

## ORIGINAL ARTICLE

# Frequency and Factors Leading to Recurrent Laryngeal Nerve (RLN) Injury during Thyroid Surgery

GUL ZARIN KHAN, FAROGH ZAHRA, IMTIAZ HUSSAIN, NISAR AHMAD KHAN, AMIR ZAMAN KHAN  
<sup>1</sup>Registrar Surgical Unit I, <sup>2</sup>Assistant Professor, Surgical Unit I, <sup>3</sup>Registrar Surgical Unit I, <sup>4</sup>Registrar Surgical Unit I, <sup>5</sup>Professor & Head of Department Fatima Jinnah Medical College/Sir Ganga Ram Hospital, Lahore.

Correspondence: email: dr\_gulzarin@hotmail.com. Cell no.: +923462880801

## ABSTRACT

**Objectives:** The objectives of this study were to determine the frequency and to assess the factors leading to Recurrent Laryngeal Nerve (RLN) injury during thyroid surgery at a tertiary care hospital.

**Study Design:** Descriptive case series.

**Setting:** Surgical Unit-I, Fatima Jinnah Medical College/Sir Ganga Ram Hospital, Lahore.

**Subject and Methods:** Four hundreds and seventy patients were included in this study. Patients with pre-existing RLN injury and those with concomitant parathyroid pathology were excluded from the study. RLN injury was documented by post-operative finding of absent vocal cord movement on direct laryngoscopy by the anesthetist at the time of extubation.

**Results:** The mean age of the patients was 45.33±10.20 years and 71.9% were female. Total thyroidectomy was the most common (43%) surgical procedure performed. Fifty nine (12.6%) patients underwent redo surgery and in 61 (13%) patients histopathology report revealed malignant lesion. RLN injury was noted in 18 (3.8%) cases of the total surgeries. The occurrence of RLN injury was significantly higher among Total Thyroidectomy patients (7.4%,  $p=.006$ ) and those with malignant thyroid lesion (13.1% vs. 2.4%,  $p=.000$ ). However, there was only insignificant difference between redo and primary surgery (3.9% vs. 3.4%;  $p=.851$ ).

**Conclusion:** RLN injury is a frequent complication of thyroid surgery and the occurrence is even higher among patients undergoing total thyroidectomy, redo surgery and those with malignant thyroid lesion.

**Key Words:** Total Thyroidectomy, RLN Injury.

## INTRODUCTION

Thyroid surgery is one of the most frequently performed surgical procedures in any institution. The primary complications related to the thyroid surgeries include recurrent laryngeal nerve injury, parathyroid insufficiency, primary and reactionary haemorrhage and respiratory distress. Problems less frequently seen are infection and sympathetic nerve injury<sup>1</sup>. While prevention of these complications is a primary goal during thyroid surgery, early identification and management by the surgeon is essential for the safe recovery of the patient.<sup>2</sup>

The recurrent laryngeal nerve (RLN) innervates all of the intrinsic muscles of the larynx with the exception of the cricothyroid muscle, which is innervated by the superior laryngeal nerve (SLN). The result of a RLN injury is true vocal-fold paresis or paralysis. Permanent nerve palsy may vary from 0 to 2.1% with an average of 0.5% to 1%. Temporary palsy varies from 2.9% to over 10%. The right RLN is at greater risk as compared

to left RLN due to its wide anatomical variations. Mechanisms of injury to the RLN include complete or partial transection, misplaced ligature, contusion, crush, traction, diathermy burn and compromised blood supply.<sup>3</sup>

Chaudhary et al. in 2007 showed that the overall frequency of RLN injury was 3.22% which was only transient in 87.5% cases. They also observed higher frequency of injury in patients who underwent total thyroidectomy (7.69%).<sup>4</sup> Zakaria et al. in 2011 showed that transient RLN palsy occurred in 3.2% cases with significantly higher incidence in patients undergoing redo surgery (2.8%), total thyroidectomy (7.2%) and malignant thyroid disease (12.8%).<sup>5</sup>

RLN injury is a major concern in thyroid and parathyroid surgery. Therefore, methods that can reduce the frequency of this complication are of great interest. Even though nerve monitors and stimulators have been promoted, their utility still remains highly questionable.<sup>6</sup>

The objectives of this study were to determine the frequency and the factors associated with RLN injury. Previously only a single local study is available on this topic.<sup>4</sup> It will enable the surgeon to be careful and actively look for RLN during surgery in patients in future, thus minimizing the postoperative morbidity in patients undergoing thyroid surgery.

## MATERIALS AND METHODS

It's a descriptive case series study. Research was conducted at Surgical Unit-I, Sir Ganga Ram Hospital, Lahore. Sample size estimated was 470 using 95% confidence interval and 0.5% margin of error with an expected percentage of RLN injury as 2.8% during thyroid surgery.<sup>4</sup> Patients were selected by Non-probability Consecutive Sampling. All the patients of both sex groups falling in the age group of 20-70 years; patients operated on elective list for thyroid disease and patients who gave written informed consent to participate in the study were included in the study. Patients with pre-existing RLN palsy as documented by indirect laryngoscopy performed pre-operatively and patients with parathyroid pathology as per history, clinical examination and investigations were excluded. Four hundreds and seventy patients who presented in the surgical outdoor of Sir Ganga Ram Hospital, Lahore who fulfilled the above criteria were counseled and explained the details of the study. Written informed consent and detailed history was taken from each patient. All the patients underwent a pre-operative indirect laryngoscopy to rule out pre-existing RLN palsy. All

the cases were operated by consultant in charge of the unit and were assessed by the same anesthetist pre and post-operatively to eliminate inter operative bias. Confounding variables were controlled by exclusion. Malignant thyroid lesions, total thyroidectomies, redo surgery and injuries to recurrent laryngeal nerve were recorded. All the details were entered into the attached Proforma.

## RESULTS

Four hundreds and seventy patients were included in this descriptive study who underwent thyroid surgery. The age of the patients ranged from 20 years to 70 years with a mean of 45.33±10.20 years. Most of the patients (n=338, 71.9%) were female while 132 (28.1%) were male.

Total thyroidectomy was the most common (43%) surgical procedure performed followed by subtotal thyroidectomy performed in 34% cases as shown in table 1. 59 (12.6%) patients underwent redo surgery as shown in table 2. Histopathology reports revealed malignant lesion in 61 (13%) patients as shown in table 3.

RLN injury was noted in 18 (3.8%) cases. When cross-tabulated, the occurrence of RLN injury was significantly higher among Total Thyroidectomy patients (7.4%,  $p=.006$ ) and those with malignant thyroid lesion (13.1% vs. 2.4%,  $p=.000$ ) as shown in table 4 and 5. However, there was only insignificant difference between redo and primary surgery (3.9% vs. 3.4%;  $p=.851$ ) as shown in table 6.

**Table 1:** Frequency Table for Type of Surgery Performed, N=470

Procedure		Frequency	Percent
Valid	Total Thyroidectomy	202	43.0
	Sub Total Thyroidectomy	160	34.0
	Near Total Thyroidectomy	82	17.4
	Lobectomy	26	5.5

**Table 2:** Frequency Table for Primary/ Redo Surgery, N= 470

Type of surgery		Frequency	Percent
Valid	Redo	59	12.6
	Primary	411	87.4

**Table 3:** Frequency Table for Pathology of Patients who underwent Thyroidectomies, N=470

Thyroid pathology		Frequency	Percent
Valid	Malignant	61	13.0
	Benign	409	87.0

Frequency and Factors Leading to Recurrent Laryngeal Nerve (RLN) Injury during Thyroid Surgery

**Table 4:** Surgery Performed \* RLN Injured Crosstabulation, N= 470

			RLN Injured		Total
			Yes	No	
Surgery Performed	Total Thyroidectomy	Count	15	187	202
		% within Surgery Performed	7.4%	92.6%	100.0%
		% within RLN Injured	83.3%	41.4%	43.0%
	Sub Total Thyroidectomy	Count	2	158	160
		% within Surgery Performed	1.3%	98.8%	100.0%
		% within RLN Injured	11.1%	35.0%	34.0%
	Near Total Thyroidectomy	Count	1	81	82
		% within Surgery Performed	1.2%	98.8%	100.0%
		% within RLN Injured	5.6%	17.9%	17.4%
	Lobectomy	Count	0	26	26
		% within Surgery Performed	.0%	100.0%	100.0%
		% within RLN Injured	.0%	5.8%	5.5%
Total		Count	18	452	470
		% within Surgery Performed	3.8%	96.2%	100.0%
		% within RLN Injured	100.0%	100.0%	100.0%

**Table 5:** Thyroid Lesion \* RLN Injured Crosstabulation, N= 470

			RLN Injured		Total
			Yes	No	
Thyroid Lesion	Malignant	Count	8	53	61
		% within Thyroid Lesion	13.1%	86.9%	100.0%
		% within RLN Injured	44.4%	11.7%	13.0%
	Benign	Count	10	399	409
		% within Thyroid Lesion	2.4%	97.6%	100.0%
		% within RLN Injured	55.6%	88.3%	87.0%
Total		Count	18	452	470
		% within Thyroid Lesion	3.8%	96.2%	100.0%
		% within RLN Injured	100.0%	100.0%	100.0%

**Table 6:** Primary/ Redo Surgery \* RLN Injured Crosstabulation, N= 470

			RLN Injured		Total	P value
			Yes	No		
Primary/ Redo Surgery	Redo	Count	2	57	59	.851
		% within Primary/ Redo Surgery	3.4%	96.6%	100.0%	
		% within RLN Injured	11.1%	12.6%	12.6%	
	Primary	Count	16	395	411	
		% within Primary/ Redo Surgery	3.9%	96.1%	100.0%	
		% within RLN Injured	88.9%	87.4%	87.4%	
Total		Count	18	452	470	0.006
		% within Primary/ Redo Surgery	3.8%	96.2%	100.0%	

## ORIGINAL ARTICLE

### DISCUSSION

Thyroid surgery is one of the most frequently performed surgical procedures in any institution. The primary complications related to the thyroid surgeries include recurrent laryngeal nerve injury, postoperative bleeding, respiratory distress and parathyroid deficiency. Problems less frequently seen are infection and sympathetic nerve injury.<sup>1</sup> While prevention of these complications is a primary goal during thyroid surgery, early identification and management by the surgeon is essential for the safe recovery of the patient.<sup>2</sup>

The recurrent laryngeal nerve (RLN) innervates all of the intrinsic muscles of the larynx with the exception of the cricothyroid muscle, which is innervated by the superior laryngeal nerve (SLN). The result of a RLN injury is true vocal-fold paresis or paralysis resulting in hoarseness of

voice. A lot of previous literature reports variable frequency of RLN injury during thyroid surgery and identifies different factors which can lead to such an incident. These studies have been summarized in table 7.

As obvious from this review, there is a great degree of disparity among various authors about the observed frequency of RLN injury varying from as minimum as 3%<sup>7</sup> to as high as 13.39%<sup>8</sup>. Also these studies report higher frequency among patients undergoing total thyroidectomy and redo surgery and those with malignant thyroid lesion.

A possible explanation for this disparity among different authors can be population differences (short neck), inclusion criteria (retrosternal thyroids) and differences in surgical skills of different operating surgeons.

**Table 7:** Previous Studies on Frequency and Factors leading to RLN Injury during Thyroid Surgery

Author	Year	Population	Frequency	Redo Surgery	Total Thyroidectomy	Malignant Thyroid Disease
Sheahan et al. <sup>9</sup>	2011	Ireland	4.7%	22.2%	N/A	7.6%
Dutta et al. <sup>8</sup>	2011	Nepal	13.39%	50%	31.57%	N/A
Zakaria et al. <sup>5</sup>	2011	Oman	3.2%	2.8%	7.2%	12.8%
Cabs et al. <sup>10</sup>	2011	Iraq	4.5%	0%	7.69%	5%
Canbaz <sup>11</sup>	2008	Turkey	3.9%	25%	4.31%	0%
Chaudhary et al. <sup>4</sup>	2007	Pakistan	3.22%	N/A	7.69%	N/A
Chan et al. <sup>12</sup>	2006	China	4.7%	14.2%	N/A	6.1%
Aytac <sup>13</sup>	2005	Turkey	3.8%	N/A	12%	8.9%
Chiang et al. <sup>14</sup>	2005	Taiwan	5.1%	10.8%	N/A	2.7%
Baker & Al-Jarah <sup>7</sup>	2001	Saudi Arab	3%	20%	20.8%	14.3%
Wagner & Seller <sup>15</sup>	1999	Switzerland	3.5%	10%	8.1%	10%
Friedrich et al. <sup>16</sup>	1998	Germany	5.1%	11%	N/A	10%
<b>Current Study</b>	<b>2014</b>	<b>Pakistan</b>	<b>3.8%</b>	<b>3.9%</b>	<b>7.4%</b>	<b>13.1%</b>

The only existing such study in Pakistani population by Chaudhary et al.<sup>4</sup> reported frequency of RLN injury to be 3.22% and showed it to be higher among patients undergoing total thyroidectomy (7.69%). In the current study, we observed frequency of RLN injury to be 3.8%. Our observation matches closely with that of Zakaria et al. (3.2%)<sup>5</sup>, Chaudhary et al. (3.22%)<sup>4</sup>, Canbaz et al. (3.9%)<sup>11</sup>, Aytac (3.8%)<sup>13</sup>, Baker & Al-Jarah (3%)<sup>7</sup> and Wagner & Seller (3.5%)<sup>15</sup>.

We also observed higher frequency among those undergoing redo surgery (3.9%). Our observations is comparable to that made by Zakaria et al. (2.8%)<sup>5</sup>. However this difference was

statistically insignificant ( $p=.851$ ) when compared with those undergoing primary surgery (3.4%).

The frequency of RLN injury was also higher among patients undergoing total thyroidectomy (7.4%). Our result match with that of Chaudhary et al. (7.69%)<sup>4</sup>, Zakaria et al. (7.2%)<sup>5</sup>, Cabs et al. (7.69%)<sup>10</sup> and is comparable to those of Wagner & Seller (8.1%)<sup>15</sup>. This observed difference was statistically significant ( $p=.006$ ).

The frequency of RLN injury was also higher among patients having malignant thyroid lesion (13.1%). Our result match with that of Zakaria et al. (12.8%)<sup>5</sup> and Baker & Al-Jarah (14.3%)<sup>7</sup>. This observed difference was statistically significant ( $p=.000$ ).

## Frequency and Factors Leading to Recurrent Laryngeal Nerve (RLN) Injury during Thyroid Surgery

Thus RLN injury is a frequently observed (3.8%) complication of thyroid surgery and the rate is even higher among patients undergoing redo surgery (3.9%), total thyroidectomy (7.4%) and those with malignant thyroid lesion (13.1%).

### CONCLUSION

RLN injury is a frequent complication of thyroid surgery and the rate is even higher among patients undergoing total thyroidectomy, redo surgery and those with malignant thyroid lesion.

### REFERENCES

1. Khanzada TW, Samad A, Memon W, Kumar B. Post thyroidectomy complications: the Hyderabad experience. *J Ayub Med Coll Abbot* 2010;22(1):65-8.
2. Ernandes-Neto M, Tagliarini JV, López BE, Padovani CR, Marques Mde A, Castilho EC, Mazeto GM. Factors influencing thyroidectomy complications. *Braz J Otorhinolaryngol* 2012;78(3):63-9.
3. Hayward NJ, Grodski S, Yeung M, Johnson WR, Serpell J. Recurrent laryngeal nerve injury in thyroid surgery: a review. *ANZ J Surg* 2013;83(1-2):15-21.
4. Chaudhary IA, Samiullah, Masood R, Majrooh MA, Mallhi AA. Recurrent laryngeal nerve injury: an experience with 310 thyroidectomies. *J Ayub Med Coll Abbot* 2007;19(3):46-50.
5. Zakaria HM, Al Awad NA, Al Kreedes AS. Recurrent laryngeal nerve injury in thyroid surgery. *Oman Med. J* 2011;26(1):34-8.
6. Barczyński M, Konturek A, Stopa M, Hubalewska-Dydejczyk A, Richter P, Nowak W. Clinical value of intraoperative neuromonitoring of the recurrent laryngeal nerves in improving outcomes of surgery for well-differentiated thyroid cancer. *Pol Przegl Chir* 2011;83(4):196-203.
7. Baker QF, Al-jarah AS. Recurrent laryngeal nerve injury after thyroid gland surgery. prospective study. *Iraqi postgraduate medical journal* 2001;1(3):248-53.
8. Dutta H, Sinha BK, Baskota DK. Recurrent laryngeal nerve palsy after thyroid surgery and literature review. *J ENT Surg Nepal* 2011;2(2):27-8.
9. Sheahan P, O'Connor A, Murphy MS. Risk factors for recurrent laryngeal nerve neuropraxia postthyroidectomy. *Otolaryngol Head Neck Surg.* 2012;146(6):900-5.
10. Cabs LH, Alnasar M, Rassam RE. The Incidence Of Recurrent Laryngeal Nerve Injury During Thyroid Surgery. *Al-Kindy Col Med J* 2011;7(2):111-8.
11. 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;9(6):482-8.
12. Chan WF, Lang BH, Lo CY. The role of intraoperative neuromonitoring of recurrent laryngeal nerve during thyroidectomy: a comparative study on 1000 nerves at risk. *Surgery* 2006;140(6):866-72.
13. Aytac B, Karamercan A. Recurrent laryngeal nerve injury and preservation in thyroidectomy. *Saudi Med J.* 2005;26(11):1746-9.
14. Chiang FY, Wang LF, Huang YF, Lee KW, Kuo WR. Recurrent laryngeal nerve palsy after thyroidectomy with routine identification of the recurrent laryngeal nerve. *Surgery* 2005;137(3):342-7.
15. Wagner HE, Seller CH. Recurrent laryngeal nerve palsy after thyroid gland surgery. *Br. J Surg.* 1999;(81):226-8.
16. Friedrich T, Steinert M, Keitel R, Sattler B, Schonfelder M. The incidence of damage to recurrent laryngeal nerve in surgical therapy of various thyroid gland diseases-a retrospective study. *Zentralbl Chir* 1998;123(1):25-9.