fazal Dad<sup>6</sup>

<sup>1</sup>Associate Professor, Department of General Surgery, Bolan Medical College, Sandeman Provincial Hospital, Quetta, Pakistan.

<sup>2</sup>Assistant Professor, Department of ENT, Bolan Medical College, Sandeman Provincial Hospital, Quetta, Pakistan.

<sup>3,4,5</sup>Associate Professor, Department of ENT, Bolan Medical College, Sandeman Provincial Hospital, Quetta, Pakistan.

<sup>6</sup>Associate Professor, Department of Maxillofacial Surgery, Bolan Medical College, Sandeman Provincial Hospital, Quetta, Pakistan.

**Corresponding author:** Dr. Asmatullah

Associate Professor, Department of ENT, Bolan Medical College, Sandeman Provincial Hospital, Quetta, Pakistan.

**Email:** asmatullahkhan.1dr@gmail.com

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## ABSTRACT

**Background:** Total thyroidectomy with central neck dissection is an established treatment for thyroid malignancies with central compartment involvement; however, postoperative hypocalcemia, recurrent laryngeal nerve injury, and prolonged hospital stay remain important causes of morbidity.

**Objective:** To identify predictors of postoperative hypocalcemia, recurrent laryngeal nerve injury, and prolonged hospital stay among patients undergoing total thyroidectomy with central neck dissection.

**Methodology:** This retrospective cohort study was conducted at Department of ENT, Bolan Medical Complex Hospital, Quetta from 1<sup>st</sup> October 2025 to 31<sup>st</sup> March 2026 and 210 patients undergoing total thyroidectomy with unilateral or bilateral central neck dissection for thyroid malignancies were included.

**Results:** The mean age of patients was 46.8±12.9 years, and 154 (73.3%) were female. Postoperative hypocalcemia occurred in 64 patients, while recurrent laryngeal nerve injury was observed in 18 patients. Patients with hypocalcemia had longer operative times (176.4±41.2 vs. 145.0±32.4 minutes;  $p<0.001$ ), fewer preserved parathyroid glands (2.4±0.7 vs. 3.4±0.6;  $p<0.001$ ), and more frequent bilateral central neck dissection (64.1% vs. 34.2%;  $p<0.001$ ). Recurrent laryngeal nerve injury was associated with larger tumor size (4.1±1.8 vs. 2.7±1.3 cm;  $p<0.001$ ), extrathyroidal extension (61.1% vs. 24.5%;  $p=0.001$ ), longer operative time (201.7±44.6 vs. 150.2±35.3 minutes;  $p<0.001$ ), and lower use of intraoperative nerve monitoring (38.9% vs. 68.8%;  $p=0.012$ ). Preservation of fewer than three parathyroid glands (AOR=4.28,  $p<0.001$ ), bilateral central neck dissection (AOR=2.74,  $p=0.004$ ), and operative time >180 minutes (AOR=2.21,  $p=0.028$ ) independently predicted hypocalcemia. Tumor size >3 cm (AOR=3.65,  $p=0.013$ ), extrathyroidal extension (AOR=3.17,  $p=0.026$ ), and absence of nerve monitoring (AOR=2.86,  $p=0.041$ ) independently predicted RLN injury.

**Conclusion:** Postoperative complications following total thyroidectomy with central neck dissection are influenced by both disease-related and operative factors. Careful preservation of parathyroid glands, selective use of bilateral central neck dissection, routine intraoperative nerve monitoring, and strategies to reduce operative duration may help minimize postoperative morbidity and shorten hospital stay.

**Keywords:** Thyroidectomy, Central Neck Dissection, Hypocalcemia, Recurrent Laryngeal Nerve Injury, Hospital Stay, Thyroid Cancer.

## INTRODUCTION

This surgery is called total thyroidectomy and central neck dissection and is reserved for

differentiated thyroid cancer and selected patients with advanced thyroid cancers that are known or suspected to have Central

compartment lymph node involvement.<sup>1</sup> Although surgical techniques, peri-operative management, and intraoperative nerve monitoring have improved significantly, the potential for complications after surgery remains a major concern due to its impact on patient morbidity, health-related quality of life and use of health resources.<sup>2</sup> The most frequent complication after total thyroidectomy is hypocalcemia, reported with 15-50% of patients who experience transient hypocalcemia and 1-5% with permanent hypoparathyroidism.<sup>3</sup> This is primarily because of inadvertent removal of the parathyroid glands at surgery or devascularization or accidental injury of them.<sup>4</sup> Symptoms can range from being non-clinical (biochemical hypocalcemia) to more severe neuromuscular symptoms such as paresthesia, muscle cramping, tetany, convulsions, and cardiac arrhythmia.<sup>5</sup>

Early detection of patients with high risk for POHC is essential to enable prompt interventions and to reduce rehospitalisations. A second serious problem with thyroid surgery is injury to the recurrent laryngeal nerve (RLN).<sup>6</sup> Temporary RLN palsy occurs in about 1%-10% of the patients, while permanent injury occurs in up to 2%.<sup>7</sup> In bilateral cases, the damage to the RLN can result in changes to the voice, dysphonia, aspiration and/or swallowing problems, and even airway compromise, which can be life-threatening.<sup>8</sup> Some risk factors for RLN injury include long surgery, locally advanced disease, reoperative surgery, anatomic variations and central neck dissection.<sup>9</sup> Central neck dissection is an important step for optimal oncological control in patients with nodal metastasis with a reported higher risk of postoperative complications due to the close anatomic relationship of the lymphatic structures, parathyroid glands and recurrent laryngeal nerve.<sup>10</sup> That is why, in the treatment of thyroid cancer, achieving the oncological effect without compromising surgical safety remains a great challenge.<sup>11</sup>

Some complications do occur with thyroid surgery, and the length of the post-surgical hospital stay has emerged as a critical measure of recovery and the quality of health care delivery.<sup>12</sup> The costs of healthcare increase with length of stay, hospitals pick up infections and patient satisfaction suffers.<sup>13</sup> Hypocalcemia after surgery, RLN injury, advanced stage of disease, duration of surgery, comorbidities, and surgical extent are all factors that can be associated with an extended LOS.<sup>14</sup> Age and gender of the patient, preoperative vitamin D status, tumor

size, multifocality, lymph node involvement, operative time, surgeon experience, and extent of neck dissection are several factors that have been studied to predict postoperative complication following thyroidectomy.<sup>15</sup> But, different outcomes have been reported and different predictors may exist depending on the patients and surgical scenario.<sup>16</sup> Reliable prediction of postoperative hypocalcemia, RLNI and longer hospital stay would be helpful for better counseling, optimized postoperative monitoring and surgical planning and perioperative risk stratification.

## MATERIALS AND METHODS

This retrospective cohort study was conducted at Department of ENT, Bolan Medical Complex Hospital, Quetta from 1<sup>st</sup> October 2025 to 31<sup>st</sup> March 2026 including 210 patients who underwent total thyroidectomy with central neck dissection for thyroid malignancies to evaluate predictors of postoperative hypocalcemia, recurrent laryngeal nerve injury, and hospital stay. The study included the patients who underwent primary total thyroidectomy with central neck dissection for thyroid malignancy in patients aged 18 years and older and confirmed by histopathology. Patients who had all available peri-operative records, documented post-operative biochemical assessment, laryngoscopic evaluation and a minimum follow-up period of six months were eligible. Patients who had previously had thyroid or neck surgery, had known parathyroid disease, chronic kidney disease (CKD) with impaired calcium metabolism, hypocalcemia before surgery, lateral neck dissection without dissection of the central compartment, thyroidal benign disease, were not included, nor were patients for whom medical records were incomplete or lost.

Data were collected from hospital records, operative notes, pathological reports, anesthesia records and follow-up databases with the help of structured data collection proforma. Demographic factors were age, gender, body mass index, comorbidities and smoking status. Clinical and laboratory parameters involved were preoperative serum calcium, parathyroid hormone, and vitamin D level, thyroid function tests, and tumor characteristics, as well as the preoperative imaging parameters. Operative variables were extent of central neck dissection, operative duration, estimated blood loss, number of identified and preserved parathyroid glands, parathyroid transplant, intraoperative recurrent laryngeal nerve monitoring, surgeon experience, and intraoperative complications.

The histopathological variables included were: size of the tumour, the presence of multifocality, presence of extrathyroidal extension, presence of lymphovascular invasion, number of lymph nodes extracted, number of metastatic lymph nodes and pathological TNM stage. Main outcomes were hypocalcemia, recurrent laryngeal nerve injury and hospital stay. Postoperative hypocalcemia was defined as presence of calcium below institutional reference value, with or without clinical symptoms, within 48 hours following surgery. All recurrent laryngeal nerve injuries were confirmed during postoperative fiberoptic laryngoscopy and classified as temporary or permanent based on the recovery within 6 months. Hospital stay was determined by the total number of days the patient remained in the hospital after surgery until discharge.

Data were analyzed using SPSS version 26. Independent t-tests, Mann-Whitney U tests, chi-square tests, or Fisher's exact tests were used as appropriate to compare patients with and without postoperative complications. Variables with p-values <0.10 in univariable analyses were included in multivariable logistic regression models to identify independent predictors of postoperative hypocalcemia and recurrent laryngeal nerve injury. A p-value ≤0.05 was considered statistically significant.

## RESULTS

There were majority of females 154 (73.3%) with mean age was 46.8±12.9 years. Papillary thyroid carcinoma was the most common diagnosis (183, 87.1%). Mean tumor size was 2.8±1.4 cm, while multifocal disease, extrathyroidal extension, and lymphovascular invasion were present in 72 (34.3%), 58 (27.6%), and 46 (21.9%) patients, respectively. Bilateral central neck dissection was performed

in 91 (43.3%), and mean operative time was 154.6±38.7 minutes (Tables 1-2).

Postoperative hypocalcemia occurred in 64 patients. It was more frequent in females (54, 84.4% vs. 100, 68.5%; p=0.019) and patients undergoing bilateral central neck dissection (41, 64.1% vs. 50, 34.2%; p<0.001). Patients with hypocalcemia had longer operative time (176.4±41.2 vs. 145.0±32.4 minutes; p<0.001), fewer preserved parathyroid glands (2.4±0.7 vs. 3.4±0.6; p<0.001), and more extrathyroidal extension (27, 42.2% vs. 31, 21.2%; p=0.002) [Table 3].

Recurrent laryngeal nerve injury was seen in 18 patients. Those with RLN injury had larger tumors (4.1±1.8 vs. 2.7±1.3 cm; p<0.001), more extrathyroidal extension (11, 61.1% vs. 47, 24.5%; p=0.001), and more bilateral central neck dissection (13, 72.2% vs. 78, 40.6%; p=0.011). Operative time was also longer in the RLN injury group (201.7±44.6 vs. 150.2±35.3 minutes; p<0.001) [Table 4].

Prolonged hospital stay occurred in 58 patients, with a mean stay of 5.8±1.7 days compared with 2.2±0.6 days in the standard-stay group (p<0.001). It was strongly associated with postoperative hypocalcemia (38, 65.5% vs. 26, 17.1%; p<0.001), RLN injury (11, 19.0% vs. 7, 4.6%; p<0.001), longer operative time (182.3±42.8 vs. 144.1±31.5 minutes; p<0.001), bilateral central neck dissection, and extrathyroidal extension [Table 5, Fig. 1].

Multivariable analysis showed that preservation of fewer than three parathyroid glands was the strongest predictor of postoperative hypocalcemia (AOR=4.28, 95% CI: 2.12–8.64; p<0.001), followed by bilateral central neck dissection and operative time >180 minutes (Table 6).

Table 1: Demographic, Clinical and Operative Characteristics of the Patients (N = 210)

| Variable                             | No. | %    |
|--------------------------------------|-----|------|
| <b>Gender</b>                        |     |      |
| Male                                 | 154 | 73.3 |
| Female                               | 56  | 26.7 |
| Papillary thyroid carcinoma          | 183 | 87.1 |
| Follicular thyroid carcinoma         | 17  | 8.1  |
| Medullary thyroid carcinoma          | 10  | 4.8  |
| Multifocal disease                   | 72  | 34.3 |
| Extrathyroidal Extension             | 58  | 27.6 |
| Lymphovascular Invasion              | 46  | 21.9 |
| Bilateral Central Neck Dissection    | 91  | 43.3 |
| Intraoperative nerve monitoring used | 139 | 66.2 |
| Parathyroid autotransplantation      | 36  | 17.1 |

Table 2: Descriptive Statistics of the Patients (N=210)

| Variable                               | Mean±SD    |
|----------------------------------------|------------|
| Age (years)                            | 46.8±12.9  |
| Body Mass Index (kg/m <sup>2</sup> )   | 27.1±4.6   |
| Tumor Size (cm)                        | 2.8±1.4    |
| Operative Time (minutes)               | 154.6±38.7 |
| Number of preserved parathyroid glands | 3.1±0.8    |

Table 3: Comparison of Characteristics According to Postoperative Hypocalcemia

| Variable                          | Hypocalcemia (n=64) | No Hypocalcemia (n=146) | p-value |
|-----------------------------------|---------------------|-------------------------|---------|
| Age (years)                       | 44.2±11.8           | 47.9±13.2               | 0.048   |
| Operative time (minutes)          | 176.4±41.2          | 145.0±32.4              | <0.001  |
| Preserved parathyroid glands      | 2.4±0.7             | 3.4±0.6                 | <0.001  |
| Females                           | 54 (84.4%)          | 100 (68.5%)             | 0.019   |
| Bilateral central neck dissection | 41 (64.1%)          | 50 (34.2%)              | <0.001  |
| Parathyroid autotransplantation   | 20 (31.3%)          | 16 (11%)                | <0.001  |
| Extrathyroidal extension          | 27 (42.2%)          | 31 (21.2%)              | 0.002   |

Table 4: Comparison of Characteristics According to Recurrent Laryngeal Nerve Injury

| Variable                             | RLN Injury (n=18) | No RLN Injury (n=192) | p-value |
|--------------------------------------|-------------------|-----------------------|---------|
| Age (years)                          | 49.7±13.4         | 46.5 ± 12.8           | 0.31    |
| Tumor Size (cm)                      | 4.1±1.8           | 2.7 ± 1.3             | <0.001  |
| Operative time (minutes)             | 201.7±44.6        | 150.2±35.3            | <0.001  |
| Extrathyroidal extension             | 11 (61.1%)        | 47 (24.5%)            | 0.001   |
| Bilateral central neck dissection    | 13 (72.2%)        | 78 (40.6%)            | 0.011   |
| Intraoperative nerve monitoring used | 7 (38.9%)         | 132 (68.8%)           | 0.012   |

Table 5: Factors Associated with Prolonged Hospital Stay (>3 Days)

| Variable                          | Prolonged Stay (n=58) | Standard Stay (n=152) | p-value |
|-----------------------------------|-----------------------|-----------------------|---------|
| Hospital stay (days)              | 5.8±1.7               | 2.2±0.6               | <0.001  |
| Operative time (minutes)          | 182.3±42.8            | 144.1±31.5            | <0.001  |
| Postoperative hypocalcemia        | 38 (65.5%)            | 26 (17.1%)            | <0.001  |
| RLN Injury                        | 11 (19%)              | 7 (4.6%)              | <0.001  |
| Bilateral central neck dissection | 36 (62.1%)            | 55 (36.2%)            | 0.001   |
| Extrathyroidal extension          | 24 (41.4%)            | 34 (22.4%)            | 0.008   |

Table 6: Multivariable Analysis of Predictors of Postoperative Hypocalcemia, Recurrent Laryngeal Nerve Injury, and Prolonged Hospital Stay

| Outcome Variable           | Predictor                         | Adjusted OR/β | 95% CI     | p-value |
|----------------------------|-----------------------------------|---------------|------------|---------|
| Postoperative Hypocalcemia | Preserved Parathyroid Glands (<3) | 4.28          | 2.12–8.64  | <0.001  |
|                            | Bilateral Central Neck Dissection | 2.74          | 1.38–5.45  | 0.004   |
|                            | Operative Time >180 min           | 2.21          | 1.09–4.48  | 0.028   |
| RLN Injury                 | Tumor Size >3 cm                  | 3.65          | 1.32–10.08 | 0.013   |
|                            | Extrathyroidal Extension          | 3.17          | 1.15–8.77  | 0.026   |
|                            | Absence of Nerve Monitoring       | 2.86          | 1.04–7.82  | 0.041   |

|                         |                            |                |           |        |
|-------------------------|----------------------------|----------------|-----------|--------|
| Prolonged Hospital Stay | Postoperative Hypocalcemia | $\beta = 1.84$ | 1.21–2.47 | <0.001 |
|                         | RLN Injury                 | $\beta = 1.36$ | 0.62–2.10 | <0.001 |
|                         | Operative Time >180 min    | $\beta = 0.94$ | 0.38–1.50 | 0.001  |

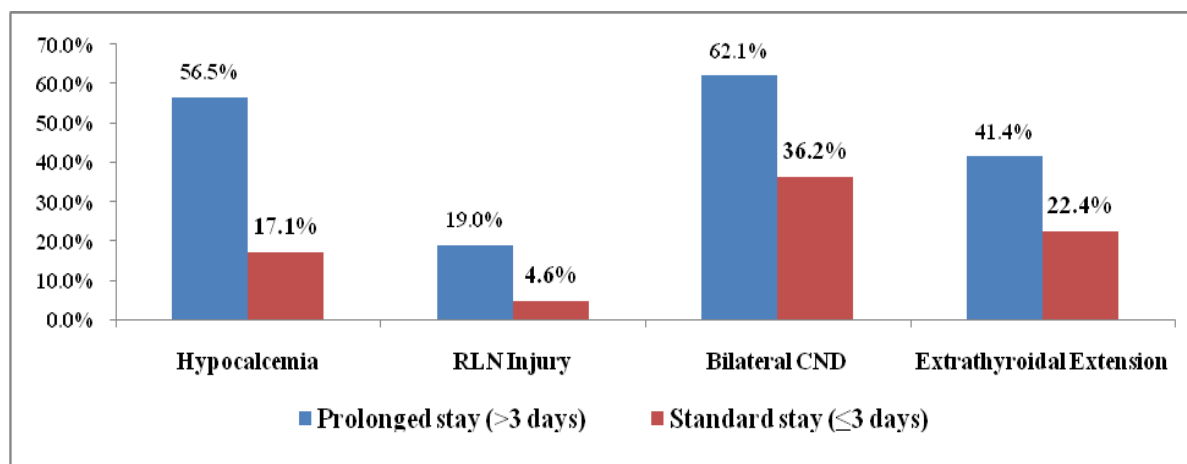


Fig. 1: Factors Associated with Prolonged Hospital Stay Following Total Thyroidectomy with Central Neck Dissection

## DISCUSSION

The results of the present study showed that 64 patients suffered from postoperative hypocalcemia, 18 patients suffered from recurrent laryngeal nerve injury or damage, 58 patients had long hospital stays. The above results indicate that total thyroidectomy with central neck dissection is successful oncologic surgery, but is still accompanied by clinically significant postoperative morbidity. Patients' age was  $46.8 \pm 12.9$  years, and the female-to-male ratio was 73.3:26.7. Papillary thyroid carcinoma is the most common thyroid diagnosis, appearing in 87.1% of the cases. Other studies also have indicated that thyroid cancer is more prevalent in women, and that it strikes at an earlier age, particularly papillary thyroid cancer. This age distribution corresponds with what is well established in the epidemiology of differentiated thyroid cancer.<sup>17</sup> The sex, bilateral central neck dissection, longer operative time, parathyroid autotransplantation, number of preserved parathyroid glands or extrathyroidal extension were all significantly associated with postoperative hypocalcemia. There was a significant difference in number of parathyroid glands preserved between patients that developed hypocalcemia and those that did not develop hypocalcemia ( $2.4 \pm 0.7$  vs.  $3.4 \pm 0.6$  glands), with preservation of <3 glands being the best independent predictor of hypocalcemia. Several other studies have also shown that hypocalcemia is most frequently seen as a result of injury to the parathyroid glands, devascularization or inadvertent

removal of the parathyroid glands after a total thyroidectomy. Hypocalcemia also was an independent risk factor for bilateral central neck dissection. Sixty-four percent of patients with hypocalcemia underwent bilateral central dissection of the neck; 34.2% did not have hypocalcemia. These results are similar to previous study<sup>18</sup> which have reported that greater risk of parathyroid compromise occurs if the central compartment dissection around the tracheoesophageal groove and parathyroid vascular supply is large. Operative time was significantly longer among patients who developed hypocalcemia ( $176.4 \pm 41.2$  vs.  $145.0 \pm 32.4$  minutes). Longer surgery is correlated with increased technical difficulty, disease severity, dissection difficulty, or increased node clearance difficulty. A longer operating time has also been reported to be a risk for postoperative hypocalcemia, which is thought to be associated with greater tissue manipulation and risk of devascularization of the parathyroids.<sup>19</sup> The incidence of recurrent laryngeal nerve injury was 18 (8%) patients and the factors associated with it were larger tumor size, extrathyroidal extension, bilateral central neck dissection, longer operative time and the lack of nerve monitoring during surgery. RLN injured patients had larger tumors, than those without RLN injury ( $4.1 \pm 1.8$  cm versus  $2.7 \pm 1.3$  cm). Previous studies have also shown that the risk of RLN injury is greater with larger tumors and locally invasive disease due to the distortion of normal anatomy and tumors that are attached or invading the nerve.

Extrathyroidal extension was an independent predictor of RLN injury in this study. It was detected in 61.1% of the RLN-injured patients compared with 24.5% of the noninjured patients. This has been noted previously, where extrathyroidal extension was reported to make surgical treatment more difficult and was associated with a risk of nerve traction, thermal injury and direct involvement by tumour.<sup>20</sup> Finally, intraoperative nerve monitoring also appeared to have a protective effect; 38.9% of patients sustaining RLN injury were monitored during surgery, compared to 68.8% without nerve monitoring. Nerve monitoring was an independent risk factor for RLN injury. Another previous study also revealed that intra-operative nerve monitoring could be helpful in the identification and preservation of the recurrent laryngeal nerve, particularly in high risk thyroid surgery and in central neck dissection. Hypocalcemia, RLN injury, longer operative time, bilateral central neck dissection, and extrathyroidal extension were significant and strong predictors of prolonged hospital stay, among postoperative complications. The mean hospital stay for prolonged stay group was  $5.8 \pm 1.7$  days, while for the patients in the standard-stay group was  $2.2 \pm 0.6$  days. Similarly, there have been previous studies concluding that the delayed discharge following thyroid surgery is due to major complications, including hypocalcaemia, and voice-related complications.<sup>21</sup>

### Limitations

There are some limitations of this study. Firstly, the retrospective nature of this study can have led to certain selection biases and prevented any causal relationship between peri-operative parameters and post-operative outcomes. Secondly, the study was performed at a single center, so the results might not be applicable to other centers with different patient populations and surgical practices. The differences in complication rates may have been due to variations in surgical experience, surgical techniques, or postoperative management protocols. Intraoperative nerve monitoring wasn't performed uniformly in all the procedures, which may have led to performance bias. Furthermore, some patients did not have information on the following factors before surgery: vitamin D status, baseline parathyroid hormone levels, and detailed nutritional evaluations. The follow up period could also have been too short to differentiate temporary from permanent

hypocalcemia and recurrent laryngeal nerve dysfunction in some instances. Further multicenter prospective studies with standard surgical techniques and longer follow-up periods should confirm these results.

### CONCLUSION

Postoperative hypocalcemia, recurrent laryngeal nerve injury, and prolonged hospital stay remain significant concerns following total thyroidectomy with central neck dissection. Preservation of fewer than three parathyroid glands, bilateral central neck dissection, and prolonged operative time were independent predictors of postoperative hypocalcemia. Larger tumor size, extrathyroidal extension, and absence of intraoperative nerve monitoring independently increased the risk of recurrent laryngeal nerve injury. Furthermore, postoperative hypocalcemia, recurrent laryngeal nerve injury, and extended operative duration were strongly associated with prolonged hospitalization.

### REFERENCES

1. Kazaure HS, Zambeli-Ljepovic A, Oyekunle T, Roman SA, Sosa JA, Stang MT, et al. Severe hypocalcemia after thyroidectomy: an analysis of 7366 patients. *Ann Surg* 2021; 274(6): e1014-21.
2. Abdallah T, Ahmed S, Mohamed M, Murad J. Predictors of post-thyroidectomy complications, a tertiary centre experience: A retrospective cohort study. *Egyptian J Surg* 2024; 43(4): 1131-8.
3. Haseeb M, Amjad D, Ali MA. Evaluating the incidences of complications after total thyroidectomy. *Res Gate* 2025; 45.
4. Gunn A, Oyekunle T, Stang M, Kazaure H, Scheri R. Recurrent laryngeal nerve injury after thyroid surgery: an analysis of 11,370 patients. *J Surg Res* 2020; 255: 42-9.
5. Mahoney RC, Vossler JD, Murayama KM, Woodruff SL. Predictors and consequences of recurrent laryngeal nerve injury during open thyroidectomy: An American College of Surgeons National Surgical Quality Improvement Project database analysis. *Am J Surg* 2021; 221(1): 122-6.
6. dos Santos PMD, Lourenço JD, Viana CM, Pinto JP, Pereira RS, Pereira JC. Predictive factors of a hospital length of stay > 24 h in patients undergoing total thyroidectomy. *Thyroid Res Prac* 2025; 21(1): 17-24.

7. Giulea C, Enciu O, Toma EA, Martin S, Fica S, Miron A. Total thyroidectomy for malignancy-is central neck dissection a risk factor for recurrent nerve injury and postoperative hypocalcemia? A tertiary center experience in Romania. *Acta Endocrinologica (Bucharest)* 2019; 15(1): 80.
8. Tuychibekov S. Postoperative complications after neck surgery: comparative patterns and statistical approaches for clinical research. *J Clin Biomed Res* 2026; 1(2): 1-9.
9. Ye Y, Wang X, Liu Y, Qin L, Amdulla M, Ren C, et al. Different approaches of dissecting the recurrent laryngeal nerve during total thyroidectomy affect postoperative parathyroid function. *BMC Surg* 2026; 26(1): 325.
10. Shrestha K, Gautam DK, Karki AB, Karmacharya D, Shrestha A, Adhikari S, Neupane B. Complications of Thyroid Surgery and their risk factors in Malignant Thyroid disease: A Retrospective Study at a Tertiary Care Cancer Center of Nepal. *Nepalese J Cancer* 2026; 10(1): 31-37.
11. Torabi SJ, Avery JM, Salehi PP, Lee Y. Risk factors and effects of hypocalcemia prior to discharge following thyroidectomy. *Am J Otolaryngol* 2020; 41(3): 102420.
12. Berhanu AB, Mitiku MW, Shumargaw AT, Kidane KH. Outcomes and predictors of complications of thyroidectomy in a scarce resource setting: retrospective cross-sectional study. *Am J Otolaryngol* 2024; 45(2): 104125.
13. Panthi N, Chettri ST, Shah SP, Poudel D, Manandhar S, Acharya K. Complications of thyroid surgery & their risk factors: a prospective study at a tertiary care center of eastern Nepal. *J BP Koirala Inst Health Sci* 2019; 2(1): 25-33.
14. Leong EKF, Yixun L, Lee JWK. Predictors and outcomes of postoperative hypocalcemia following total thyroidectomy: a single institution's experience. *Asian J Surg* 2026; 38.
15. Alkaf H, Abuduruk S, Bayounos S, Abdelmonim SK, Alharbi J, Alessa MA, et al. Incidence of recurrent laryngeal nerve injury and associated risk factors after thyroidectomy: a retrospective study. *Ann Saudi Med* 2025; 45(5): 295-303.
16. Shetty D. Factors affecting serum calcium levels in patients undergoing total thyroidectomy [Master's Thesis] Rajiv Gandhi University of Health Sciences India, 2019.
17. Phalke NP, Meyers FR, Schroeder JC, McDaniel L, Mays AC. Thyroidectomy with and without laryngectomy: Differences in post-operative hypocalcemia and management. *Am J Otolaryngol* 2022; 43(2): 103316.
18. Bayram F, Duymaz YK, Cırık AA. Evaluation of early postoperative complications after thyroidectomy: A retrospective study. *Praxis of Otorhinolaryngology/Kulak Burun Boğaz Uygulamaları* 2024; 12(2).
19. Bass E, Hintze J, Chang B. Determinants of postoperative outcomes and cost in short-stay total thyroidectomy hospitalisations: a retrospective database study. *Clin Otolaryngol* 2026.
20. Chen Z, Zhao Q, Du J, Wang Y, Han R, Xu C, Shu, M. Risk factors for postoperative hypocalcaemia after thyroidectomy: A systematic review and meta-analysis. *J Int Med Res* 2021; 49(3): 0300060521996911.
21. Jan BS, Alamri AH, Alkaff HH, Almuqati WQ, Sayed SI, Abdelmonim SK, et al. Risk factors for postoperative hypocalcemia following total thyroidectomy: a retrospective study. *Ann Saudi Med* 2024; 44(1): 39-47.