RECURRENT LARYNGEAL NERVE INJURY: AN EXPERIENCE WITH 310 THYROIDECTOMIES

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Background: Thyroid surgery has been associated with complications ranging from nerve injury to death. Improvements in techniques have reduced the mortality rate to minimum. Morbidity, however, remains a significant concern. This study was designed to determine the prevalence of recurrent laryngeal nerve (RLN) injury and duration of recovery following transient recurrent laryngeal nerve injury, during thyroid surgery. **Methods:** This prospective, observational study was carried out in the Surgical Department of Fauji Foundation Hospital, Rawalpindi, from January 2000 to December 2005. All patients undergoing Thyroid surgery were included. **Results:** 310 patients, predominantly female (97.09%), were operated. Majority were euthyroid (90.33%). 3.22% patients had recurrent laryngeal nerve injury. Amongst them, 87.5% had transient and 12.5% had permanent nerve lesion. Majority of the patients (87.5%) showed signs of recovery within 12 weeks after surgery. Injury was observed more in huge goiters (3.57% transient and 1.42% permanent), total thyroidectomy (7.69% transient and 3.84% permanent) and during lobectomy and total thyroidectomy (6.25% respectively for transient and permanent nerve injury. **Conclusion:** Thyroid surgery should be done by experienced surgeon and care should be taken especially in huge goiters and patients undergoing total thyroidectomy.

Keywords: Thyroidectomy; Recurrent laryngeal nerve; Injury; Prevalence; Recovery

INTRODUCTION

Theodor Kocher was the first surgeon who performed total thyroidectomy in 1909 with minimal risk to recurrent laryngeal nerve and parathyroid glands. His accomplishment led to a reduction in surgical mortality from 50% to less than 4.5% [1]. Additional improvements in techniques have reduced the mortality rate near to zero. Morbidity, however, always remains a concern.

Complications of any surgical procedure are a sensitive measure of the quality. Reported complications following thyroid surgery are rare but their consequences can often be life-threatening as compared to the some other surgeries being performed routinely. Complication rate after thyroid surgery varies widely from surgeon to surgeon and from center to center, as reported in the literature.

The location of the thyroid gland in relation to the airway and the gland's abundant vascularity are primary reasons to be alert to early changes seen in the post-operative thyroidectomy patient. An understanding of both the anatomy and physiology of the thyroid gland, as well as the surgical approach itself, can help to detect potential complications postoperatively. The patient can then receive early intervention to minimize the chance of life-threatening consequences.

Vascular insult, viruses, bacterial infections, neurotoxic drugs, tumors and trauma have all been implicated in nerve injury. Recurrent laryngeal nerve is invariably at risk in surgery on the neck, thorax and skull base and damage to the nerve may be the cause of litigation [2]. Surgery on thyroid gland is one of the causes of recurrent laryngeal nerve paralysis. Injury to recurrent laryngeal nerve anywhere along its course usually results in paralysis of the vocal cord. Surgically induced recurrent laryngeal nerve paralyses are frequently not recognized at the time of thyroid surgery. The exact incidence of recurrent laryngeal nerve injury is unknown [2]. Different studies have reported varying prevalence (0-14%) [2-4]. This difference in complication rates may reflect variation in surgical experience or number of surgeries performed at a particular center.

This study was done to determine the prevalence of RLN injury during thyroid surgery and the duration of recovery following transient RLN palsy, comparing the data with the national and international literature.

MATERIAL AND METHODS

This prospective, observational study was carried out in the Department of Surgery, Fauji Foundation Hospital, Rawalpindi, a tertiary care centre, from January 2000 to December 2005. All patients booked for thyroid surgery were included. However, patients with recurrent goiter, thyroid malignancy and those who failed to complete one year follow up, were excluded. All patients were admitted and thorough clinical, biochemical and histopathological evaluations were done. Indirect laryngoscopy was done in each patient to assess the status of vocal cords. Patients were prepared for operation and all necessary routine investigations for thyroid surgery

were carried out. All surgeries were done by consultant or senior fellow surgeon having same competency level of our team. RLN nerve was not identified routinely. Vocal cords mobility was checked by the operating surgeon at the time of extubation. Postoperatively, indirect laryngoscopy was done on the second and fifteenth post operative day. All preoperative, operative and post-operative findings were recorded in detail. The patients who developed vocal cord paralysis were planned to be followed up on fortnightly basis in the first three months and then at monthly intervals for at least six months. Clinical evaluation of these patients was done regarding any improvement in voice quality or vocal cord function. Results were evaluated and statistical analysis was done on software Epi6.

RESULTS

310 patients were operated during the study period. Majority were female (97.09%) and most of them were in their fourth & fifth decade of life (Table 1). 90.33% patients were euthyroid, while 8.06% were hyperthyroid and 1.16% were hypothyroid (Table 2). Recurrent laryngeal nerve palsy was noticed in 10 (3.22%) patients, 8 (87.5%) having transient palsy, recovered completely within 20 weeks. Only 2 patients (12.5%) had permanent injury (Table 3). 45.16% patients had huge goiter while 52.26% had medium sized goiter. In these patients, transient and permanent nerve injuries (3.57% and 1.42%, respectively) were observed in surgery on huge goiters (Table 4). Commonest surgical procedure done was subtotal thyroidectomy (63.23%), followed by lobectomy and near total thyroidectomy, 12.26% and 10.96%, respectively. Table 5 shows that the majority of the patients developed transient recurrent laryngeal nerve injury during total thyroidectomy and lobectomy plus total thyroidectomy i.e. 7.69% and 6.25% respectively. Permanent recurrent laryngeal nerve injury was noticed during lobectomy and subtotal thyroidectomy (6.25%) and total thyroidectomy (3.84%). All patients in our study had unilateral vocal cord paralysis.

Table 1- Age and sex distribution (n = 310)

Ages	Male		Female		Total	
	No.	% in group	No.	% in group	No	% of total
11-20	5	55.56	30	9.96	35	11.29
21-30	-	-	30	9.96	30	9.68
31-40	2	22.22	91	30.23	93	30.00
41-50	1	11.11	112	37.21	113	36.45
51-60	1	11.11	27	8.97	28	9.00
>60	-	-	11	3.65	11	3.55
Total	9 (2.91 %)	100	301 (97.09%)	100	310	100

Table 2- Thyroid function status (n=310)

Hormonal Status	Frequency	%	Statistics (95% Confidence limits)
Euthyroid	280	90.33	86.33 to 93.27
Hyperthyroid	25	8.06	5.39 to 11.81
Hypothyroid	5	1.61	0.59 to 3.93

Table 3- Duration of recovery from RLN injury (n = 10)

Duration of recovery	Transient			Permanent		
	No of pt.	% among lesion	% among total	No of pt.	% among total	% among total
< 4 weeks	-	-	-	-	-	-
5 – 8 weeks	2	25%	0.64%	-	-	-
9 – 12 weeks	5	62.5%	1.61%	-	-	-
13 – 16 weeks	-	-	-	-	-	-
17 – 20 weeks	1	12.5%	0.32%	-	-	-
21 – 24 weeks	--	-	-	-	-	-
No recovery	-	-	-	2	12.5%	0.64%
Total	8	87.5%	2.58%	2	12.5%	0.64%
Statistical analysis: 95% confidence limits for RLN injury = 1.64 to 6.03% (analyzed by software Epi6)						

Table 4- Frequency distribution of RLN injury according to the size of the goiter (n=310)

Size of the Goiter	Frequency	RLN injury		Statistics (95% Confidence Limits)
		Transient	Permanent	
Small	8 (2.58%)	-	-	1.20 to 5.10
Medium	162(52.26%)	3 (1.85%)	-	46.54 to 57.9
Huge	140 (45.16%)	5 (3.57%)	2 (1.42%)	39.55 to 50.88
Total	**310**	**8 (2.58%)**	**2 (0.64%)**	(Analyzed by Software Epi6)

Table 5- Type of surgical procedure and frequency distribution of RLN injury (n=310)

Surgical Procedure	Frequency	RLN Palsy		Statistics (95% Confidence Limits)
		Transient	Permanent	
Sub-total Thyroidectomy (STT)	196 (63.23%)	3 (1.53 %)	-	57.56 to 68.55
Lobectomy	38 (12.26%)	1(2.63%)	-	8.92 to 16.55
Lobectomy and STT	16(5.16 %)	1(6.25%)	1(6.25 %)	3.07 to 8.41
Near total thyroidectomy	34(10.96%)	1(2.94%)	-	7.81 to 15.11
Total thyroidectomy	26(8.39%)	2(7.69%)	1(3.84%)	5.65 to 12.19
Total	**310**	**8(2.58%)**	**2(0.64 %)**	(Analyzed by Software Epi6)

DISCUSSION

Surgical management of the thyroid disease has changed significantly over the course of the twentieth century. Advances in the investigations to diagnose thyroid disease have provided for adequate treatment and control of functional problems.

RLN innervates all the intrinsic muscles of the larynx with exception of the Cricothyroid muscle, which is supplied by the superior laryngeal nerve [2]. Mechanism of injury to the nerve includes complete or partial transaction, traction, contusion, crushing injury, thermal damage, misplaced ligature or compromised blood supply. Any thing that increases local scar formation e.g. thyroiditis, previous surgery and radiation, increases the chances of RLN injury [2,5].

The consequence of RLN injury is the true vocal fold paresis or paralysis with varying degrees of symptoms and signs depending upon the severity and side of involvement. Unilateral RLN injury causes the ipsilateral vocal cord to remain in the median or paramedian position. The voice may be hoarse and breathy. The patient's cough is weak, and aspiration may occur. Presentation is often subacute. Definite voice changes may not manifest for days or weeks. The paralyzed vocal fold undergoes atrophy, causing voice to worsen. Dysphagia and aspiration are other potential sequelae of unilateral vocal fold paralysis [6].

Bilateral RLN paralysis may manifest immediately after extubation and patient exhibit signs of airway obstruction in the immediate postoperative period. Bilateral RLN injury is a severe, life threatening complication that results in airway obstruction and requires immediate attention. In this condition, both vocal cords remain in a median or paramedian position. As a result, the patient exhibits inspiratory stridor, dyspnoea, tachypnoea, and nasal flaring, although the voice is near normal [6,7].

RLN injury is an annoying but avoidable complication which results from severing, clamping or stretching of the nerve during surgery and may result in severe untoward sequelae for the patient [2].

The relationship of RLN to the inferior thyroid artery is highly variable and surgeon must have a thorough knowledge of all types of relationships during surgery[8]. Basic principle of surgery to avoid damage to any vital structure dictates that the structure must be clearly identified. RLN is no exception, and routine exposure of RLN through out its course has been shown to reduce the rate of nerve injury[9]. By adopting this principle, nerve injury rate of zero has been reported in the literature even after total thyroidectomy for thyroid cancer [9,10]. Conversely, when nerve is not clearly identified, the reported injury rate is three to four times higher[2].

The use of electrophysiological monitoring of RLN during thyroid surgery has been mentioned in the literature. Electromyography (EMG) has not been recommended during routine thyroid surgery because of low prevalence of nerve injury in such surgery[11]. It may be beneficial during revision thyroid surgery or previously irradiated neck or with very large masses when the nerve is at a greater risk [1,11]. Some surgeons are of the opinion that it is too dangerous practice to dissect the nerve [8]. It is reported that prevalence of RLN injury increases with the size of the diseased gland and extent of thyroid resection [3,10,12]. Some surgeons are of the opinion that it is not possible to identify the recurrent laryngeal nerve in every case. In these circumstances, technique of staying close to the thyroid capsule and division of terminal branches at capsular level is recommended[9]. Careful identification and meticulous thyroid dissection is essential to prevent RLN injury.

Prevalence of 0.5% to 14% has been reported after primary thyroid surgery [2,3,4,6]. Transient and permanent RLN palsy, 2.58% and 0.64% respectively, was observed in this study. None of the patients developed bilateral RLN palsy.

Review of literature revealed that the prevalence of RLN palsy varies from centre to centre depending upon the level of experience in thyroid surgery and the nature of surgery. Aytec and colleagues [13] reported 3.5% and 1.2% incidence of transient and permanent RLN injury, respectively, whereas, Chaing [14] has reported figures of 5.1% and

0.9% for transient and permanent RLN injury. Xu and colleagues[15] have reported 0.2% incidence of permanent RLN injury in their study in China. Schulte has reported prevalence of RLN palsy in the range of 0.5% - 2.5%, from Australia [7]. In Pakistan, an incidence of 4.7%, both for transient and permanent RLN palsy has been reported in a study by Arif and his colleagues [16]. On the other hand, Shah and his colleagues[17] have reported it to be 13.5%.

In this study, it was observed that RLN carries higher risk of injury in patients with huge multinodular goiter; 3.57% had transient and 1.42% had permanent injury. Similarly, patients undergoing total thyroidectomy or lobectomy and subtotal thyroidectomy are more at risk of getting RLN injury; 7.69% and 6.25% respectively had transient and 3.84% and 6.25% respectively developed permanent RLN injury. Literature revealed comparable observation from different studies carried out at different centers in the world [3,7,13,14,16].

The potential for recovery is generally proportional to the degree of injury, although clinical factors such as unrecognized severity of injury and delay in the diagnosis have precluded establishing an exact relation. This principle underlies the policy of watchful waiting in certain surgical etiologies, where nerve is known or even suspected to be intact [2].

In our study RLN palsy was observed in 10 patients, postoperatively. Out of these, 87.5% of the patients showed signs of recovery within five months period. 20% of patient did not show any sign of recovery even after six months of surgery and were declared as permanent RLN palsy. Chaing and colleagues[14] observed a period of three days to four months recovery time, in majority of their patients.

Any corrective procedure is not recommended for unilateral vocal cord paralysis until at least six months because a reversible injury may improve by that time[12,18]. Different treatment options are recommended; medialization of the vocal cord[19], neurorrhaphy of RLN [12] and reinnervation of vocal cord [20]. Medialization by injection laryngoplasty (Gel foam injection, Sialastic or Gore-Tex implant) or by laryngeal frame work surgery (Type-I thyroplasty) is commonly performed [19]. Neurorrhaphy of RLN with good results has been reported at some specialized centers[12]. Reinnervation is another recommended procedure for permanent RLN injury. Phrenic nerve, Ansa cervicalis, Hypoglossal nerve or preganglionic sympathetic neurons have been used with limited success[21,22].

The principal goals for surgery in case of bilateral vocal cord paralysis are to improve air way patency. Cordotomy and arytenoidectomy are the most common procedures. However, the patient must be counseled about worsening of voice quality post-operatively. Neuromuscular pedicle transfer has been reported to improve air way in case of bilateral vocal fold paralysis but reports are limited and results are not widely accepted[19,21].

CONCLUSION

RLN injury is an annoying complication of thyroid surgery. This can be avoided, if surgery is performed by experienced surgeons and more care should be taken while doing surgery on huge sized goiter and during extensive surgery like total thyroidectomy. Majority of nerve lesions are transient which shows recovery within six months of surgery. Definitive procedures for corrective treatment of RLN injury should not be considered for at least six months after surgery.

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