

Recurrent laryngeal nerve injury and preservation in thyroidectomy

Bülent Aytac, MD, Ahmet Karamercan, MD.

ABSTRACT

Objectives: We aim to evaluate the rates of recurrent laryngeal nerve (RLN) injury after thyroidectomy and to put forward the factors influencing the risk of RLN injury during thyroid surgery.

Methods: We retrospectively analyzed the records of 418 patients who underwent thyroid surgery for thyroid disease at the Turkish State Railway Hospital, Ankara and Gazi University Hospital between 1989-2003 for RLN injury and factors affecting this complication. Moreover, we evaluated 6 different types of operations used during surgical practice. Indirect laryngoscopy was performed preoperatively and was repeated postoperatively for all patients.

Results: Three hundred and thirty-nine (81.1%) were females and 79 (18.9%) were male. Indications for surgery were multinodular goiter in 253 cases, solitary nodule in 69, hyperthyroidism in 68, thyroid carcinoma in 5 and recurrent goiter in 23 cases. Bilateral subtotal thyroidectomy was performed in 286 cases (68.4%), unilateral subtotal thyroidectomy in 52 (12.4%), unilateral total thyroidectomy in 25 (5.9%), bilateral total thyroidectomy in 22 (5.3%), nodule excision in 10 (2.4%) and completion thyroidectomy for recurrent goiter in 23

(5.5%) cases. Unilateral vocal cord problems occurred, 16 (3.8%) cases and in 6 (1.2%) cases it became permanent. The distribution of permanent RLN paralysis over the cases was 0.04% multinodular goiter, 2.9% hyperthyroidism and 8.7% recurrent goiter ($p<0.05$). Transient RLN paralysis rate was 2%, while permanent RLN paralysis rate was 0.03% for bilateral subtotal thyroidectomies. In addition, in unilateral total thyroidectomies, transient RLN paralysis was 12% while permanent paralysis was 4%. For bilateral total thyroidectomies, 13.6% was transient and 9% was permanent RLN paralysis and 13% was transient and 8.7% was permanent paralysis for completion cases ($p<0.05$).

Conclusion: We can avoid RLN injury during thyroid surgery by identifying the nerve and following its course carefully. Intraparenchymal dissection or subtotal excision can be performed if failure to identify RLN occur, and new operative techniques and medical management of benign thyroid diseases should be considered.

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Surgically treated thyroid disease is widespread and thyroid surgery is a very common procedure among all surgical procedures in Turkey. Complications during thyroid operations are so often such as bleeding, hypoparathyroidism and RLN damage, which represent nearly half of all complications alarms surgeons. The RLN damage is seen in 1% in thyroidectomy operations, where it

is higher during re-exploration, Graves disease and thyroid carcinoma procedures.¹⁻³ The RLN damage, when bilateral, presents a serious complication causing functional sequelae such as phonatory, respiratory and psychologic problems that limit working capacity and social relationships of patients. It is still controversial how to avoid RLN

From the Department of General Surgery, Gazi University Faculty of Medicine, Besevler, Ankara, Turkey.

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Address correspondence and reprint request to: Dr. Ahmet Karamercan, Assistant Professor, Department of General Surgery, Gazi University Faculty of Medicine, Besevler 79. Sokak 2/16, Yesiltepe Bloklari, Emek, Ankara 06510, Turkey. Tel. +90 (312) 2025720. Fax. +90 (312) 4340257. E-mail: karamercan@gazi.edu.tr

damage during surgery. Some recommend RLN identification during the operation, and accept it as a helpful technique to decrease the rate of RLN damage, where others emphasize RLN exploration during operation which increases the rate of RLN damage.^{4,5}

In this study, we reported our personal experience of a series of 418 thyroidectomy and aimed to evaluate the rates of recurrent nerve injury after thyroidectomy.

Method. From 1989-2003, records of 418 patients (339 females, 79 males) who underwent surgery for thyroid diseases at the Departments of General Surgery of the Turkish State Railway Hospital, Ankara and Gazi University Hospital were retrospectively analyzed for RLN damage. Patients were preoperatively evaluated with their history, physical examination, complete blood count, routine biochemical tests, chest and cervical x-ray, thyroid scan, ultrasound and thyroid function tests. Indirect laryngoscopy was performed preoperatively in all patients for vocal cord functions. This was repeated for all patients in postoperative 48-72 hours. Pre- and postoperative vocal cord functions were compared. Operations were performed by same surgical team. Six different type of operations was carried out; unilateral subtotal, bilateral subtotal, unilateral total, bilateral total and completion thyroidectomy, and nodule excision. Extracapsular thyroidectomy technique was utilized in all patients. In this method, the thyroid tissue was excised radically in the extracapsular plain so that identification of RLN and parathyroid glands could be made without causing any injury. In all cases, we tried to identify the RLN and the inferior thyroidal artery, and the RLN was followed to its

penetration point in to the larynx. The inferior thyroidal artery was found and ligated. In case of failure to identify the RLN, careful dissection of the gland and ligation of the related vessels to their distal branches is carried out to avoid injury. The unidentified structures and structures resembling the RLN were saved. A drain was placed at the end of operation in all patients.

Cases were analyzed for RLN paralysis in relation to incidence with gender, type of goiter, surgical technique and histopathological diagnosis. Dysphonia or vocal cord paralysis during indirect laryngoscopy longer than 6 months was accepted as permanent RLN paralysis and cases healing in 6 months were accepted as transient RLN paralysis. Univariate analysis (chi-square, Fisher's exact tests) was used for statistical analysis and values $p < 0.05$ are accepted to be significant.

Results. The age of our patients varied between 12 and 78 years (median age 48.4 years). Vocal cord paralysis was not present in all our patients during preoperative evaluation. In the 395 (94.5%) patients, the operation carried out was the first operation they experienced while the other 23 (5.5%) patients it were the second. The diagnosis was multinodular goiter in 253 (60%), solitary nodule in 69 (16.5%) and hyperthyroid goiter in 68 (16.3%) patients (10 adenomas, 28 diffuse and 30 multinodular toxic goiters). Completion thyroidectomy for recurrent goiter was performed in 23 patients (5.5%). The types of operations performed are shown on **Table 1**. Complete thyroidectomy was carried out in 4 patients with papillary carcinoma and one patient follicular carcinoma. The RLN was identified bilaterally in 370 (88.5%) patients, where in 22 (5.3%) patients

Table 1 - Relation of RLN paralysis with types of operations and histopathological diagnosis.

Operation	Number of patients (%)	Number of RLN paralysis (%)	
		Transient	Permanent
Bilateral subtotal thyroidectomy	286 (68.4)	6 (2)	1 (0.3)
Unilateral subtotal thyroidectomy	52 (12.4)	1 (1.9)	-- --
Unilateral total thyroidectomy	25 (5.9)	3 (12)	1 (4)
Bilateral total thyroidectomy	22 (5.3)	3 (13.6)	2 (9)
Completion thyroidectomy	23 (5.5)	3 (13)	2 (8.7)
Nodule excision	10 (2.4)	-- --	-- --
Histopathological diagnosis			
Multinodular goiter	253 (61)	5 (2)	1 (0.4)
Solitary nodule	69 (16.5)	3 (4.1)	-- --
Hyperthyroid	68 (16.3)	4 (5.8)	2 (2.9)
Recurrent goiter	23 (5)	3 (13)	2 (8.7)
Thyroid carcinoma	5 (1.2)	1 (20)	1 (20)
RLN - recurrent laryngeal nerve			

only right and in 18 patients (4.3%) only left RLN can be identified. In 8 (1.9%) patients neither of the RLN's could be identified. After identification of RLN during surgery, it was followed to its penetration point to the larynx where RLN has multiple branches in extralaryngeal region. Due to close anatomic relation between inferior thyroidal artery and RLN, identification of this artery is very important. In 386 (92.3%) patients, the inferior thyroidal artery was identified. However, in 18 (4.3%) patients, the right and in 14 (3.3%) patients the left inferior thyroidal artery could not be identified. The course of right the RLN was anteriorly to the branches of the inferior thyroidal artery in 141 cases (35.3%), through the branches of it in 124 cases (31%) and posteriorly in 135 cases (33.7%). The course of the left RLN was anteriorly to the left inferior thyroidal artery in 138 cases (34.2%) and through its branches in 152 cases (37.6%) and posteriorly in 114 cases (28.2%). The anatomic relation of inferior thyroidal artery and RLN varied even between left and right side of the same patient.

Indirect laryngoscopy revealed unilateral vocal cord paralysis in 16 patients (3.8%). Paralysis was lower in bilateral subtotal thyroidectomy cases compared to a complete and total thyroidectomy cases (Table 1) ($p < 0.05$). Vocal cord movements returned to normal in 2.3 months (mean, 10 days - 4 months) in 10 out of 16 RLN paralysis cases. Permanent unilateral vocal cord paralysis was ascertained in 6 patients (1.2%).

Transient RLN paralysis was seen in 13 (3.9%) female patients out of which 4 (1.2%) permanent. Transient or permanent RLN paralysis rates were higher significantly ($p < 0.05$) in hyperthyroid goiter, recurrent goiter and thyroid carcinoma cases compared to multinodular goiter cases (Table 1).

Discussion. Iatrogenic injury of RLN is one of the most serious complications of thyroid surgery. This complication is generally unilateral and transient, but occasionally it can be bilateral and permanent. Surgeon's experience, histopathological diagnosis, previous thyroid surgery, surgical technique and anatomic variations are important factors effecting complication occurrence.⁶

Recurrent laryngeal nerve paralysees are may be due to nerve cut, ligation, traction, aspiration trauma, cauterization and hemostasis.^{7,8} Dysphonia starting on the 2nd - 5th postoperative days are commonly due to edema whereas dysphonia continuing less than 6 months are due to traction of the nerve and damage of axons.⁹ Dysphonia continuing after 6 months is commonly permanent caused by cutting, ligating or cauterization of the nerve. Recurrent laryngeal nerve injury is more common in operations for thyroid carcinoma,

hyperthyroid (toxic) goiter and recurrent goiter cases. In recurrent goiter, injuries are due to adhesions and anatomic disorder, in hyperthyroid cases due to increased vascularization, rate of RLN injury is higher. In thyroid carcinoma cases, rate of RLN injury is 8-13.4%.¹⁰⁻¹³ In our study, in hyperthyroid goiter cases the transient RLN injury rate was 5.8%, and permanent in 2.9%, in recurrent goiter cases the transient RLN injury rate was 13% and permanent in 8.7%. Type of surgical procedure is another factor influencing the rate of RLN injury. In subtotal thyroidectomy cases RLN injury rate is low where it is higher in total thyroidectomy cases.¹⁴ In our study, transient RLN injury rate was 2%, while permanent RLN paralysis rate was 0.03% for bilateral subtotal thyroidectomies. In addition, in unilateral total thyroidectomies, transient RLN paralysis was 12% while permanent paralysis was 4%. For bilateral total thyroidectomies, 13.6% was transient and 9% was permanent RLN paralysis and 13% was transient and 8.7% was permanent paralysis for completion cases ($p < 0.05$). Another important factor influencing RLN injury rate is variable course of the nerve and the absence of fixed relation of the nerve with close anatomic structures. The recurrent laryngeal nerve ascends to the middle third of the thyroid gland, it may consist of several branches closely associated with the inferior thyroid artery. Inferior thyroidal artery is the most common used structure to identify the course of RLN, however, as it has a variable course also, it is not always a reliable guide, and it can even show variable course in the right and left side of the same patient.¹⁴ The same condition was observed in our study.

It is still controversial, which is the most effective method for protection of RLN from injury. Some surgeons claim that omitting the identification of RLN may cause little trauma, however in other studies proved that this is not true.^{12,15} Opposing this idea, identification of RLN during operation requires surgeon to experience the anatomic course of the nerve and its variations leading to decreased RLN injury incidence.^{1,16} Surgeon who identifies RLN during operation will be more confident when faced with RLN paralysis, as he is sure about the nerve integrity so he can wait calmly for improvement.

Experience of surgeons and starting point of dissection are also important factors influencing iatrogenic RLN injury. Dissection beginning from avascular cricothyroid space was reported as a safe method of RLN preservation.¹⁷ Rate of transient RLN paralysis was 12%, permanent RLN paralysis was 5.5% in operations performed by surgeons who operated less than 50 thyroid cases, where these rates were 2.6% for transient and 0.4% for permanent in operations performed by surgeons who operated more than 100 thyroid cases.¹⁸ These

rates were found to be 3.8% for transient and 1.2% permanent in our study.

The result of our study confirms that iatrogenic injury to the RLN, or its branches, can be avoided by seeking, identifying and exposing the nerve and by following its course carefully. Cases in which the RLN cannot be identified; intraparenchymal dissection or subtotal excision is preferable. It must be kept in mind that risk of iatrogenic RLN injury incidence is higher in hyperthyroid goiter, re-operation cases and thyroid cancer cases, thus, these patients must be informed regarding this condition preoperatively.

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