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Original Article

Predictive Factors for Recurrent Laryngeal Nerve Palsy after Thyroid Surgery

Rahaman HMM[1], Razib SFA[2], Naha A[3], Rahman MM[4], Rahman MH[5], Haque MH[6], Siddiquee BH[7]

Abstract:

Background: Recurrent laryngeal nerve (RLN) palsy is a frequent complication of thyroid surgery, often leading to significant morbidity. Routine visual identification of the RLN through meticulous dissection remains the most effective method to prevent nerve injury. This study aims to identify key predictive factors for RLN palsy following thyroidectomy.

Methods: *Conducted at the Department of Otolaryngology-Head & Neck Surgery, Bangladesh Medical University, this study included 39 patients aged 20–60 years with thyroid swelling. All underwent ultrasound and fine-needle aspiration cytology (FNAC). Data analysis was performed using SPSS v.26, with results expressed as frequencies and percentages. The Fisher's Exact test assessed statistical significance, with a p-value <0.05 deemed significant.*

Results: *Of the participants, 5 cases (12.82%) developed RLN palsy, while 6 (15.38%) developed hypothyroidism, and 2 (5.13%) had wound infections. Among the RLN palsy cases, 3 (7.69%) were temporary, and 2 (5.13%) were permanent. Pathologically, 4 of the RLN palsy cases (7.69%) had papillary thyroid carcinoma, and 1 (2.56%) was a colloid goiter, a non-neoplastic condition. Factors associated with RLN palsy included central neck dissection (2 cases; 5.13%), lateral neck dissection, non-tracing of the RLN (3 cases; 7.69%), and reoperation (3 cases; 7.69%).*

1. Hawlader Mohammad Mustafizur Rahaman, Assistant Professor, Department of Otolaryngology-Head and Neck Surgery, Bangladesh Medical University, Dhaka
2. Syed Farhan Ali Razib, Associate Professor, Department of Otolaryngology-Head and Neck Surgery, Bangladesh Medical University, Dhaka
3. Abirvab Naha, Assistant Professor, Department of Otolaryngology-Head and Neck Surgery, Bangladesh Medical University, Dhaka
4. Md. Murshedur Rahman, Consultant, Department of Otolaryngology-Head and Neck Surgery, Bangladesh Medical University, Dhaka
5. Md. Habibur Rahman, Assistant Professor, Department of Otolaryngology-Head and Neck Surgery, Bangladesh Medical University, Dhaka
6. Md. Hasanul Haque, Associate Professor (C.C.), Department of Otolaryngology-Head and Neck Surgery, Ahsania Mission Cancer Hospital, Dhaka
7. Belayat Hossain Siddiquee, Professor, Department of Otolaryngology-Head and Neck Surgery, Bangladesh Medical University, Dhaka

Correspondence: Dr. Syed Farhan Ali Razib, Associate Professor, Department of Otolaryngology-Head and Neck Surgery, Bangladesh Medical University, Dhaka, E-mail: razib10@bsmmu.edu.bd, Contact: +880-1883686006.

Conclusion: *RLN palsy remains a significant postoperative risk in thyroid surgery, especially in cases involving malignancy, neck dissections, reoperations, or failure to trace the nerve. Identifying these factors can help improve surgical strategies and reduce nerve injury rates.*

Key Words: Recurrent Laryngeal Nerve (RLN) palsy, Thyroidectomy complications, Papillary thyroid carcinoma, Nerve identification, Reoperation risk factors.

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Introduction:

Recurrent laryngeal nerve (RLN) palsy is one of the most common and serious complications of thyroid surgery.[1]In 1938, Lahey first recommended routine RLN identification during thyroid procedures, which has since been shown to reduce the risk of postoperative nerve injury.[2] Numerous prospective studies support this approach, designating routine nerve visualization as the "gold standard" for safe thyroidectomy.[3]

Despite these measures, RLN palsy remains a significant concern.[4] The incidence varies from 0% to 20%, with higher risks associated with thyroid malignancies, Graves' disease, re-operations, mediastinal goiters, less experienced surgeons, and failure to identify the RLN intraoperatively.[5,6] Voice impairment resulting from nerve damage impacts patients' quality of life and is often a leading cause of legal action in endocrine surgeries.[7]

The reported incidence of temporary RLN palsy ranges from 1.3% to 20%, while permanent palsy occurs in about 0% to 9%, depending on the type of surgery and underlying pathology. [5]Higher risks are observed in surgeries involving thyroid carcinomas and Graves' disease, with re-operations and surgeon experience being notable risk factors.[8]

While meticulous visual identification of the RLN remains the primary strategy to prevent injury, accidental nerve damage still occurs.[9] Intraoperative neuromonitoring is a relatively recent technique that has shown promise in reducing temporary RLN palsy, especially in high-risk cases.[10] The most common mechanism of injury involves overstretching the nerve near Berry's ligament, or accidental clamping or transaction.[11]

Thyroidectomy is among the most frequently performed surgeries in iodine-deficient regions. While the overall nerve injury rate is low, when it occurs, it can be a lifelong disability.[2] Even experienced surgeons may inadvertently injure the nerve, leading to persistent nerve palsy in approximately 1-2% of patients.[6] It is widely accepted that precise anatomic identification of the RLN is the most effective strategy for minimizing nerve injury.[11] Surgeons typically make every effort to prevent this complication, and nerve monitoring has become an important adjunct to visual nerve identification, enhancing safety during procedures.[10]This study aimed to identify the predictive factors associated with RLN palsy following thyroid surgery.

Method:

Study Procedure:

This prospective study was conducted at the Department of Otolaryngology-Head & Neck Surgery, BMU, Shahbagh, Dhaka, from January 2019 to June 2020. The sample included 39 patients selected based on predefined inclusion and exclusion criteria. Although the expected sample size,

calculated using the formula (n = \frac{z^2 p (1-p)}{d^2}), was 96, the final sample was limited to 39 due to time constraints and the COVID-19 pandemic. Since the prevalence of RLN palsy in our population is unknown, the sample size was determined with this formula, considering a confidence level and margin of error.

Following informed consent, detailed history-taking and physical examinations were performed. All patients underwent ultrasound of the neck and FNAC of thyroid nodules and suspicious cervical lymph nodes. Preoperative staging was conducted clinically, and final diagnoses were confirmed by histopathology.

All patients underwent thyroidectomy via a transverse cervical incision. The superior and inferior subplatysmal flaps were elevated, strap muscles retracted laterally, and the thyroid gland was exposed. The upper pole was identified, clamped, dissected, and ligated with 2/0 Vicryl sutures. The recurrent laryngeal nerve (RLN) and parathyroid glands were identified and preserved in situ whenever possible; at-risk glands were auto transplanted into the sternocleidomastoid muscle. The lower pole was managed similarly.

Intracapsular dissection was performed for total thyroidectomy, adhering to standard capsular dissection techniques. The external branch of the superior laryngeal nerve, parathyroid glands, and RLN were routinely identified and preserved. Postoperatively, all patients' vocal cord movements were observed directly via laryngoscopy and clinically assessed through verbal communication.

Patients were followed regularly for six months post-surgery. During follow-up, clinical evaluations and fiberoptic laryngoscopy were performed to assess vocal cord function. Data were analyzed using SPSS version 26, with results expressed as frequencies, percentages, and mean ± SD.

Statistical Analysis:

All collected data were organized and analyzed using SPSS Version 26. Results were presented as frequencies and percentages. The Fisher's Exact test was employed to compare qualitative variables between groups. A p-value of less than 0.05 was considered statistically significant.

Demographic and Clinical Characteristics

- The study included 39 patients: 24 females (61.54%) and 15 males (38.46%).
- Most participants were aged 21–30 years (41.03%), with only 1 patient (2.56%) over 50.
- Most patients (58.97%) had a BMI between 18 and 24.9 kg/m²; the remainder had a BMI of 25–29 kg/m².
- Common benign thyroid conditions were colloid goiter (38.46%) and multinodular goiter (17.95%). Malignancies consisted of papillary carcinoma (38.46%) and medullary carcinoma (2.56%).

Surgical Procedures and Complications

- Hemithyroidectomy was the most frequent procedure (58.97%), followed by total (23.08%), near-total (12.82%), and subtotal thyroidectomy (5.13%).
- Complications included RLN palsy in 5 patients (12.82%), hypothyroidism in 6 patients (15.38%), and wound infections in 2 (5.13%).

RLN Palsy Analysis

- All 5 RLN palsy cases occurred in patients aged 45 or younger.
- Temporary RLN palsy was observed in 3 females (7.69%); permanent RLN palsy occurred in 1 male (2.56%).
- Regarding pathology, 4 RLN palsy cases were associated with papillary carcinoma, and 1 with colloid goiter.

Risk Factors for RLN Palsy

- Central compartment neck dissection and reoperation were notable clinical risk factors, each accounting for 2 and 3 of the RLN palsy cases, respectively.
- Non-tracing of the RLN was observed in 3 RLN palsy cases.

Statistical Association: Fisher's Exact Test

To investigate the association between reoperation and RLN palsy, a Fisher's Exact test was performed:

	RLN Palsy	No RLN Palsy
Reoperation	3	0
No Reoperation	2	34

- The p-value is 0.001, indicating a statistically significant association between reoperation and risk of RLN palsy.
- The odds ratio is infinite (“), suggesting reoperation markedly increases RLN palsy risk in this dataset.

Summary of Statistical Findings

- The overall RLN palsy rate was 12.82%, temporary 7.69%, permanent 5.13%.
- Female patients predominated in temporary palsy; permanent palsy was restricted to males in this sample.
- The majority of RLN palsy cases were associated with papillary carcinoma.
- Central compartment dissection, non-tracing of the RLN, and reoperation are significant risk factors, with reoperation showing strong statistical significance for RLN palsy development (p = 0.001).
- These findings highlight the importance of surgical technique, careful nerve identification, and the risks associated with reoperation in thyroid surgery patient outcomes.

Results:

In this study, most patients (41.03%) were aged 21-30 years. The age distribution included 13 patients (33.33%) in the 31-40 years group, 9 patients (23.08%) in the 41-50 years group, and 1 patient (2.56%) in the 51-60 years group. The youngest patient was 20 years old, while the oldest was 55 years. Females comprised most of the participants, accounting for 61.54%, while 38.46% were males. Regarding BMI, 23 patients (58.97%) had a BMI between 18 and 24.9 kg/m², and 16 patients (41.03%) had a BMI between 25 and 29 kg/m². Benign thyroid conditions included colloid goiter in 38.46% of cases, multinodular goiter in 17.95%, and Graves' disease in 2.56%. Malignant cases consisted of papillary carcinoma (38.46%) and medullary carcinoma (2.56%) (Figure 1). Regarding the surgical procedures, 23 patients (58.97%) underwent hemithyroidectomy, 9 (23.08%) total thyroidectomy, 5 (12.82%) near-total thyroidectomy, and 2 (5.13%) subtotal thyroidectomy (Figure 2). Recurrent laryngeal nerve (RLN) palsy developed in 5 patients (12.82%), hypothyroidism in 6 patients (15.38%), and wound infections in 2 patients (5.13%) (Figure 3). Of the RLN palsy cases, 3 (7.69%) were temporary, and 2 (5.13%) were permanent (Figure 4). Notably, all RLNP cases occurred in patients aged 45 years or younger, with females experiencing temporary RLNP and only one male (2.56%) experiencing permanent RLNP. Among the RLNP cases, 4 (7.69%) had papillary carcinoma, and 1 (2.56%) had a benign colloid goiter (Table 1). Factors associated with RLNP included central compartment neck dissection (2 cases; 5.13%), lateral neck dissection, non-tracing of the RLN (3 cases; 7.69%), and reoperation (3 cases; 7.69%) (Table 2).

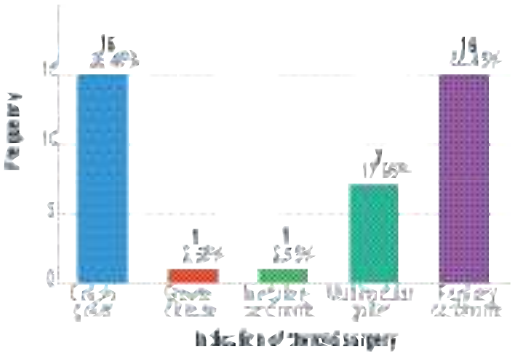

Figure-1: Distribution of study subjects according to indication of thyroid surgery (N=39)

In this study, 15 (38.46%) had colloid goiter, 7 (17.95%) had multinodular goiter, and 1 (2.56%) had graves' disease. They were accounted as benign cases. The malignant cases were papillary carcinoma (15; 38.46%) and medullary carcinoma (1; 2.56%).

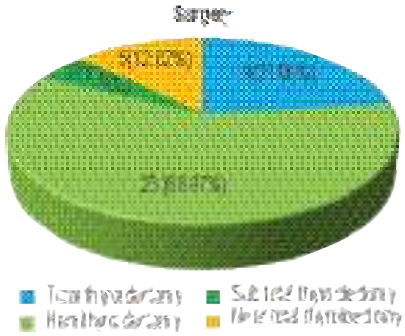

Figure-2: Distribution of study subjects according to mode of surgery (N=39)

In this study, 23 (58.97%) cases needed hemithyroidectomy, 9 (23.08%) cases needed total thyroidectomy, 5 (12.82%) cases needed near total thyroidectomy and only 2 (5.13%) cases needed subtotal thyroidectomy.

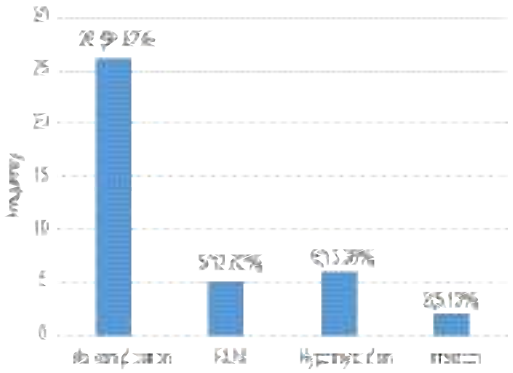

Figure-3: Distribution of study subjects according to post-operative complications (N=39)

Among the study subject, only 5 (12.82%) cases developed recurrent laryngeal nerve palsy, 6 (15.38%) cases developed hypothyroidism and 2 (5.13%) cases developed wound infections.

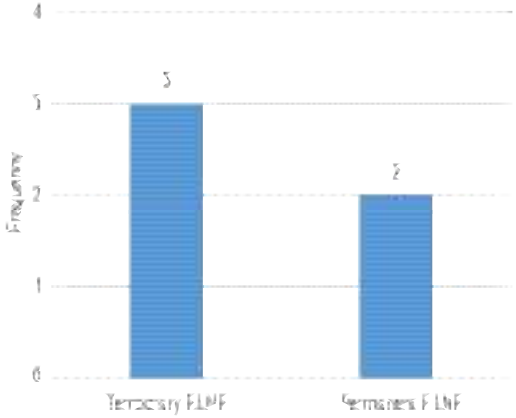

Figure-4: Distribution of study subjects according to types of recurrent laryngeal palsy (RLNP) (N=39)

Among 5 cases of recurrent laryngeal palsy, 3 (7.69%) cases were temporary types, and 2 (5.13%) cases were permanent types.

Table-I

Predictive factors associated with recurrent laryngeal nerve palsy (N=39)

Variable	n (%)	Temporary RLNP n (%)	p value	Permanent RLNP n (%)	P value
Nature of disease					
Non neoplastic	10(25.64%)	1(2.56%)		0 (0%)	
Neoplastic	29(74.36%)		0.150		0.027
Benign	13(44.82%)				
Malignancy	16(41.02%)				
Extra thyroidal	10(25.64%)	2 (5.13%)		2 (5.13%)	
Intra thyroidal	6(15.38%)				

Table-II

Predictive factors associated with recurrent laryngeal nerve palsy (n=39)

Variable	n (%)	Temporary RLNP n (%)	p value	Permanent RLNP n (%)	p value
Central compartment neck dissection					
Yes	13 (33.33%)	2 (5.13%)	0.287	2 (5.13%)	0.128
No	26 (66.67%)	1 (2.56%)		0 (0%)	
Lateral neck dissection					
Yes	2 (5.13%)	1 (2.56%)	0.204	1 (2.56%)	0.143
No	37 (94.87%)	2 (5.13%)		1 (2.56%)	
Re-operation					
Yes	5 (12.82%)	3 (7.69%)	0.003	2 (5.13%)	0.023
No	34 (87.18%)	0 (0%)		0 (0%)	
Tracing of RLN					
Yes	34 (87.18%)	0 (0%)	0.003	0 (0%)	0.023
No	5 (12.82%)	3 (7.69%)		2 (5.13%)	

Data were expressed as frequency and percentage. Fisher Exact test was performed to compare between the groups. N= Total no. of study subjects, n=frequency.

The two tables reveal key factors associated with recurrent laryngeal nerve palsy (RLNP). Table I shows that patients with malignant thyroid disease have a significantly higher risk of RLNP (p = 0.027), while benign conditions and intra-thyroidal diseases have a lower association. Table II indicates that re-operations (p = 0.003) and not tracing the RLN during surgery (p = 0.003) are significantly linked to increased RLNP rates, both temporary and permanent. Although procedures like central and lateral neck dissections show higher RLNP occurrences, these are not statistically significant. Overall,

malignancy, re-operative surgeries, and failure to trace the RLN are the most significant risk factors for RLNP in this study.

Discussion:

This study identified key predictive factors influencing the risk of recurrent laryngeal nerve (RLN) palsy following thyroidectomy, underscoring the critical importance of meticulous surgical technique and patient selection to minimize nerve injury.

Thyroidectomy remains among the most commonly performed endocrine surgeries globally, with advances in technique contributing to a reduction in postoperative complications.[5] Nevertheless, RLN palsy continues to be a significant concern owing to its potential for causing lasting voice impairment and detriment to quality of life.[6] Our observed RLN palsy incidence of 12.82%, predominantly transient, aligns with reported international rates ranging from 1.5% to 14%.[12]

Younger age and female gender were significant predictors of RLN palsy in our cohort, consistent with studies demonstrating higher RLN injury rates among females and younger populations, possibly due to anatomical or disease prevalence factors. Conversely, males exhibited lower incidence and fewer cases of permanent palsy.[9,13]

Surgical procedure type varied from hemithyroidectomy to total thyroidectomy, with complication rates comparable to those documented elsewhere, including a transient and permanent RLN palsy rate between 1% and 2%.[14] Risk factors such as malignancy—specifically papillary thyroid carcinoma—were significantly associated with increased RLN injury risk, reflecting findings that tumor invasion and extended resections elevate nerve injury likelihood.[15]

Reoperations and central/lateral neck dissections were strongly correlated with nerve injury due to altered anatomy and fibrosis complicating nerve identification.[16] Notably, the failure to trace the RLN intraoperatively markedly increased palsy risk, affirming the necessity of precise nerve identification as the cornerstone of safe thyroid surgery.

While intraoperative neuromonitoring (IONM) was not utilized in this study, literature supports its adjunctive role in enhancing nerve safety, particularly in re-operative or high-risk cases. Nevertheless, despite careful surgical technique and nerve monitoring, nerve injuries can still occur, reflecting the unpredictable nature of intraoperative trauma.[10]

In summary, this study reinforces that younger age, female sex, malignancy, neck dissections, reoperations, and failure to identify the RLN are significant predictors of nerve palsy. Preoperative recognition of these factors can improve surgical planning, risk stratification, and patient counseling. Future investigations incorporating IONM may further reduce RLN injury rates, enhancing postoperative outcomes and safety.

Conclusions

Malignancy, central and lateral neck dissections, failure to identify the recurrent laryngeal nerve, and re-operation were identified as significant predictors of postoperative complications, particularly RLN palsy. To minimize the risk of such adverse outcomes, it is essential to have a thorough understanding of neck anatomy and to employ meticulous surgical techniques.

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Ethical Approval

Ethical clearance was obtained from the Institutional Review Board (IRB) of Bangladesh Medical University.

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