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RISK FACTORS AND INCIDENCE OF RECURRENT LARYNGEAL INJURY DURING THYROID SURGERY

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Abstract:

Objectives: *Paralysis or vocal cord paresis due to iatrogenic recurrent laryngeal nerve damage (RLNI) is one of the major problems in thyroid surgery. Although many procedures have been introduced to prevent nerve damage, the incidence of recurrent laryngeal nerve palsy ranges between 1.5–14%. The purpose of this study is to assess the risk factors for recurrent laryngeal nerve injury during thyroid surgery.*

Place and Duration: *In the Surgical department of Holy Family Hospital, Rawalpindi for two years duration from May 2018 to April 2020.*

Methods: *Patients who underwent thyroid surgery were admitted to the surgical unit were qualified for retrospective review. Factors predisposing to recurrent laryngeal nerve damage, such as pathology of the lesions and type of surgery, and identification of recurrent laryngeal nerve intra-operatively were assessed. All patients underwent pre-operative and postoperative indirect laryngoscopic examinations.*

Results: *340 patients were included in the study. Transient unilateral problems with the vocal cords occurred in 11 (3.2%) cases and in 1 (0.3%) cases permanent (after Rt hemithyroidectomy). Bilateral problems with the vocal cords occurred in 2 cases (0.58%), but none became permanent. There was a significant increase in recurrent laryngeal nerve damage during secondary surgery (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 frequency of recurrent laryngeal nerve damage in relation to sex (4.1% in men vs 3.8% in women, p = 0.849).*

Conclusion: *The current study showed that thyroid cancer, recurrent goiter surgery, lack of RLN identification and total thyroidectomy were associated with a significantly increased risk of surgical recurrent laryngeal nerve damage.*

Keywords: *Recurrent laryngeal nerve injury, Thyroidectomy, carcinoma of thyroid.*

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INTRODUCTION:

Thyroid surgery is a common surgery in Pakistan. Complications such as bleeding, hypoparathyroidism and recurrent laryngeal nerve damage (RLNI) account for nearly half of all thyroid surgery complications[1-2]. The last complication after thyroid surgery can rarely affect the quality of life. In addition to hoarseness that occurs with unilateral RLNI, bilateral RLNI causes shortness of breath and often life-threatening glottis obstruction[3-4]. The incidence of RLNI was higher during follow-up, Graves' disease and thyroid cancer[5-6]. RLNI is an important problem in thyroid and parathyroid surgery. Therefore, methods that can reduce the incidence of this complication are very interesting[7]. An almost certain way to guarantee the integrity of RLN is always to identify the nerve during the entire thyroid and parathyroid surgery[8-9]. The purpose of this study is to assess the factors that influence the risk of RLN injury during thyroid surgery.

METHODS:

This study was held in the Surgical department of Holy Family Hospital, Rawalpindi for two years duration from May 2018 to April 2020. All patients who underwent thyroid surgery and referred to the surgical ward were subjected to a retrospective assessment. Patient records were evaluated to confirm history, physical examination, thyroid function tests and type of surgery (total, nearly total or subtotal thyroid) as well as if RLN was detected. Indirect laryngoscopic reports were recorded before surgery and 3 days after surgery. The study included categories of operations such as primary surgery (without prior thyroid surgery) or secondary surgery (one or more thyroid surgery prior to this intervention). In all cases, attempts were made to establish RLN. If RLN was not identified, careful excision of the gland and ligation of related vessels were performed near the distal arms to prevent injury. The cases were analyzed for RLNI in terms of sex, category and type of surgery and histopathological diagnosis. Dysfunction or paralysis of the vocal cords detected by indirect laryngoscopy was considered a transient paralysis if it resolved within 6 months, and permanent paralysis if it lasted longer than 6 months. The differences between the two groups (RLNI and no injuries) were tested to determine statistical significance using the chi-square test, Fisher's exact test, respectively. Significance was defined as $p < 0.05$ for all comparisons. Statistical analyzes were performed using SPSS 18 software (Chicago, USA).

RESULTS

During the study, 340 patients underwent thyroid surgery. The age of the patients ranged from 15 to 84 (median age 37). Most of the patients were males (260, 76.5%). In the preoperative evaluation, the vocal cords were normal in all cases. Surgical indications; 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%)]. Unilateral transient vocal cord paresis developed in 11 (3.2%) cases and became permanent in one case (0.3%) (After the next hemi-throidectomy). While bilateral vocal cord paralysis developed in two cases (0.58%), none of them became permanent in our examination. 23 cases (6.8%) were secondary operations (22 in 22 cases) and a complete thyroidectomy for recurrent simple goiter and papillary carcinoma). (Table 1)

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%)	…….	…….	…….

In the univariate analysis, there was a significant increase in the incidence of RLNI in the secondary operation (21.7% secondary in primary operation, 2.8% in primary operation, $p = 0.001$), total / near total thyroidectomy (7.2% in total and 1.9% in subtotal, $p = 0.024$), during surgery. However, there was no gender difference in the incidence of RLNI in males (in males disease, 12.8%, benign disease 2.9%, $p = 0.004$). 4.1%, 3.8% in women, $p = 0.849$). (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:

For the last 25 years, total thyroidectomy has replaced bilateral subtotal thyroidectomy as the preferred option in the treatment of all patients with benign bilateral multinodular goiter, Graves' disease and very low thyroid cancer risk[11]. The main change in the surgical technique was the movement from "lateral dissection" to "capsular dissection". When applied by experienced neck surgeons, the frequency of recurrent laryngeal nerve injuries in different thyroid surgery centers has been reported between 1% and 2%[12]. This incidence is higher when thyroidectomy is performed by a less experienced surgeon or when thyroidectomy is performed for a malignant disease. Sometimes, if he encounters aggressive thyroid cancer, the nerve is intentionally sacrificed. In this study, the RLNI ratio was 4.1%. This complication is usually unilateral and temporary, but sometimes it can be bilateral and permanent and can be deliberate or accidental. Permanent injury in damaged RLN often manifests as irreversible phonetic dysfunction and is the most common complication after thyroid surgery. Recurrent laryngeal nerve is best prevented from permanent injuries by carefully identifying and tracing the path of the recurrent nerve[13]. Surgeon's experience, histopathological diagnosis, previous thyroid surgery, surgical technique and anatomical variations are important factors affecting this complication. Nerve injury mechanisms include full or partial transection, nerve traction or management, contusion, crushing, burning, clamp, misplaced ligation, and poor blood circulation. In one-sided RLN, the sound is muted because the vocal cords do not converge. Dysphonia that starts on the second to fifth days postoperatively is usually caused by edema, while nerve traction damage and axon damage can lead to dysphonia lasting up to 6 months. Dysphonia, which persists after 6 months, usually results from nerve cutting, ligation or cauterization[14]. Bilateral NRI is much more severe because both vocal cords can take a median or paramedian position and cause airway obstruction and tracheostomy may be required. Accidental processing usually occurs at the level of the two upper tracheal rings, where the nerve is closely approaching the thyroid lobe in the Berry ligament area. Despite many excellent studies, recurrent nerve dissection has been questioned repeatedly as no risk of changes or vocal cord paralysis increases. Many of these studies have concluded that repetitive nerve dissection is not compulsory in subtotal resection, but they still recommend the procedure for administration, which will be useful in complex cases (eg thyroid cancer). In our study, the incidence of RLNI increased to 7.6% in cases where the nerve was not defined[15]. Dissection from the avascular cricothyroid field has been reported as a safe method of RLN protection. This situation is clearly superior to the partial exposure of the nerve, which is supported by the poor results of surgeons who are trying to identify only the nerve. In recent years, many surgeons have tried to reduce the incidence of low RNNI by using nerve monitoring devices during surgery. Although various devices are used, they all have some means to detect the movement of the vocal cords when the recurrent laryngeal nerve is stimulated. Many small series have been reported in the literature that evaluate the potential benefits of monitoring to reduce the incidence of nerve damage. Given the low incidence of RLNI, it is not surprising that none of the studies showed a statistically significant decrease in RLNI using a nerve monitor. The use of a nerve stimulator did not assist in anatomical dissection of RLN and was only useful in identifying the superior laryngeal nerve. During

total thyroidectomy, it does not provide any significant benefit to the surgeon experienced in discontinuous nerve monitoring, nerve identification, functional testing or injury prevention with stimulation. In this study, the rate of RLNI in thyroid carcinoma was 12.8% and the rate of temporary RLN damage in benign goiter cases was permanent at 2.9% and 0.33%. This rate was higher in cases of recurrent goiter (21.7%). The type of surgical procedure is another factor that affects the NLR injury rate. While NRI rate is low in subtotal thyroidectomy cases, it is higher in total thyroidectomy cases. In this study, the rate of transient RLNI was 7.2% in total total / almost thyroidectomy and 1.9% in subtotal. Table 3 shows a review of the literature on RNNI incidence. Recently, Echternach et al. In a study involving 761 patients, it was concluded that after thyroidectomies, laryngeal complications were mainly caused by intubation of the vocal cords and injuries of the laryngeal nerve to a lesser extent. The most effective method to protect RLN from injury is controversial. Some surgeons claim that skipping the RLN definition may cause very little trauma[16]. However, other studies have shown that this is not true1. In contrast to this idea, the identification of RLN during surgery requires the surgeon to be familiar with the anatomical course of the nerve and variations that lead to the incidence of lower RLN injuries. If RLN is not defined, intra-parenchymal dissection or subtotal excision may be recommended.

CONCLUSION:

This study showed that thyroid carcinoma, reoperation for recurrent goiter, unidentified RLN, and total thyroidectomy was associated with a significant increase in the risk of surgical RLNI.

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