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Laryngeal Complication After Total Thyroidectomy

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ABSTRACT: ***Background:*** Thyroidectomy is commonly performed for large goiters and thyroid malignancies. Laryngeal complications, primarily due to recurrent laryngeal nerve injury, are a frequent concern. The incidence of temporary and permanent RLN paralysis varies based on surgical type and different studies. ***Methods:*** The study is a prospective observational study carried out in National Institute of ENT, Tejgaon, Dhaka. A total of 60 patients, fulfilling preoperative inclusion criteria, were recruited from the period of March 2020 to August 2020. All 60 patients underwent total thyroidectomy with or without neck dissection. Follow-up of these patients was for a period of one year (up to 31st August 2021) after surgery. All patients between the ages of 18 and 65 who are willing to participate in the study are eligible for inclusion. ***Results:*** In the study, 65% of patients were female, with a mean age of 43.15±12.2 years. The most common conditions were multinodular goiter (33.3%), Graves' disease (21.7%), thyroid carcinoma (15%), and Hashimoto's disease (8.3%). Transient unilateral RLN injury occurred in 15% of cases, bilateral vocal cord paralysis in 3.3%, and permanent injury in 1.7%. RLN injury incidence was 12%, significantly higher in ages 39-58 (11.6%, p=0.034), primary vs. secondary operations (15% vs. 5%, p=0.002), subtotal vs. total thyroidectomy (16.7% vs. 3.3%, p=0.024), non-identification of RLN (8.3% vs. 1.6%, p=0.0443), and malignant vs. benign disease (8.3% vs. 11.6%, p=0.004). No significant association was found with gender. ***Conclusion:*** Total thyroidectomy is a safe procedure with a low RLNP risk for Graves' disease, thyroid cancer, and Hashimoto's disease. However, RLNI risk is higher in total thyroidectomy, re-operation, non-identification of RLN, and older age.

Keywords: Laryngeal Thyroidectomy, Total Thyroidectomy, Laryngeal Complication, Recurrent Laryngeal Nerve (RLN) Injury Transient, Total Thyroidectomy Surgery.

Article at a glance:

Study Purpose*: The purpose of this study was to investigate the incidence and causes of laryngeal complications following thyroidectomy.*

Key findings: *Demographic characteristics, pathology (benign vs. malignant), and the extent of thyroidectomy were not significantly associated with the risk of recurrent laryngeal nerve injury.*

Newer findings: *Their incidence may be lower than previously reported, and factors such as surgical volume and technique play a crucial role in minimizing risks.*

Abbreviations: *MNG: Multinodular Non-Toxic Goiter.*

INRODUCTION

Thyroid disorders are among the most prevalent endocrine conditions. The surgical removal of the thyroid gland may be required for the treatment of several conditions.[1] For benign conditions such as symptomatic big goiters and malignant diseases of the thyroid gland, thyroidectomy is advised.[2] There might be difficulties with thyroid removal. Hypocalcemia, wound infection, hematoma and Horner's syndrome are the main postoperative consequences.[3, 4] Following thyroidectomy, laryngeal complications are a prevalent issue. Injury to the recurrent nerve is the primary contributor to the issue.[5] After initial surgery, the frequency of persistent palsy of the recurrent nerve ranges from 0% to 20%, according to studies conducted on large patient populations.[6] In recent years, complete thyroidectomy has replaced partial thyroidectomy as the therapy of choice for bilateral multinodular non-toxic goiter (MNG) in several high-volume endocrine surgical departments.[7] However, the significant advantages of complete thyroidectomy, which include a decreased incidence of recurrent goiter and the elimination of the need for future revision thyroid surgery, must be weighed against the risk of postoperative morbidity. Thus, total thyroidectomy for benign thyroid disease

remains controversial, as there are numerous contradictory data published in the medical literature regarding the risk of hypoparathyroidism and recurrent laryngeal nerve injury stratified according to surgical indications, extent of thyroid resection, and surgical volume.[8] The incidence of unilateral or bilateral recurrent laryngeal nerve (RLN) damage during thyroidectomy is low but not zero. Incidence varies according to the interval of follow-up post-surgery, with a mean incidence of 2.3% at one year versus 9.8% in the immediate postoperative period; the mode of diagnosis, with incidence ranging from 2% to 6% depending on whether indirect mirror laryngoscopy or fiberoptic laryngoscopy is routinely performed postoperatively.[9] Hoarseness or dysphonia is caused by unilateral rigidity of the vocal cords and laryngeal paralysis as a consequence of recurrent RLN damage. It often comes with difficulties swallowing, especially with drinks, and upper airway dyspnea. Acute, life-threatening dyspnea is one of the extreme signs of bilateral recurrent laryngeal nerve palsy. This is an uncommon complication; Rosato estimates its occurrence at 0.4% although it is hard to gauge from the literature.[10]

Any thyroid surgery has a risk of recurrent nerve damage. This kind of surgery increases the risk (reoperation vs. initial surgery). The best way to prevent harm to the RLN is by precise dissection and routine visual identification of the nerve. However, even though the visual integrity was guaranteed, unexpected RLN palsy still happens.[11] Any thyroid surgery has a risk of recurrent nerve damage. The size of the resection, the underlying thyroid disease, the kind of surgery (reoperation vs. first surgery), and the surgeon's volume of practice all raise the risk.[10] Additional risk factors include malignancy that necessitates a central nodal dissection or invades nearby tissues.[12] The rate of temporary and permanent RLNP after thyroid gland surgery varies considerably in the literature, not only according to different authors, but also according to the different types of thyroid gland surgery (total or subtotal thyroidectomy). While some authors achieve very good results, with the incidence of permanent RLNP below 1%, others have a higher percentage of complication.[13] Moreover, to present, there is little data about laryngeal complication after surgery near the larynx. Although Musholt *et al.* and Lombardi *et al.* describe increased hoarseness and video laryngoscopy in individuals after thyroidectomy, there is no mention of vocal fold damage.[14, 15] In smaller groups of patients having thyroidectomy, laryngeal dysfunction was found in 2 of 15 symptomatic and 2 of 30 asymptomatic individuals by Stojadinovic *et al* and in 28 of 100 patients by de Pedro Netto *et al.*[16, 17] Additionally, Echternach *et al*. demonstrated that laryngeal problems after thyroidectomies are caused predominantly by injury to the vocal folds during intubation and, to a lesser degree, by injury to the laryngeal nerve.[18] The aim of the study is to find out the incidence and risk factors for recurrent laryngeal nerve (RLN) injury transient r permanent after total thyroidectomy surgery.

METHODS

The study is a prospective observational study carried out in National Institute Of ENT, Tejgaon, Dhaka. A total of 60 patients, fulfilling preoperative inclusion criteria, were recruited from the period of March 2020 to August 2020. All 60 patients underwent total thyroidectomy with or without neck dissection. Follow-up of these patients was for a period of one year (up to 31st August 2021) after surgery. Multinodular goitre and Graves' disease were the most common causes for surgery, followed by thyroid gland carcinomas and Hashimoto's thyroiditis. All patients between the ages of 18 and 65 who are willing to participate in the study are eligible for inclusion. Benign or suspected thyroid carcinoma, suitable for thyroidectomy with or without neck dissection. Exclusion criteria include patients with a history of thyroid or neck surgery, patients requiring unilateral lobectomy or completion or revision thyroidectomy, patients with known voice dysfunction preoperatively, or hearing impairment, deafness or detected with an asymptomatic vocal cord palsy, and intraoperative involvement of the laryngeal nerve by the tumor. During surgery, a horizontal skin incision was made between the cricoid cartilage and sternum. Following the elevation of skin flaps, the strap muscles were located and split in the midline to expose the thyroid glands isthmus. Following the identification and closure of the central thyroid vein, the lateral border of the thyroid gland was mobilized. The superior pole of the thyroid was then isolated, followed by the closure of the superior thyroid artery and vein. The RLN was determined to be in the tracheoesophageal groove. Upon identification of the parathyroid glands and RLN, the inferior thyroid artery and accompanying veins were

ligated. The anterior thyroid lobe was raised, and the Berry ligament was split. When completing complete thyroidectomy, the second lobe was treated using the same technique. During the procedure, identification and imaging of the recurrent laryngeal nerve (RLN) were performed on all patients without the use of electrostimulation.

Statistical Analysis

The obtained data was analyzed using SPSS software version23. Analytic methods included descriptive statistics, chi-square test, Student's t-test to compare between two continuous variables, Correlation matrix and coefficient of correlation using Pearson's method (p-value=level of significance, p>0.05=non-significant, p<0.05=significant, p<0.001=highly significant). Pattern of change was observed and compared to his/her own preoperative reading.

RESULTS

The present study included a total of 60 patients for assessment of postoperative complications. Out of 60 patients, three was lost to follow up due to death, eight months after surgery. This patient died of myocardial infarction. In the study 65% of patients were female and 35% male, reflecting higher incidence of thyroid disease in females. The mean age of the patients was 43.15±12.2. 53.3% of the patients were of age between 39-58. In this study patients of professional voice users are teacher and performer; 15% and 18.3%, respectively, which means voice was important for their profession. 20% of the patients had voice change.

Table 1: Sociodemographic Details on Patients

Characteristics	N (60)	%
Gender		
Male	21	35
Female	39	65
Age		
19-38	12	20
39-58	32	53.3
59≤	16	26.7
Mean age ± SD	43.15±12.2	
Profession		
Student	6	10
Teacher	9	15
Coach	1	1.6
Receptionist	2	3.3
Performer	11	18.3
Consultant	5	8.3
Other	26	43.3
Voice change	12	20

The indications for surgery of various diseases and nerves at risk in *table 2, fig 1* showed; multinodular goiter (20 cases, 33.33%), graves' disease (13 cases, 21.7%), thyroid carcinoma (9 cases (15%)), and Hashimoto disease (5 cases (8.3%)). The incidence of transient unilateral RLN injury developed among 9 cases (15%) (*table 3, fig 2*). Whereas bilateral vocal cord paralysis developed in 2 cases (3.3%). 1 case (1.7%) were permanent injuries. Even though the incidents for RLN on disease such as multinodular goiter and graves' disease were high, however, there was no significant association; p=0.083 and p=0.069, respectively.

Table 2: The RNLI at Risk for Different Thyroid Gland Disease

Diagnosis	No of RLN at risk	Temporary RLN injury	Permanent RLN injury	P value

Multinodular goiter	20 (33.33)	4 (6.7)	-	0.083
Graves' disease	13 (21.7)	4 (6.7)	-	0.069
Thyroid cancer	9 (15)	3 (5)	-	0.056
Hashimoto's disease	5 (8.3)		1 (1.7)	0.090

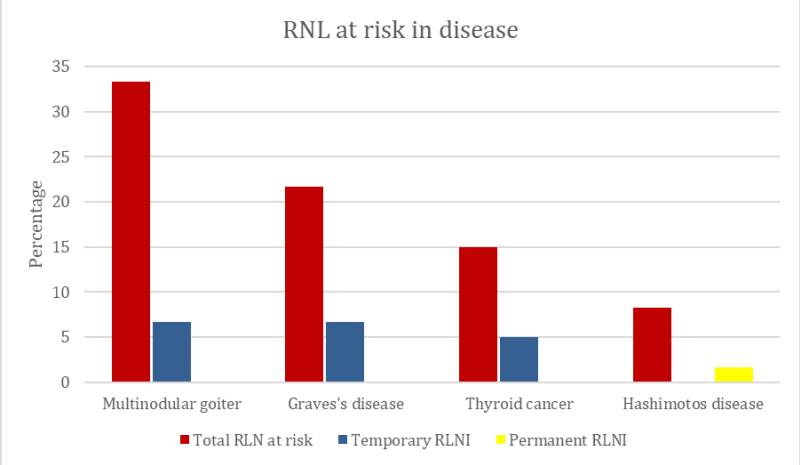

Figure 1: The RNLI at Risk for Different Thyroid Gland Disease

Table 3: Types of operations and RLN injury

Operation	No of patients N (%)	No. of RLN injury transient n (%)		
		Unilateral	Bilateral	Permanent
Bilateral thyroidectomy	23(38.3)	3 (5)	-	-
Unilateral thyroidectomy	12 (20)	1 (1.7)	-	-
Total bilateral thyroidectomy	2 (3.3)	1 (1.7)	2 (3.3)	-
Unilateral Hemi thyroidectomy	16 (26.7)	-	-	1 (1.7)
Reoperation for recurrent goiter	3 (5)	4 (6.7)	-	-
Completion thyroidectomy	1 (1.7)	-	-	-
Near total thyroidectomy	3 (5)	-	-	-

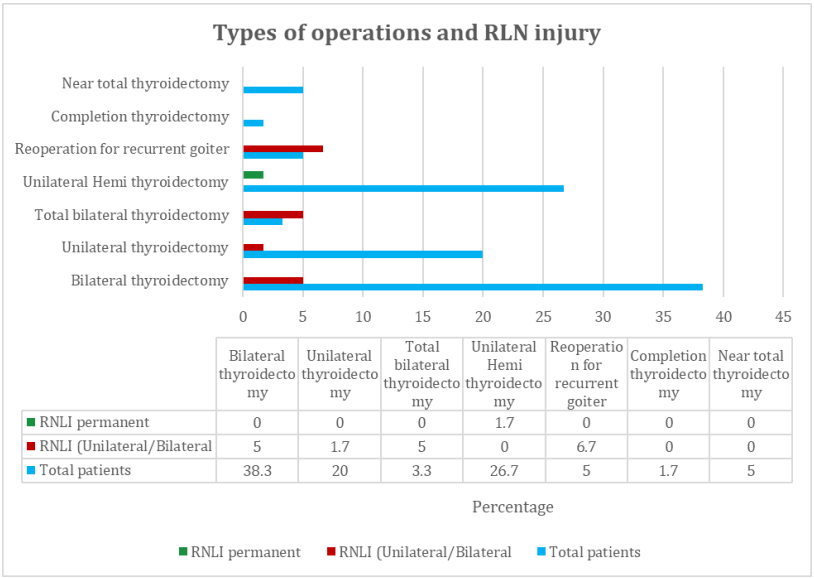

Figure 2: Types of Operations and RLN Injury

Table 4 shows the risk factors associated with RNL injury during thyroid surgery. The incidence of RNL injury was 12% (in table 2 and 3). On uni-variate analysis, the total RNL cases, 13.3% were male and

6.7% were female, without any significant association, p=0.823. There is a significant association with age and RNL injury where the incidence of patients with age 39-58 were high, 11.6%, p=0.034.There was a significant increase in the incidence of RLNI in primary operation, 15% vs secondary operation, 5% , p=0.002), total/near total thyroidectomy (3.3% in total vs. 16.7% in subtotal, p=0.024), non-identification of RLN during surgery (1.6% in non-identification vs. 8.3% in identification, p=0.0443) and in malignant disease (8.3% in malignant vs. 11.6% in benign disease, p=0.004).

Table 4: Risk Factors for RLN Injury During Thyroid Surgery

Variables	RLNI n=12 (%)	P value
Gender		
Male	8 (13.3)	0.823
Female	4 (6.7)	
Age		
19-38	2 (3.3)	
39-58	7 (11.6)	0.034
59≤	5 (8.3)	
Category of operation		
Primary	9 (15)	0.002
Secondary	3 (5)	
Identification of the nerve		
Yes	5 (8.3)	0.043
No	7 (1.6)	
Type of operation		
Subtotal	10 (16.7)	0.024
Total/near total	2 (3.3)	
Pathology		
Benign	7 (11.6)	0.004
Malignant	5 (8.3)	

DISCUSSION

The aim of the study is to find out the incidence and risk factors for recurrent laryngeal nerve (RLN) injury transient r permanent after total thyroidectomy surgery. As the patient group, most of the published research on thyroidectomy complications comprises a diverse mix of partial lobectomy, whole lobectomy, and revision surgery patients. This results in diverse partial thyroidectomy has a lower incidence of problems compared to a revision of thyroid surgery, where the incidence of complications is the highest. In most publications, benign and malignant thyroid disorders are included together; nevertheless, the prevalence of complications varies substantially across these two categories. This study is restricted to patients having complete thyroidectomy who are at risk for RLN injury, resulting in a more homogeneous sample in terms of risk factors. In this investigation, 9 cases (15%) of transient unilateral RLN damage were reported. In contrast, in 2 cases (3.3%), bilateral vocal cord paralysis resulted. One case (1.7%) had permanent damage. Although there was a high incidence of RLN in diseases like multinodular goiter and graves' disease, p=0.083 and p=0.069, respectively, did not show a significant association. According to various authors and different forms of thyroid gland surgery, as well as the literature, the incidence of temporary and permanent RLNP following thyroid gland surgery varies significantly (total or subtotal thyroidectomy). While some writers have excellent outcomes, with the incidence of persistent RLNP being less than 1%, others experience a greater rate of problems.[19-21] Following thyroid gland surgery, 27 papers and studies covering around 25,000 patients were included in Jeannon's comprehensive evaluation of the literature.[22] Temporary RLNP had an average frequency of 9.8%, while permanent RLNP had an average rate of 2.3%. 418 individuals who had thyroid gland surgery were examined by Aytac. For the whole cohort, the rates of both temporary and permanent RLNP were 3.8% and 1.2%, respectively. For bilateral subtotal thyroidectomies, the transient/permanent RLNP rates were 2.0/0.03%, but the ratio for bilateral

complete thyroidectomies was 13.6/9%. The author suggests doing a subtotal operation, particularly if RLN cannot be found.[23]

Some thyroid gland disorders may be regarded as risk factors for postoperative RLNP, according to the research. Chiang examined a group of 521 people suffering from various thyroid gland disorders. Overall, there were 5.1% and 0.9%, respectively, of both temporary and permanent RLNP. Temporary/permanent RLNP rates for benign thyroid illness were 4.0/0.2%, thyroid cancer was 2.0/0.7%, Graves' disease was 12.0/1.1%, and recurrent goiter was 10.8/8.1%. The author concluded that surgeries for Graves' disease, thyroid cancer, and recurrent goiter showed significantly increased RLNP rates.[24] Erbil presented a big collection of 3250 thyroid gland procedures for diverse diseases.[25] The incidence of RNL damage was 12% in our research. In the total RNL instances, 13.3% of the patients were male and 6.7% were female; nevertheless, there was no significant relation between the genders and RNL risk, p=0.823. There is a strong correlation between age and RNL damage, with a high prevalence of patients aged 39 to 58 (11.6%, p=0.034). The incidence of RLNI increased significantly in main surgery (15.0% vs. secondary surgery, 5%, p=0.002), whole/near total thyroidectomy (3.3% vs. 16.7% vs. subtotal, p=0.024), non-identification of RLN during surgery (1.6% vs. 8.3%, p=0.0443), and malignant illness (8.3% vs. 11.6%, p=0.004). However, in another research, individuals who had prolonged thyroidectomy, had RLN discovered after surgery, required further surgeries, or were over 50 years old had much greater incidence of problems.[25] In one research of 761 patients, Echternach *et al*. came to the conclusion that laryngeal problems after thyroidectomies are predominantly brought on by damage to the vocal folds during intubation, with injury to the laryngeal nerve having a less significant role.[18] The best strategy for shielding RLN from harm is still up for debate. Some surgeons assert that there may not be any trauma if the RLN is not identified. However, additional research has shown that this is untrue.[26, 27] According to this theory, RLN identification during surgery necessitates that the physician be familiar with the nerve's anatomical route and any changes, which lowers the likelihood of RLN damage. If RLN cannot be identified, intra-parenchymal dissection or subtotal excision would be advised.[28]

CONCLUSION

In addition to benign multinodular goiter, total thyroidectomy is a safe operation with a low incidence of RLNP for Graves' disease, thyroid cancer, and Hashimoto's disease (there is no significant difference of RLNP rates among the diseases). The current research also showed a substantially elevated risk of operational RLNI was linked to complete thyroidectomy, re-operation for recurrent goiter, and non-identification of RLN. Age itself is a danger element for RNLI.

Authors' Contributions

SMMA, MSA, MMA: Concept and design, data acquisition, interpretation and drafting. MSIM, DL and MAH: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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