Thi-Qar Medical Journal (TQMJ): Vol(10) No (2)2015

Recurrent laryngeal nerve injury during thyroid surgery

Dr. Abdulameer Mohsen Aldarajy**

** *General Surgeon in Alfayha Hospital /Basra/Iraq*

Dr. Asaad Mohammed kadhim*

**General Surgeon in Alfayha Hospital and Lecturer in Basra University*

ABSTRACT

Iatrogenic injury of the recurrent laryngeal nerve (RLN) which frequently leads to vocal cord paresis or paralysis is one of the main problems in thyroid surgery. The incidence of recurrent laryngeal nerve palsy varies between 1.5-14%. A total of 100 patients were included in this retrospective study. All patient underwent thyroidectomy at Al Fayhaa General Hospital from 1st April 2003 to 1st April 2004. Transient unilateral vocal cord paralysis occurred in 7 (4.06%) While permanent paralysis was found in only one patient (0.58%). There was significant increases in the incidence of transient RLN injury in total and near total thyroid lobectomy. There were no significant increases in the incidence of permanent RLN injury in malignant tumors

.

Introduction

Thyroid surgery is a common surgical procedure. Recurrent laryngeal nerve injury (RLN), although infrequently encountered, can jeopardize the quality of life.(1) Bilateral RLN injury leads to dyspnea and often life-threatening glottal obstruction in addition to the hoarseness that occurs with unilateral RLN injury,.(2) The incidence of RLN injury has been found to be higher during re-explorations, Graves disease and thyroid carcinoma procedures.(3-5).

RLN injury is a major concern in thyroid surgery, therefore, methods that can reduce the concurrent incidence of this complication are of great interest.(6) The best way to ensure the integrity of the RLN is to always identify the nerve during surgical procedures on thyroid gland.(7,8)

The aim of the present study is to assess factors that influence the risk of RLN injury during thyroid surgery.

Materials & Methods

A retrospective review was undertaken on 100 patients who had thyroid surgery between 1st of April 2003 and 1st of April 2013 and were admitted to Al Fayhaa general hospital, and operated upon and completed one year follow up. Patient's charts were evaluated for history, physical examination, thyroid function tests , operative reports for the type of operation (total, near total or subtotal thyroidectomy) and also to check if RLN was identified during surgery or not and method of resection(conventional by use of ligation and coagulation or ultrasonic dissector)) and histopathological diagnosis. Reports of pre-operative and 3 days post-operative indirect laryngoscopy were recorded and one year follow up. Categories of the operation as primary surgery (no prior thyroid surgery) or reoperation(one or more thyroid operations before this intervention)

were included in the study. In all cases, attempts were made to identify the RLN. In case of failure to identify the RLN, careful dissection of the gland and ligation of the related vessels close to their distal branches was carried out to avoid injury. Analysis of cases was done for RLN injury in relation to nerve exposure during surgery, histopathological diagnosis, extent of thyroidectomy, surgical training, method of resection and heamostasis and weather the operation was primary or secondary(reoperation). Vocal cord paralysis detected on indirect laryngoscopy was considered as transient paralysis if recovered within 12 months and as permanent if it continued beyond 12 months.

Differences between the 2 groups (RLN injury and no injury) were tested for statistical significance using the chi-square test, Fisher's exact test as appropriate. Significance was set at $p<0.05$ for all comparisons. Statistical analyses were performed using SPSS 15 software (Chicago, USA).

Results

A total of 100 patients who underwent thyroid surgery during the study period (10 years) were included in the present analysis. Most of patients were females (80%) and their age between 20 and 49(77%). On preoperative evaluation, all cases had normal vocal cords. The indications for surgery were; multinodular goiter (57%), solitary nodule (44%),diffuse goiter(7%) , hyperthyroidism (25%), (tables 1,2,3).

Table (1): Age & gender distribution

Age/Years	Male	Female	Total
≤19	0	6	**6**
20-29	4	9	**13**
30-39	10	36	**46**
40-49	3	15	**18**
50-69	2	14	**16**
70 ≥	1	0	**1**
Total	20	80	**100**

Table (2):Types of goiter

Type	No.	%
Multinodulare goiter	57	57
Solitary thyroid nodule	44	44
Diffuse goiter	7	7
No goiter	2	2
Total	100	100

Table (3)Thyroid function status

Thyroid Function	No.	%
Euthyroid	72	72
Hyperthyroid	25	25
Hypothyroid	3	3
Total	100	100

Type of operation(Extent of thyroidectomy) are shown in Table (4). The associated procedures included 2 cases of tracheostomy prior to surgery because of failure of endo-trachial intubation due to severe tracheal displacement and modified neck dissection for malignant thyroid tumor with lymph node involvement.

Table (4):Extent of thyroidectomy .

Thyroidectomy	NO.	%
Lobectomy	28	28
Subtotal Thyroidectomy	32	32
Total or Near total Thyroidectomy	40	40
Associated procedures:		
Tracheostomy	2	2
Modified Neck Dissection	1	1

Histopathological diagnosis is shown below. Most of cases were nodular colloid hyperplasia(77%).Normal gland was for completion thyroidectomy for patient with thyroid malignancy underwent lobectomy at primary operation.{Table5}

Table (5): HISTOPATHALOGICAL DIAGNOSIS

Histopathology	No.	%
Nodular Colloid Hyperplasia	77	77
Diffuse hyperplasia	3	3
Malignant Tumors	9	9
Benign Tumors	7	7
Autoimmune Thyroiditis	2	2
Colloid Cyst	1	1
Normal Thyroid Tissue	1	1
Total	100	100

Transient unilateral vocal cord paralysis developed in 7 (4.06%) cases, and permanent in 1(0.58%) {Table 6 }

Table (6) RLN PARALYSIS TYPES

RLN	No.	%
Transient Paralysis	7	4.06
Permanent Paralysis	1	0.58

RLN recovery period in transient paralysis was shown below.{Table 7}

Table(7)RLN RECOVERY PERIOD

(transient paralysis)

Period/Months	No,	%
1	1	14.28
2	3	42.85
3	1	14.28
6	1	14.28
9	1	14.28
Total	7	100

RISK FACTORS FOR RLN PARALYSIS

1- RLN exposure during surgery
2- Extent of thyroid resection
3- Histopathological diagnosis
4- Surgical training
5- Method of resection and haemostsis:

-Conventional(ligation and electro coagulation)

-Ultrasonic Dissection

6- Reoperation

Regarding RLN exposure during surgery there was no significant increase in the incidence of permanent RLN injury in non-exposure of RLN (1.03% in non-exposure vs. 0%% in exposure, $p>0.05$) and there was no increase in the incidence of transient RLN paralysis in exposure of the nerve (5.15 in exposure group vs. 2.06 in non-exposure group,$p>0.05$) {Table 8}

Table (8): RLN EXPSURE DURING SURGERY

RLN Exposure		Transient paralysis		Permanent paralysis	
RLN	NO.	NO.	%	No|.	%
Exposed	75	5	5.15	0	0
Not Exposed	97	2	2.06	1	1.03
Total	172	7	7.21	1	1.03

Regarding histopathological diagnosis all 7 cases of transient RLN nerve paralysis occurred in nodular colloid hyperplasia and 1 case of permanent paralysis occurred in malignant tumor. There was no significant difference in the incidence of RLN paralysis between various histopathological types($p>0.05$)

TABLE (9) HISTOPATHOLOGICAL DIAGNOSIS & RLN PARALYSIS

Histopathology	No.	Transit paralysis		Permanent paralysis	
		No.	%	No.	%
Nodular Colloid hyperplasia	140	7	5	0	0
Diffuse hyperplasia	6	0	0	0	0
Malignant tumors	14	0	0	1	7.1
Benign tumors	8	0	0	0	0
Autoimmune Thyroiditis	2	0	0	0	0
Colloid cyst	1	0	0	0	0
Normal Thyroid Tissue	1	0	0	0	0
Total	172	7	5	1	7.1

Regarding the extent of thyroidectomy there were significant increase in the incidence of transient RLN paralysis in total/near total lobectomy (7% in total vs, 0% in subtotal lobectomy) and no increase in the incidence of permanent RLN injury in total/ near total lobectomy(1% in total vs,0% in subtotal lobectomy, $p>0.05$) {Table 10}

TABLE(10) EXTENT OF THYROIDECTOMY&RLN PARALYSIS

Extent of Thyroid Resection	No.	Transit paralysis		Permanent paralysis	
		No.	%	No.	%
Subtotal Lobectomy	72	0	0	0	0
Total or Near total Lobectomy	100	7	7	1	1
Total	172	7	7	1	1

Regarding surgical training there was no significant difference in the incidence transient RLN injury between the 1st and the 2nd half of surgical training (3.48% in the 1st 86 lobectomy vs,4.56% in the 2nd 86 lobectomy p>0.05) and there was no significant difference in the incidence of permanent RLN injury between the 1st and the 2nd course of training(1.16% in the 1st course vs, 0% in the 2nd course.p>0.05){Table 11}

Table (11): SURGICAL TRIANING&RLN PARALYSIS

Surgical Training	No. of lobectomies	Transit paralysis		Permanent paralysis	
		No.	%	No.	%
The 1st Half of Training	86	3	3.48	1	1.16
The 2nd Half of Training	86	4	4.65	0	0

Regarding method of thyroid resection and hemostasis there was no significant increase in the incidence of transient RLN injury with the use of ultrasonic (u/s)dissector(10% in u/s dissector vs., 2.81% in the conventional method ,p>0.05) and there was no significant difference in the two methods(0.7% in conventional method vs0%in u/s dissector group, p>0.05) {TABLE 12}

Table (12): METHODS OF THYROID RESECTION & HEMOSTASIS &RLN PARALYSIS

Method	No.	Transit paralysis		Permanent paralysis	
		No.	%	No.	%
Conventional	142	4	2.81	1	0.7
Ultrasonic Dissector	30	3	10	0	O

Regarding comparison between primary surgery and reoperation there was no significant increase in the incidence of transient RLN injury in reoperation(16.66% in reoperation Vs 3.61 in primary surgery), (p>0.05),and no significant difference in the incidence of permanent injury[Table 13}

Table (13): REOPERATION&RLN PARALYSIS

Operation	No.	Transient paralysis		Permanent paralysis	
		No.	%	No.	%
Primary operation	166	6	3.61	1	0.60
Reoperation	6	1	16.66	0	0

Discussion

In the last 25 years, bilateral subtotal thyroidectomy has been replaced by total thyroidectomy as the preferred option for the management of patients with bilateral benign multinodular goiter, Graves' disease, and all but very low-risk thyroid cancer patients. The principal change in operative technique has been the move from 'lateral dissection' to 'capsular dissection.'[9] RLN injury has been reported between 1% to 2% from different thyroid surgery centers when performed by experienced neck surgeons. This incidence is higher when thyroidectomy is performed by a less experienced surgeon,[10-11]or when thyroidectomy is done for a malignant disease. Sometimes the nerve is purposely sacrificed if it runs into an aggressive thyroid cancer.[12] In the present study, the rate of transient RLN injury was 4.06%.This complication is generally unilateral and transient, but occasionally it can be bilateral and permanent and may be either deliberate or accidental.[13,14] The permanent lesion of damaged RLN often manifests as an irreversible dysfunction of phonation and is the most common complication following thyroid surgery.[15] Permanent injuries to the recurrent laryngeal nerve are best avoided by identifying and carefully tracing the path of the recurrent nerve.[16] Surgeon's experience, histopathologic diagnosis, previous thyroid surgery, surgical technique and anatomic variations are important factors affecting this complication.[17].

Dysphonia starting on the 2nd to 5th post-operative days is mostly due to edema. The injury of the nerve by traction and damage of its axons may result in dysphonia lasting up to 6 months. Dysphonia continuing after 6 months is commonly permanent caused by cutting, ligating or cauterization of the nerve.[18] Bilateral RLN injury is more serious, because both vocal cords may assume a median or paramedian position that may cause airway obstruction necessitating performing urgent tracheostomy .

Despite many important studies, recurrent nerve dissection has been repeatedly questioned since there was either no change or there was an increased risk of vocal cord paralysis. Several studies concluded that recurrent nerve dissection is not essential in subtotal resection but still advocate the procedure for the sake of practice, which is useful in complicated cases (e.g., thyroid cancer).[19-20].

In our study, there was no significant difference in the incidence of RLN injury in cases where the nerve was exposed or not.

Deliberate identification of the RLN minimizes the risk of injury. When the nerve is identified and dissected, the RLN injury rate during thyroidectomy ranges from 0 to 2.1%. This rate is higher in the re-operative setting

(2-12%) or if the nerve is not clearly identified (4-6.6%).[21].

Intraoperative hemostasis and a thorough understanding of the anatomy are essential for nerve identification and preservation.22 RLN 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 anatomical displacement whereas in hyperthyroid cases, it is due to increased vascularization of the gland.[22,23].

In present study, there was no significant difference in the incidence of RLN injury in relation to histopathological diagnosis . The surgical procedure is another factor influencing the rate of RLN injury. In subtotal thyroidectomy cases RLN injury rate was low while it is higher in total thyroidectomy cases.[24] In the present study, transient RLN injury rate was 0% in subtotal lobectomy compared to 7% in total/ near total lobectomy. Recently, Echternach et al. in a study of 761 patients concluded that laryngeal complications after thyroidectomies are primarily caused by injury to the vocal folds from intubation and to a lesser extent by injury to the laryngeal nerve.[25] The most effective method for protection of RLN from injury is still controversial. Some surgeons claim that omitting the identification of RLN may cause little trauma. However, other studies have proved that this is not true. 12,26 Opposing this idea, identification of RLN during operation requires surgeon to have the knowledge of the anatomic course of the nerve and its variations leading to decreased incidence of RLN injury .[17, 27] Intra-parenchymal dissection or subtotal excision would be recommended if failure to identify RLN occurs. The RLN is vulnerable to injury in thyroid and parathyroid reoperations because of the presence of extensive scaring and displacement of the nerve from its normal position.28

In the present study no significant difference was found in the incidence of RLN injury between primary operation and reoperation.

Ultrasonic dissector may reduce the rate of complications (transient and definitive hypocalcaemia, transient damage of the recurrent laryngeal nerve) and operative time.29, In our study ,there was no significant difference in the incidence of RLN injury with use of ultrasound dissector.

The RLN damage five days after thyroid gland surgery is mainly caused by the great number of recurrent goiter and thyroid cancer (16.1 per cent), the rate of procedures performed by younger surgeons and the near total resection of euthyroid goiter. The exposure of RLN is important for the training to manage thyroid gland surgery30,

In this study ,there was no significant difference in the incidence of RLN injury in relation to surgical training.

Conclusion

The present study showed that thyroid carcinoma, re-operation for recurrent goiter, non-identification of RLN were not associated with a significantly increased risk of operative RLN injury. Total thyroid resection was associated with a significantly increased risk of operative transient RLN injury.

References

1- Bergamaschi R, Becouarn G, Ronceray J, Arnaud JP. Morbidity of thyroid surgery. Am J Surg 1998. Jul;176(1):71-75.10.1016/S0002-9610(98)00099-3 [**PubMed**] [**Cross Ref**]

2- Jatzko GR, Lisborg PH, Müller MG, Wette VM. Recurrent nerve palsy after thyroid operations–principal nerve identification and a literature review. Surgery 1994. Feb;115(2):139-144. [**PubMed**]

3- Fewins J, Simpson CB, Miller FR. Complications of thyroid and parathyroid surgery. Otolaryngol Clin North Am 2003. Feb;36(1):189-206, x.10.1016/S0030-6665(02)00129-9 [**PubMed**] [**Cross Ref**]

4- Hisham AN, Lukman MR. Recurrent laryngeal nerve in thyroid surgery: a critical appraisal. ANZ J Surg 2002. Dec;72(12):887-889.10.1046/j.1445-2197.2002.02578.x [**PubMed**] [**Cross Ref**]

5- Kasemsuwaran L, Nubthuenetr SJ. Recurrent laryngeal nerve paresis: a complication of thyroidectomy. Otorhinolaryngology 1997;26:365-367. [**PubMed**]

6- Gavilán J, Gavilán C. Recurrent laryngeal nerve. Identification during thyroid and parathyroid surgery. Arch Otolaryngol Head Neck Surg 1986. Dec;112(12):1286-1288. [**PubMed**]

7- Sosa JA, Bowman HM, Tielsch JM, Powe NR, Gordon TA, Udelsman R. The importance of surgeon experience for clinical and economic outcomes from thyroidectomy. Ann Surg 1998. Sep;228(3):320-330.10.1097/00000658-199809000-00005 [**PMC free article**] [**PubMed**] [**Cross Ref**

8- Lamadé W, Renz K, Willeke F, Klar E, Herfarth C. Effect of training on the incidence of nerve damage in thyroid surgery. Br J Surg 1999. Mar;86(3):388-391.10.1046/j.1365-2168.1999.01017.x [**PubMed**] [**Cross Ref**]

9- Delbridge L. Total thyroidectomy: the evolution of surgical technique. ANZ J Surg 2003. Sep;73(9):761-768.10.1046/j.1445-2197.2003.02756.x [**PubMed**] [**Cross Ref**]

10- 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):377-380.10.1016/S0002-9610(99)00196-8 [**PubMed**] [**Cross Ref**]

11- Snyder SK, Lairmore TC, Hendricks JC, Roberts JW. Elucidating mechanisms of recurrent laryngeal nerve injury during thyroidectomy and parathyroidectomy. J Am Coll Surg 2008. Jan;206(1):123-130.10.1016/j.jamcollsurg.2007.07.017 [**PubMed**] [**Cross Ref**]

12- Witte J, Simon D, Dotzenrath C. Recurrent nerve palsy and hypocalcemia after surgery of benign thyroid disease. Acta Chir Austria 1996;28:361-364.10.1007/BF02616290 [**Cross Ref**]

13- Sancho JJ, Pascual-Damieta M, Pereira JA, Carrera MJ, Fontané J, Sitges-Serra A. Risk factors for transient vocal cord palsy after thyroidectomy. Br J Surg 2008. Aug;95(8):961-967.10.1002/bjs.6173 [**PubMed**] [**Cross Ref**]
14- Woodson GE. Spontaneous laryngeal reinnervation after recurrent laryngeal or vagus nerve injury. Ann Otol Rhinol Laryngol 2007. Jan;116(1):57-65. [**PubMed**]

15- Randolph GW, Kobler JB, Wilkins J. Recurrent laryngeal nerve identification and assessment during thyroid surgery: laryngeal palpation. World J Surg 2004. Aug;28(8):755-760.10.1007/s00268-004-7348-x [**PubMed**] [**Cross Ref**]
16- 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. [**PubMed**]
17- Aytac B, Karamercan A. Recurrent laryngeal nerve injury and preservation in thyroidectomy. Saudi Med J 2005. Nov;26(11):1746-1749. [**PubMed**]
18- Eisele DW. Intraoperative electrophysiologic monitoring of the recurrent laryngeal nerve. Laryngoscope 1996. Apr;106(4):443-449.10.1097/00005537-199604000-00010 [**PubMed**] [**Cross Ref**]

19- Acun Z, Cinar F, Cihan A, Ulukent SC, Uzun L, Ucan B, et al. Importance of identifying the course of the recurrent laryngeal nerve in total and near-total thyroid lobectomies. Am Surg 2005. Mar;71(3):225-227. [**PubMed**]
20- Bailleux S, Bozec A, Castillo L, Santini J. Thyroid surgery and recurrent laryngeal nerve monitoring. J Laryngol Otol 2006. Jul;120(7):566-569.10.1017/S0022215106000946 [**PubMed**]
21- 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 Univ Sci B 2008. Jun;9(6):482-488.10.1631/jzus.B0820033 [**PubMed**]
22- Mutlu D, Ramazan M. Factors Effecting Recurrent Laryngeal nerve Injury after thyroid gland surgery. Turkiye Klinikleri J Med Sci. 1999;19:193-199.
23- 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. [**PubMed**]
24- Hermann M, Keminger K, Kober F. Risk factors of recurrent nerve palsy: a statistical analysis of 7566 thyroid operations. Chirurgie 1991;62:182-188. [**PubMed**]
25- Echternach M, Maurer CA, Mencke T, Schilling M, Verse T, Richter B. Laryngeal complications after thyroidectomy: is it always the surgeon? Arch Surg 2009. Feb;144(2):149-153, discussion 153.10.1001/archsurg.2008.530 [**PubMed** }
26- Dimov RS, Doikov IJ, Mitov FS, Deenichin GP, Yovchev IJ. Intraoperative identification of recurrent laryngeal nerves in thyroid surgery by electrical stimulation. Folia Med (Plovdiv) 2001;43(4):10-13. [**PubMed**]
27- Marcus B, Edwards B, Yoo S, Byrne A, Gupta A, Kandrevas J, et al. Recurrent laryngeal nerve monitoring in thyroid and parathyroid surgery: the University of Michigan experience. Laryngoscope 2003. Feb;113(2):356-361.10.1097/00005537-200302000-00028[**PubMed**]
28- Douglas W.,Laurence Y,Alden H,James W,Thyroid and parathyroid procedures In ACS principles and practice 2003,p 602

29- Sista F, Schietroma M, Ruscitti C, De Santis G, De Vita F, Carlei F, Amicucci G.J Laparoendosc 1New ultrasonic dissector versus conventional hemostasis in thyroid surgery: a randomized prospective study. Adv Surg Tech A. 2012 Apr;22(3):220-4. doi: 10.1089/lap.2011.0266. Epub 2012 Mar 6.

30- Friedrich T[1], Steinert M, Keitel R, Sattler B, Schönfelder M. [Incidence of damage to the recurrent laryngeal nerve in surgical therapy of various thyroid gland diseases--a retrospective study]. Zentralbl Chir. 1998;123(1):25-9 .