**ORIGINAL RESEARCH**

# Retrospective Analysis of Recurrent Laryngeal Nerve Injury in Thyroid Surgery and its Risk Factors

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## ABSTRACT

**Background:** A major worry in thyroid surgery is iatrogenic harm to the Recurrent laryngeal nerve. One major consequence of vocal cord paralysis is thyroidectomy. **Objective:** Using a single-institutional data set, we assessed the rate of RLN injury in patients having thyroid surgery and looked into the variables linked to RLN injury during thyroid surgery. **Methods:** Forty-nine patients (22 females, 27 males) whose median age was 41 years who had undergone thyroidectomy in our department in the last 3 years were selected for retrospective analysis. **Results:** Of the 49 cases, we were able to identify the recurrent laryngeal nerve in 15 (30.61%), but in the remaining 34 individuals, we were unable to do so. Nine patients had transient RLN damage, while six patients had chronic RLN injury. Vocal cord paresis was temporary in five cases (10.2%) and bilateral in two cases. In postoperative instances with malignant illness (22.45% in malignant vs. 8.16% in benign disease) and non-identifying of RLN during surgery (10.2% in identification vs. 20.4% in non-identification), the prevalence of recurrent laryngeal nerve injury rose dramatically. **Conclusion:** It may be possible to prevent iatrogenic damage to the recurrent laryngeal nerve or its branches by carefully tracing, identifying, and exposing the nerve itself. A markedly elevated incidence of operational recurrent laryngeal nerve damage was linked to thyroid cancer, re-operation for recurrent goiter, and non identification of RLN.

**Keywords:** Thyroidectomy, Recurrent laryngeal nerve injury, Carcinoma of thyroid, Surgery



## INTRODUCTION

Thyroid surgery is a common surgical procedure for the management of thyroid tumor. Through comprehensive knowledge of thyroid anatomy and strategies for preventing each problem, the surgeon can reduce the risk for each patient. Bleeding, damage to the recurrent laryngeal nerve, hypoparathyroidism, hypothyroidism, thyrotoxic storm, damage to the superior laryngeal nerve, and infection are possible serious side effects of thyroid surgery. There are a number of reasons to consider thyroid surgery. The most evident one is the identification of thyroid cancer using fine needle aspiration biopsy, which remains the gold standard for thyroid node diagnoses [1]. The development of novel hemostatic techniques, enhanced anesthetic, infection prevention, and surgical methods led to a faster pace of thyroid surgery. One can categorize complications into two main categories: minor complications and significant complications. Seroma development and more noticeable wound scarring are categorized as moderate consequences [2].

One of the most frequent serious complications following thyroid surgery is damage to the recurrent laryngeal nerve (RLN) [3]. Unilateral RLN injury is more likely. The incidence of RLN damage has decreased (approximately 0.5%~5% in the overseas publications) with increased awareness and improved surgical procedures [4]. Bilateral RLN injuries can result in aphonia, dyspnea, and even suffocation, endangering the lives of patients. Unilateral RLN injuries can produce varied degrees of hoarseness, microaspiration, coughing, and other symptoms [5]. One of the primary causes of medical disagreement

resulting from thyroid surgery is RLN damage [6]. RLN complication after thyroidectomy, although infrequently encountered, can jeopardize the quality of life. Bilateral RLNI not only causes hoarseness similar to that of unilateral RLNI, but it also causes dyspnea and frequently fatal glottal blockage [7]. It has been discovered that RLNI is more common following thyroid cancer,

Graves disease, and re-explorations surgeries [8]. Managing and preventing RLN damage during thyroid surgery is crucial.

By using nerve monitoring devices during surgery, several surgeons have attempted in recent years to further minimize the minimal incidence of RLNI. Numerous short series evaluating the possible advantages of monitoring to lower the frequency of nerve damage have been documented in the literature [9]. Intentionally identifying the RLN reduces the possibility of harm. The reported risk of RLN damage after thyroidectomy is between 0 to 2.1% when the nerve is located and dissected [10]. Identification and preservation of nerves depend on intraoperative hemostasis and a good grasp of anatomy [11]. RLNI is increasingly frequently used during thyroid cancer surgery, as well as in situations of hyperthyroid (toxic) goiter and recurring goiter. Adhesions and anatomical displacement cause injuries in recurrent goiter instances, whereas enhanced gland vascularization causes injuries in hyperthyroid cases [11].

## MATERIALS AND METHODSStudy Design

A retrospective review was undertaken on all patients who had thyroid surgery and were admitted to the ENT department and Surgery department.

## DATA COLLECTION

The history, physical examination, thyroid function tests, and operational reports for the kind of surgery (total, near total, or subtotal thyroidectomy) as well as to determine whether or not RLN was found were assessed in the patient's documents. Pre-operative and three-day post-operative indirect laryngoscopy reports were kept on file. The study comprised categories of the procedure as main surgery (no previous thyroid surgery) or secondary surgery (one or more thyroid surgeries previously to this intervention). In every instance, an effort was made to identify the RLN. In order to prevent harm in the event that the RLN could not be identified, the gland was carefully dissected, and the associated vessels were tied off near their distant branches. The patients were examined for RLNI with respect to gender, surgical procedure category and type, and histological diagnosis. When vocal cord paralysis or dysphonia was discovered during an indirect laryngoscopy, it was classified as permanent paralysis if it persisted longer than six months and as temporary paralysis if it healed sooner.

## RESULTS

Forty-nine people had thyroid surgery done during the last 3 years-time period. Patients' ages ranged from 21 to 72 years old (median age of 41 years). Twenty-one patients (42.85%) were female. Prior to surgery, the voice chords in every case were found to be normal. Surgery was indicated for following conditions (Table 1).

RLN injury occurred in 15 out of 49 patients (30.61%) included in the study. The RLN injury rate varied significantly based on the primary indication for surgery, from 16.32% in patients (n=8) undergoing surgery for a single nodule to 22% in patients (n=11) undergoing surgery for differentiated cancer. RLN injury occurred more often in thyroidectomies than lobectomies and in surgeries without intraoperative nerve monitoring

**Table 1: Clinical conditions**

| Clinical condition | N | % |
|---|---|---|
| Multinodular goiter | 4 | 8.16 |
| Solitary nodule | 5 | 10.20 |
| Hyperthyroidism | 7 | 14.28 |
| Thyroid cancer | 9 | 18.36 |
| Recurrent simple goiter | 8 | 16.32 |
| Cystic lesions | 7 | 14.28 |
| Thyroiditis | 9 | 18.36 |

Five instances (10.2%) experienced transient unilateral vocal cord paresis, while one case (2.1%) resulted in persistent bilateral vocal cord paresis (after right thyroidectomy). Bilateral vocal cord paralysis occurred in 2 cases, but none of them progressed to permanent paralysis. Fourteen of the cases (28.1%) were repeat simple goiter instances, and one case involved a complete thyroidectomy due to papillary cancer. Types of operations performed and nature of RLN observed in patients after surgery are presented in
Table 2.

**Table 2: Types of operations and RLNI**

| | No. of patients | % | No. of RLN paralysis | | | |
|---|---|---|---|---|---|---|
| | | | Transient | | Permanent | |
| **Total surgeries** | **49** | | **No. of patients** | **%** | **No. of patients** | **%** |
| Reoperation for Recurrent goiter | 4 | 8.16 | 2 | 50 | | |
| Completion Thyroidectomy | 1 | 2.04 | | | | |
| Bilateral Subtotal Thyroidectomy | 12 | 24.48 | 3 | 25 | 1 | 8.33 |
| Unilateral Subtotal Thyroidectomy | 10 | 20.40 | | | 3 | |
| Total Bilateral Thyroidectomy | 8 | 16.32 | 2 | 25 | | |
| Unilateral Hemi Thyroidectomy | 11 | 22.44 | 2 | 18.18 | 2 | 18.18 |
| Near Total Thyroidectomy | 3 | 6.12 | | | | |

A significant increase in the incidence of RLN injury was observed in the following cases: non-identification of RLN during surgery (10.2% in non-identification vs. 20.4% in identification, $p<0.05$); total/near total thyroidectomy (16.33% in total vs. 14.29% in subtotal, $p>0.05$); and malignant disease (22.45% in malignant vs. 8.16% in benign disease, $p<0.01$).

The incidence of RLNI did differ significantly based on gender as well (10.2% in males vs. 20.41% in females, $p=0.01$) (Table 3).

**Table 3: Risk factors for Recurrent laryngeal nerve injury during thyroid surgery**

| Total RLNI = 15 | N | % |
|---|---|---|
| Gender | | |
| Male | 5 | 10.20 |
| Female | 10 | 20.41 |
| Category of Operation | | |
| Primary | 4 | 8.16 |
| Secondary | 11 | 22.45 |
| Identification of the nerve | | |
| Yes | 5 | 10.20 |
| No | 10 | 20.41 |
| Type of operation | | |
| Subtotal | 8 | 16.33 |
| Total/near total | 7 | 14.29 |
| Pathology | | |
| Benign | 4 | 8.16 |
| Malignant | 11 | 22.45 |

## DISCUSSION

In the last twenty-five years, complete thyroidectomy has supplanted bilateral partial thyroidectomy as the treatment of choice for all patients with Graves' disease, bilateral benign multinodulargoitre, and all but extremely low-risk individuals with thyroid cancer. The primary shift in surgical methods has been the substitution of "capsular dissection" for "lateral dissection." [12]. When conducted by skilled neck surgeons, the rate of injuries to the recurrent laryngeal nerve has been reported to range from 1% to 2% from various thyroid surgery centers. When a thyroidectomy is carried out for a malignant illness or by a surgeon with less training, this incidence is higher [13]. In certain cases, when a nerve encounters an aggressive thyroid cancer, it is deliberately destroyed. The rate of RLNI in the current investigation was 30.61%.

The most frequent side effect after thyroid surgery is the irreversible malfunction of phonation caused by the persistent lesion of damaged RLN [14]. The only way to prevent irreversible damage to the recurrent laryngeal nerve is to locate and meticulously trace its course. Anatomic differences, surgical technique, prior thyroid surgery, the surgeon's expertise, and the histopathologic diagnosis all play a significant role in this complication [15]. Complete or partial transection, traction, manipulation of the nerve, contusion, crush, burn, clamping, misplaced ligature, and impaired blood flow are some of the mechanisms of nerve damage [16].

RecurrentLaryngeal nerve dissection has been called into doubt despite several quality research since there was either no effect or an increased risk of vocal cord paralysis. While several of these studies came to the conclusion that recurrent laryngeal nerve dissection is not required in subtotal resection, they nevertheless supported the operation since it is advantageous in complex situations (such as thyroid cancer) and for practical reasons [17]. In our investigation, the

frequency of RLNI rose to 20.1% in situations in which the nerve could not be located. Dissection from the avascular cricothyroid space has been described as a secure technique for preserving RLN [17]. It also enables the surgeon to confirm the anatomic integrity of the nerve and identify any extra-laryngeal ramifications. The bad results of the surgeons who just seek to identify the nerve further reinforce the notion that this circumstance is certainly preferable to partial exposure of the nerve [17].

By using nerve monitoring devices during surgery, several surgeons have attempted in recent years to further minimize the minimal incidence of RLNI. Despite the fact that different devices have been used, they are all able to detect movement of the voice cords in response to stimulation of the recurrent laryngeal nerve [17]. Numerous short series evaluating the possible advantages of monitoring to lower the incidence of nerve damage have been published in the literature [18]. Only the superior laryngeal nerve could be identified with the use of a nerve stimulator; it was not helpful for the anatomical dissection of the RLN. For the competent surgeon, there is no discernible advantage to continuous nerve monitoring by stimulation during total thyroidectomy in terms of nerve identification, functional testing, or damage avoidance. Intentionally identifying the RLN reduces the possibility of harm. Identification and preservation of nerves depend on intraoperative hemostasis and a good grasp of anatomy. RLNI is increasingly frequently used during thyroid cancer surgery, as well as in situations of hyperthyroid (toxic) goiter and recurring goiter. Adhesions and anatomical displacement cause injuries in recurrent goiter instances, whereas enhanced gland vascularization causes injuries in hyperthyroid cases [19]. In the current study, the incidence of RLNI was 22.45% in instances of thyroid cancer and 8.2% in cases of benign goiter. An additional factor impacting the rate of RLN damage is the type of surgical operation. The rate of RLNI was shown to be lower in instances of partial thyroidectomy compared to whole thyroidectomy patients.

It may be possible to prevent iatrogenic damage to the recurrent laryngeal nerve or its branches by carefully tracing, identifying, and exposing the nerve itself. We believe that the best course of action is a complete extracapsular thyroidectomy along with a methodical search for the nerve. We think that surgeons should have a thorough understanding of the surgical anatomy of the thyroid area as well as an awareness of the highly variable courses taken by the recurrent laryngeal nerve, the inferior thyroid artery, and their relationships.

## REFERENCES

1. Lukinović J, Bilić M. Overview of Thyroid Surgery Complications. ActaClin Croat. 2020 Jun;59(Suppl 1):81-86.
2. Poudel DR, Giri S, Pathak R, Morsey M, Alsafwah S. Late onset seromapostthymectomy presenting as cardiac tamponade. *J Community Hosp Intern Med Perspect*. 2015;5(3):27459.
3. Akin M, Kurukahvecioglu O, Anadol AZ, Yuksel O, Taneri F. Analysis of surgical complications of thyroid diseases: results of a single institution. *BratislLekListy*. 2009;110:27–30.
4. Trésallet C, Chigot JP, Menegaux F. How to prevent recurrent nerve palsy during thyroid surgery? *Ann Chir.* 2006;131:149–153.
5. Shaw GY, Pierce E. Malpractice litigation involving iatrogenic surgical vocal fold paralysis: a closed-claims review with recommendations for prevention and management. *Ann OtolRhinolLaryngol.* 2009;118:6–12.
6. Marcus B, Edwards B, Yoo S, Byrne A, Gupta A, Kandrevas J, Bradford C, Chepeha DB, Teknos TN. Recurrent laryngeal nerve monitoring in thyroid and parathyroid surgery: the University of Michigan experience. Laryngoscope. 2003;113:356–361.
7. Fewins J, Simpson CB, Miller FR. Complications of thyroid and parathyroid surgery. OtolaryngolClin North Am 2003. Feb;36(1):189-206,
8. Kasemsuwaran L, Nubthuenetr SJ. Recurrent laryngeal nerve paresis: a complication of thyroidectomy. Otorhinolaryngology 1997;26:365-367
9. Bailleux S, Bozec A, Castillo L, Santini J. Thyroid surgery and recurrent laryngeal nerve monitoring. *J LaryngolOtol* 2006. Jul;120(7):566-569.
10. Canbaz H, Dirlik M, Colak T, Ocal K, Akca T, Bilgin O, et al. Total thyroidectomy is safer with identification of recurrent laryngeal nerve. *J Zhejiang UnivSci B* 2008. Jun;9(6):482-488.
11. Mutlu D, Ramazan M. Factors Effecting Recurrent Laryngeal nerve Injury after thyroid gland surgery. *TurkiyeKlinikleri J Med Sci.* 1999;19:193-199.
12. Delbridge L. Total thyroidectomy: the evolution of surgical technique. ANZ J Surg 2003. Sep;73(9):761-768.
13. Mishra A, Agarwal G, Agarwal A, Mishra SK. Safety and efficacy of total thyroidectomy in hands of endocrine surgery trainees. Am J Surg 1999. Nov;178(5):377-380.
14. Randolph GW, Kobler JB, Wilkins J. Recurrent laryngeal nerve identification and assessment during thyroid surgery: laryngeal palpation. World J Surg 2004. Aug;28(8):755-760.
15. Chaudhary IA, Samiullah MR, Masood R, Majrooh MA, Mallhi AA. Recurrent laryngeal nerve injury: an experience with 310 thyroidectomies. J Ayub Med Coll Abbottabad 2007. Jul-Sep;19(3):46-50.
16. Steurer M, Passler C, Denk DM, Schneider B, Niederle B, Bigenzahn W. Advantages of recurrent laryngeal nerve identification in thyroidectomy and parathyroidectomy and the importance of preoperative and postoperative laryngoscopic examination in more than 1000 nerves at risk. Laryngoscope 2002. Jan;112(1):124-133.
17. Bailleux S, Bozec A, Castillo L, Santini J. Thyroid surgery and recurrent laryngeal nerve monitoring. J LaryngolOtol 2006. Jul;120(7):566-569.

18. Loch-Wilkinson TJ, Stalberg PL, Sidhu SB, Sywak MS, Wilkinson JF, Delbridge LW. Nerve stimulation in thyroid surgery: is it really useful? ANZ J Surg 2007. May;77(5):377-380.

19. Richmond BK, Eads K, Flaherty S, Belcher M, Runyon D. Complications of thyroidectomy and parathyroidectomy in the rural community hospital setting. Am Surg 2007. Apr;73(4):332-336.