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Recurrent Laryngeal Nerve Injury in Thyroid Surgery

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Abstract

Objectives: Vocal cord paresis or paralysis due to iatrogenic injury of the recurrent laryngeal nerve (RLNI) is one of the main problems in thyroid surgery. Although many procedures have been introduced to prevent the nerve injury, still the incidence of recurrent laryngeal nerve palsy varies between 1.5-14%. The aim of the present study is to assess the risk factors of recurrent laryngeal nerve injury during thyroid surgery.

Methods: Patients who had thyroid surgery between 1990 and 2005 and were admitted to the surgical department of King Fahd hospital of the University, Al-Khobar, Saudi Arabia were enrolled for this retrospective review, Factors predisposing to recurrent laryngeal nerve injury were evaluated such as pathology of the lesions and the type of operations and identification of recurrent laryngeal nerve intra-operatively. Preoperative and postoperative indirect laryngoscopic examinations were performed for all patients.

Results: 340 patients were included in this study. Transient unilateral vocal cord problems occurred in 11 (3.2%) cases, and in 1 (0.3%) case, it became permanent (post Rt. Hemithyroidectomy). Bilateral vocal cord problems occurred in 2 cases (0.58%), but none became permanent. There were significant increases in the incidence of recurrent laryngeal nerve injury in secondary operation (21.7% in secondary *vs*. 2.8% in primary, p=0.001), total/near total thyroidectomy (7.2% in total *vs*. 1.9% in subtotal, p=0.024), non-identification of RLN during surgery (7.6% in non-identification *vs*. 2.6% in identification, p=0.039) and in malignant disease (12.8% in malignant *vs*. 2.9% in benign, p=0.004). However, there was no significant difference in the incidence of recurrent laryngeal nerve injury with regards to gender (4.1% in male *vs* 3.8% in female, p=0.849).

Conclusion: The present study showed that thyroid carcinoma, re-operation for recurrent goiter, non-identification of RLN and total thyroidectomy were associated with a significantly increased risk of operative recurrent laryngeal nerve injury.

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Introduction

Thyroid surgery is a common surgical procedure in the Kingdom of Saudi Arabia.[1,2] Complications such as bleeding, hypoparathyroidism and Recurrent Laryngeal Nerve Injury (RLNI) represent nearly half of all the complications of thyroid surgery.[3-5] The latter complication after thyroidectomy, although infrequently encountered, can jeopardize the quality of life.[6]

In addition to the hoarseness that occurs with unilateral RLNI, bilateral RLNI leads to dyspnea and often life-threatening glottal obstruction.[7,8] The incidence of RLNI has been found to be higher during re-explorations, Graves disease and thyroid carcinoma procedures.[9,10]

RLNI is a major concern in thyroid and parathyroid surgery. Therefore, methods that can reduce the incidence of this complication are of great interest.[11] An almost certain way to ensure the integrity of the RLN is to always identify the nerve during all surgical procedure on thyroid and parathyroid glands.[12,13] The aim of the present study is to assess the factors influencing the risk of RLN injury during thyroid surgery.

Methods

A retrospective review was undertaken on all patients who had thyroid surgery between 1990 and 2005 and were admitted to the surgical department, King Fahd hospital of the University, Al-Khobar, Saudi Arabia. Patient's charts were evaluated for history, physical examination, thyroid function tests and operative reports for the type of operation (total, near total or subtotal thyroidectomy) andalso to check if RLN was identified or not. Reports of pre-operative and 3 days post-operative indirect laryngoscopy were recorded. Categories of the operation as primary surgery (no prior thyroid surgery) or secondary (one or more thyroid operations before this intervention) were included in the study. Attempts were made to identify the RLN in all cases. 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. The cases were analyzed for RLNI in relation to gender, category and type of surgical operation, as well

as histopathological diagnosis. Dysphonia or vocal cord paralysis detected on indirect laryngoscopy was considered as transient paralysis if recovered within 6 months and as permanent paralysis if it continued beyond 6 months.

Differences between the 2 groups (RLNI 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

340 patients underwent thyroid surgery during the study period. The age of patients ranged between 15 to 84 years (median age 37 years). Most of patients were females (260, 76.5%). On preoperative evaluation, all cases had normal vocal cords. The indications for surgery were; multinodular goiter [130 cases (38.2%)], solitary nodule [102 cases (30%)], hyperthyroidism [32 cases (9.4%)], thyroid carcinoma [39 cases (11.5%)], recurrent simple goiter [22 cases (6.5%)], cystic lesions [11 cases (3.2%)], and thyroiditis [4 cases (1.2%)]. Transient unilateral vocal cord paresis developed in 11 (3.2%) cases, and in one case (0.3%) it became permanent (post Rt. Hemithyroidectomy). Whereas, bilateral vocal cord paralysis developed in 2 cases (0.58%), but none became permanent in our review from 1990 to 2005. 23 cases (6.8%) were secondary operations, (22 for recurrent simple goiter cases and one completion thyroidectomy for papillary carcinoma). (Table 1)

Table 1: Types of operations and RLNI

Operations	No. of patients %)	No. of RLN paralysis (%)		
		Transient		Permanent
		Unilateral	Bilateral	
1. Bilateral Subtotal Thyroidectomy	132 (38.8%)	3 (2.2%)	……..	-----
2.Unilateral Subtotal Thyroidectomy	70 (20.4%)	1 (1.4%)	……..	-----
3.Total Bilateral Thyroidectomy	14 (4.1%)	2 (14.2%)	2 (14.2%)	----
4.Unilateral Hemi Thyroidectomy	94 (27.6%)	……	……	1 (0.94%)
5.Reoperation for Recurrent goiter	22 (6.5%)	5 (22.7%)	…….	…….
6.Completion thyroidectomy	1 (0.3%)	……	……	……
7. Near total Thyroidectomy	7 (2%)	…….	…….	…….

On uni-variate analysis, There was a significant increase in the incidence of RLNI in secondary operation (21.7% in secondary *vs.* 2.8% in primary operation, $p=0.001$), total/near total thyroidectomy (7.2% in total *vs.* 1.9% in subtotal, $p=0.024$), non-identification of RLN during surgery (7.6% in non-identification *vs.* 2.6% in identification, $p=0.039$) and in malignant disease (12.8% in malignant *vs.* 2.9% in benign disease, $p=0.004$). However, there was no significant difference in the incidence of RLNI in terms of gender (4.1% in males *vs.* 3.8% in females, $p=0.849$). (Table 2)

Table 2: Risk factors for Recurrent laryngeal nerve injury during thyroid surgery

	No (No 326)	RLNI (No 14)	*p* value
Gender			
Male	249	11 (4.1%)	0.849
Female	77	3 (3.8%)	
Category of Operation			
Primary	308	9 (2.8%)	0.001
Secondary	18	5 (21.7%)	
Identification of the nerve			
yes	229	6 (2.6%)	0.039
No	97	8 (7.6%)	
Type of operation			
Subtotal	198	4 (1.9%)	0.024
Total/near total	128	10 (7.2%)	
Pathology			
Benign	292	9 (2.9%)	0.004
Malignant	34	5 (12.8%)	

Discussion

In the last 25 years, total thyroidectomy has replaced bilateral subtotal thyroidectomy as the preferred option for the management of all patients with bilateral benign multinodular goitre, 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.'[14]

The incidence of Injuries to the recurrent laryngeal nerve has been reported between 1% to 2% from different thyroid surgery centres when performed by experienced neck surgeons. This incidence is higher when thyroidectomy is performed by a less experienced surgeon,[15-17] or when thyroidectomy is done for a malignant disease. Sometimes the nerve is purposely sacrificed if it runs into an aggressive thyroid Cancer.[18] In the present study, the rate of RLNI was 4.1%.

This complication is generally unilateral and transient, but occasionally it can be bilateral and permanent and it may be either deliberate or accidental.[19,20] The permanent lesion of damaged RLN often manifests as an irreversible dysfunction of phonation and is the most common complication following thyroid surgery.[21] Permanent injuries to the recurrent laryngeal nerve are best avoided by identifying and carefully tracing the path of the recurrent nerve.[22] Surgeon's experience, histopathologic diagnosis, previous thyroid surgery, surgical technique and anatomic variations are important factors affecting this complication.[23]

Mechanisms of injury to the nerve include complete or partial transection, traction, or handling of the nerve, contusion, crush, burn, clamping, misplaced ligature, and compromised blood supply.[24,25] In unilateral RLN,I the voice becomes husky because the vocal cords do not approximate with one another. Dysphonia starting on the 2nd – 5th post-operative days is commonly due to edema, whereas traction injury of the nerve and damage of 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.[26] Bilateral RLNI is much more serious, because both vocal cords may assume a median or paramedian position and cause airway obstruction and tracheostomy may be required. Accidental transaction commonly occurs at the level of upper two tracheal rings, where the nerve closely approximates the thyroid lobe in the area of Berry's ligament.[27,28]

Despite many excellent studies, recurrent nerve dissection has repeatedly been questioned because there was either no change or an increased risk of vocal cord paralysis. Several of these studies concluded that recurrent nerve dissection is not mandatory in subtotal resection but still advocate the procedure for the sake of practice, that it will be useful in complicated cases (e.g., thyroid cancer).[29-31] In our study, the incidence of RLNI increased to 7.6% in cases where the nerve was not identified. Dissection beginning from the avascular cricothyroid space was reported as a safe method of RLN preservation.[31]

The improved outcome after complete dissection can be rationalized as follows; "total dissection of the recurrent nerve over its entire cervical course precludes an incorrect alignment," it also allows the surgeon to verify the anatomic integrity of the nerve and to identify extra-laryngeal ramifications. This situation is clearly superior to partial exposure of the nerve, a conclusion that is also supported by the poor outcome of the surgeons who only aim to identifying the nerve.[32]

In recent years, many surgeons have sought to try to further reduce the low incidence of RLNI by use of nerve monitoring devices during surgery. Although several devices have been utilized, all have in common some means of detecting vocal cord movement when the recurrent laryngeal nerve is stimulated.[32] Many small series have been reported in the literature assessing the potential benefits of monitoring to decrease the incidence of nerve injury.[31,32] Given the low incidence of RLNI, it is not surprising that none of the studies have shown any statistically significant decrease in RLNI by using a nerve monitor. The use of a nerve stimulator did not aid in anatomical dissection of the RLN and was useful in identifying only superior laryngeal nerve. Discontinuous nerve monitoring by stimulation during total thyroidectomy confers no obvious benefit for the experienced surgeon in nerve identification, functional testing or injury prevention.[33]

Deliberate identification of the RLN minimizes the risk of injury. When the nerve is identified and dissected, the reported RLN injury rate during thyroidectomy is 0 - 2.1%. This is reportedly higher in the re-operative setting (2-12%) or if the nerve is not clearly identified (4-6.6%).[34]

Intraoperative hemostasis and a thorough understanding of the anatomy are essential for nerve identification and preservation.[35] RLNI 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.[35,36]

In present study, the rate of RLNI was 12.8% in thyroid carcinoma and in benign goiter cases, the transient RLN injury rate was 2.9%, and permanent in 0.33%. The rate was highest (21.7%) in recurrent goiter cases. Type of surgical procedure is another factor influencing the rate of RLN injury. In subtotal thyroidectomy cases RLNI rate was low while it is higher in total thyroidectomy cases.[37] In the present study, transient RLNI rate was 1.9% in subtotal compared to 7.2% in total/ near total thyroidectomy. Table 3 demonstrate some literature review regarding the incidence of RLNI .

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.[38]

Table 3: Recurrent laryngeal nerve injury in some literatures review

Author	Year	Years	N	Procedure	Temporary	Permanent
Jatzko (7)	1994	84-91	21	Total	9.5%	4.8%
Kasemsuwan (10)	1997	93-96	105	Total	6.7%	7.6%
Aytac (23)	2005	1989-2003	418	Total Lobectomy	13.6% 12%	9% 4%
Chaudhary (22)	2007	2000-2005	310	Total Lobectomy	7.69% 6.25%	3.84% 1.42%
Present study	2010	90-2005	340	table 2	3.8%	0.29%

n: Number of patients

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.[16,18,27] 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 RLN injury incidence.[23,25,28] Intra-parenchymal dissection or subtotal excision would be recommended if failure to identify RLN occurs.

Conclusion

The present study showed that thyroid carcinoma, re-operation for recurrent goiter, non-identification of RLN and total thyroidectomy were associated with a significantly increased risk of operative RLNI.

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