Immediate Recurrent Laryngeal Nerve Repair During Thyroidectomy

Original Article

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ABSTRACT

Background: One of the most frequent problems after thyroidectomies is an injury to the recurrent laryngeal nerve (RLN) that will lead to vocal cord palsy. This study aimed to assessed the outcomes of intraoperative repair of the recurrent laryngeal nerve.

Patients and Methods: In the period of the study we retrived the data of patients who had been underwent thyroid surgery and they sufferd from RLN injery or scarification with immediate intraoperative nerve repair. This retrospective study has been conducted between 2012 and 2020, 813 patients underwent thyroid surgery, 27 (3.3%) of them diagnosed with RLN injury and divided into 2 groups: group A (n = 9), with intraoperative proof of iatrogenic injury of the RLN, and group B (n = 18), in which malignant invasion was diagnosed intraoperative or recognized during thyroidectomy with a therapeutic transection. Immediate microsurgical reconstruction of the RLN was performed. The evaluation was performed at 3, 6, and 9 months post-surgical repair utilizing aspiration and voice improvement as subjective tests, fiberoptic direct laryngoscopy as an objective test.

Results: Aspiration significantly improved in both groups ($p < 0.05$). Voice quality improved in both groups but better in group A ($p = 0.02$).

Conclusion: Immediate RLN reconstruction during thyroidectomies gave excellent postoperative voice quality especially after thyroidectomies in benign thyroid lesions.

Key Words: Aspiration, recurrent laryngeal nerve, thyroidectomy, vocal cord palsy.

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INTRODUCTION

One of the most significant issues after thyroidectomies is vocal cord paralysis. During thyroidectomy, the recurrent laryngeal nerve may be traumatized or sacrificed even when the RLN is functioning preoperatively[11]. Unilateral vocal cord palsy is a common complication that causes a breathy voice, shortening of phonation, and aspiration. Quality of life affection of the patients with unilateral vocal cord palsy has been reported[13].

The management of unilateral vocal cord palsy has different treatment modalities including vocal cord injection[3], thyroplasty type I[5], arytenoid adduction[6], and laryngeal reinnervations[15]. Several advantages have been founded of laryngeal reinnervation over other modalities as it can re-establish a normal or fairly normal voice. The thyroarytenoid muscle tone and bulk are important for voice production so a reinnervation procedure can prevent its progressive loss[7].

This study aimed to assess the outcomes of immediate intraoperative repair of the recurrent laryngeal nerve during thyroid surgery including voice quality and aspiration.

PATIENTS AND METHODS:

This is a prospective study that had been done in the period from March 2012 to July 2020. It has been conducted by collaboration between the Maxillofacial/ Head and Neck Surgery Unit, General Surgery Department, and Otolaryngology-Head and Neck Surgery Department In Sohag University Hospitals, Faculty of Medicine, Sohag University, Egypt. The eligible cases of the study were 27 (18 women and 9 men) in whom RLN injury during thyroidectomy was diagnosed. This study was approved by the local ethics committee. Informed consent was obtained from all patients. No patients with preoperative evidence of vocal cord paralysis were included in this study. Patients were divided into 2 groups: group A (n = 9), with intraoperative proof of iatrogenic injury of the

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RLN, and group B (n = 18), in which malignant invasion was recognized during thyroidectomy with scarification of the RLN (Fig.1). Immediate microsurgical reconstruction of the RLN was performed with three to five stitches using 9-0 nylon stitches with the use of microsurgical instruments,surgical microscope and Magnifying loop. The defect was different according to the group, in group A was 5mm ± 2 mm of that 6 were recurrent multi nodular goiter, 2 were primery toxic goiter, and remaning one was associated with retrosternal goiter. And this small length is due to use of magnifinge loop and microscope during dissection of recurrent laryngeal nerve and the stumps of the RLNs could be approximated without pressure. In group B, in which cancer thyroid with malignant invasion and infiltration discovered during surgery and oncological safty nesisate resection part of recurrent laryngeal nerve the defct was 20 mm ± 7 mm, and both end of RLN were approximated by using cable nerve graft that came from the greater auricular nerve.

Pathological type of cancer thyroid in group B was 2 cases of medullary thyroid cancer, 3 cases of resectable anaplastic thyroid cancer, 8 cases with follicular thyroid cancer, 5 cases of poorly differentiated papillary thyroid cancer.

Regular follow-up of the patients was done, steroid and speech therapy was offered for all patients. The evaluation was performed 3, 6 and 9 months after vocal cord paralysis finding utilizing aspiration and voice improvement as subjective tests, fibrooptic direct laryngoscopy as an objective test. A 4- point scale rating for aspiration was done, where 0 = normal (no aspiration), 1 = mild aspiration, 2 = moderate aspiration, and 3 = severe aspiration (Ryle feeding tube). Voice improvement was evaluated on a 4-point scale where 0 = remarkable improvement, 1 = improved, 2 = unaltered, and 3 = more awful. Fibrooptic direct laryngoscopy was performed, assessing voice production and doing a grading rate of the phonatory gap (0 = normal, 1 = minimal gap, 2 = moderate gap, 3 = severe gap, 4 = complete glottal incompetence).

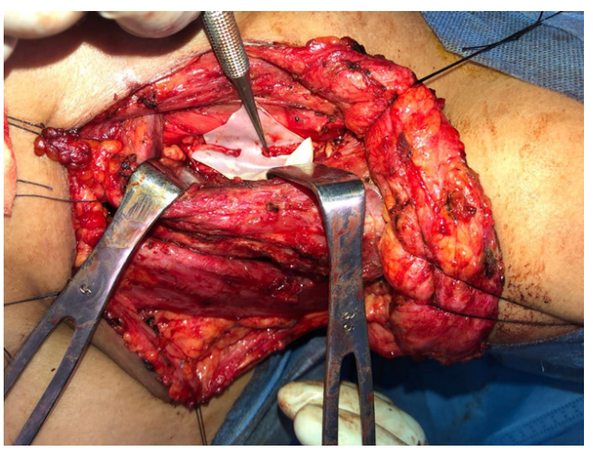

Fig. 1: Intraoperative image of an iatrogenic transection of the recurrent laryngeal nerve.

Statistical analysis:

All statistical analyses were performed using IBM® SPSS® Statistics Version 26 for Windows. Mann-Whitney or Chi-square test was used to comparing between two groups in non-related samples during each different interval. Friedman test was used to compare between more than two groups in related samples. *P-value* < *0.05* was considered significant.

RESULTS:

The mean age at surgery was 54.3 ± 17.5, sex, and histological findings of both groups were summarized in Supplemental (Table1). Supplemental (Table 2) illustrates aspiration and voice improvement as a Subjective test. Aspiration significantly improved in both groups ($p < 0.05$) (Fig. 3). Voice quality improved in both groups but better in group A ($p = 0.02$) (Fig. 4). The phonatory gap rating by fibro optic direct laryngoscopy was shown in Supplemental (Table 3) and (Fig. 5). Fixed vocal cords during fibro optic direct laryngoscopy were founded in both groups and still in the median position with good tension, not atrophic, and showed marked improvement of the phonatory gap in long-term follow-ups with significant results of group A than group B.

Supplemental Table 1: Demographic data

	Group A (n=9)		Group B (n=18)		*P. value*
	No.	%	No.	%	
Age					
Mean±SD	53.4 ± 20.7		55.7 ± 18.9		0.775
Sex					
Male	4	44.4	5	27.8	0.665
Female	5	55.6	13	72.2	
Histological finding					
Benign	3	33.3	0	0.0	0.051
Malignant	6	66.7	18	100.0	

P. value: Comparison between group A and group B in each group by Mann Whitney U test for age, and by Chi-square test for sex and histological finding.

Supplemental Table 2: Subjective ratings of postoperative aspiration and voice quality improvement at 3, 6 and 9 months.

	Group A (n=9)			Group B (n=18)		
	3m	6m	9m	3m	6m	9m
Aspiration						
0	1(11.1%)	8(88.9%)	9(100%)	5(27.78%)	6(33.3%)	12(66.67%)
1	4(44.4%)	1(11.1%)	0(0%)	6(33.33%)	5(27.78%)	4(22.22%)
2	4(44.4%)	0(0%)	0(0%)	7(38.89%)	7(38.9%)	2(11.11%)
P. value		<0.001**			<0.001**	
P1		0.010*			1.000	
P2		0.020*			0.018*	
P3		1.000			0.037*	
Voice improvement						
0	1(11.11%)	7(77.8%)	8(88.89%)	3(16.7%)	8(44.4%)	9(50%)
1	4(44.44%)	2(22.22%)	1(11.11%)	7(38.9%)	7(38.9%)	7(38.9%)
2	4(44.44%)	0(0%)	0(0%)	8(44.4%)	3(16.7%)	2(11.1%)
P. value		0.001**			0.001**	
P1		0.020*			0.112	
P2		0.010*			0.047*	
P3		1.000			1.000	

P. value: Comparison between all times
P1: Comparison between follow up after 3m and follow up after 6m
P2: Comparison between follow up after 3m and follow up after 9m
P3: Comparison between follow up after 6m and follow up after 9m
*:Statistically significant: ($p < 0.05$) **: High statistically significant: ($p < 0.01$).

Supplemental Table 3: Phonatory gap rating on indirect laryngoscopy at 3, 6 and 9 months.

	Group A (n=9)			Group B (n=18)		
	3m	6m	9m	3m	6m	9m
Score						
1	2(22.2%)	7(77.78%)	9(100%)	8(44.4%)	10(55.56%)	12(66.7%)
2	7(77.78%)	2(22.2%)	0(0%)	6(33.3%)	6(33.33%)	5(27.8%)
3	0(0.0%)	0(0.0%)	0(0%)	2(11.1%)	1(5.56%)	0(0%)
4	0(0.0%)	0(0.0%)	0(0%)	2(11.1%)	1(5.56%)	1(5.6%)
P. value		0.002**			0.006**	
P1		0.102			0.730	
P2		0.040*			0.340	
P3		1.000			1.000	

P. value: Comparison between all times
P1: Comparison between follow up after 3m and follow up after 6m
P2: Comparison between follow up after 3m and follow up after 9m
P3: Comparison between follow up after 6m and follow up after 9m
*:Statistically significant: ($p < 0.05$) **: High statistically significant: ($p < 0.01$).

Fig. 3: Unilateral vocal cord palsy, the Para median position of RLN.

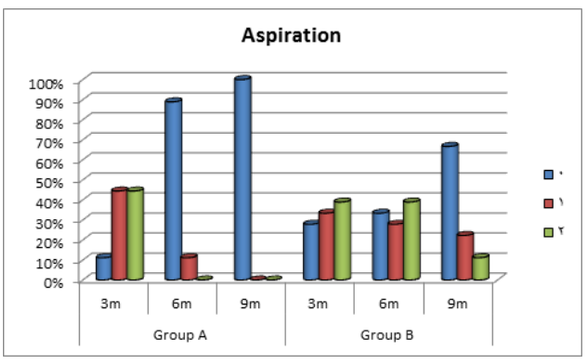

Fig. 3: Clustered cylinder chart showing the percentage of aspiration distribution between the two groups.

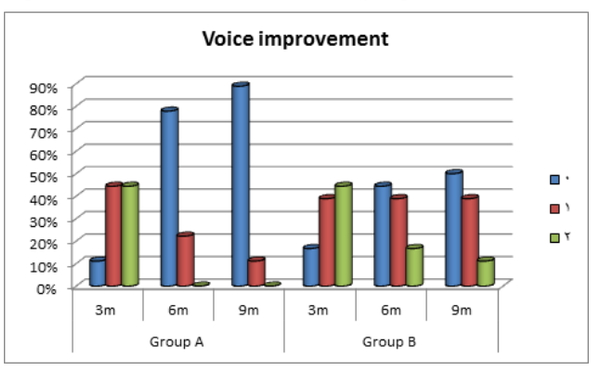

Fig. 4: Clustered cylinder chart showing the percentage of voice improvement distribution between the two groups.

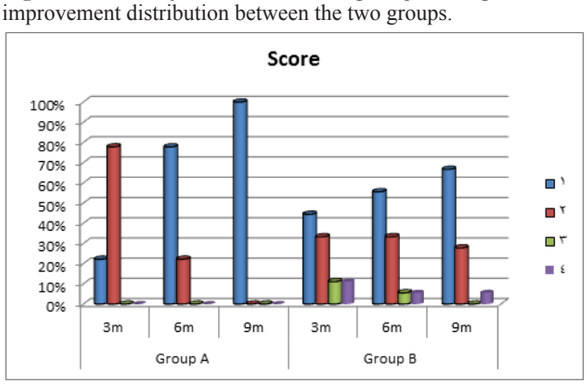

Fig. 5: Clustered cylinder chart showing the percentage of Phonatory gap rating between the two groups.

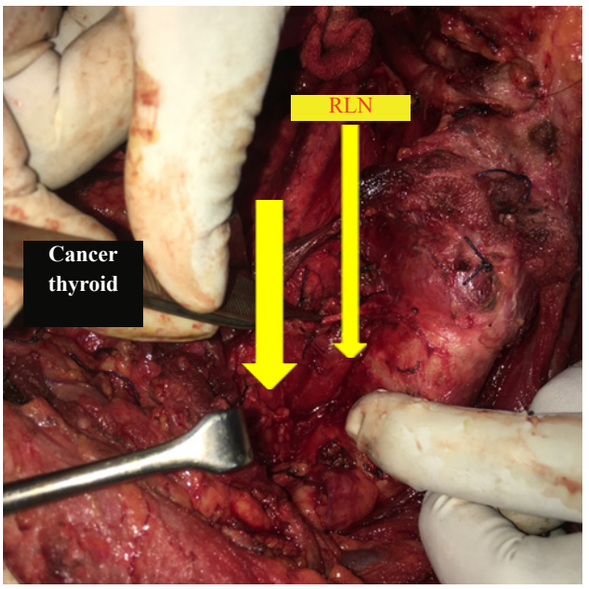

Fig. 6: RLN infiltrated by thyroid cancer.

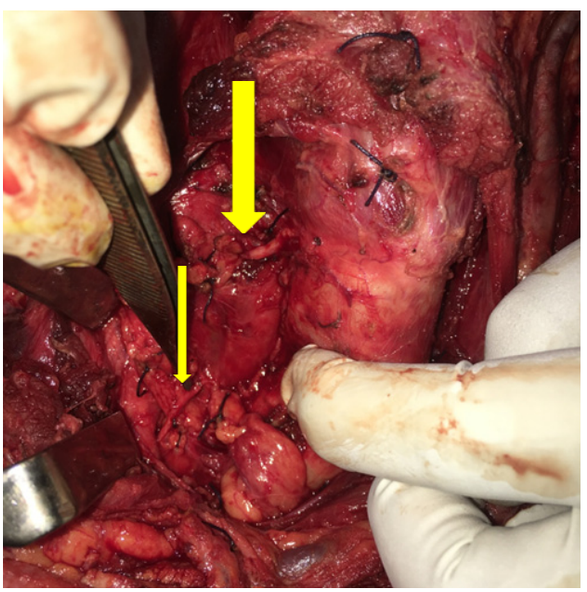

Fig. 7: Both end of recurrent laryngeal nerve after tumer resection.

Fig. 8 : Part of great auricular nerve graft befor suturing in both ends of RLN.

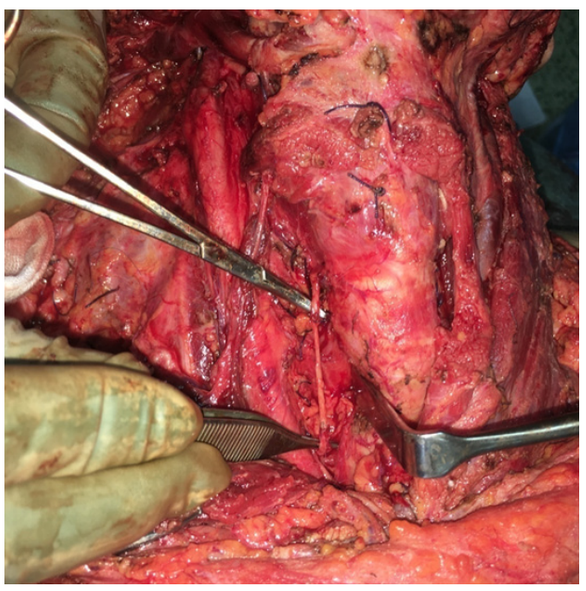

Fig. 9: intraoperative repair of RLN using microsurgical great auricular nerve graft.

DISCUSSION

Aspiration and poor voice quality are major side effects of injury to the RLN during thyroid surgery due to ipsilateral vocal-fold immobility[2]. During the initial weeks after surgery, The traumatized cord lies in the paramedian position as the RLN contains more adductor fibers than abductor fibers[10] (Fig. 2).

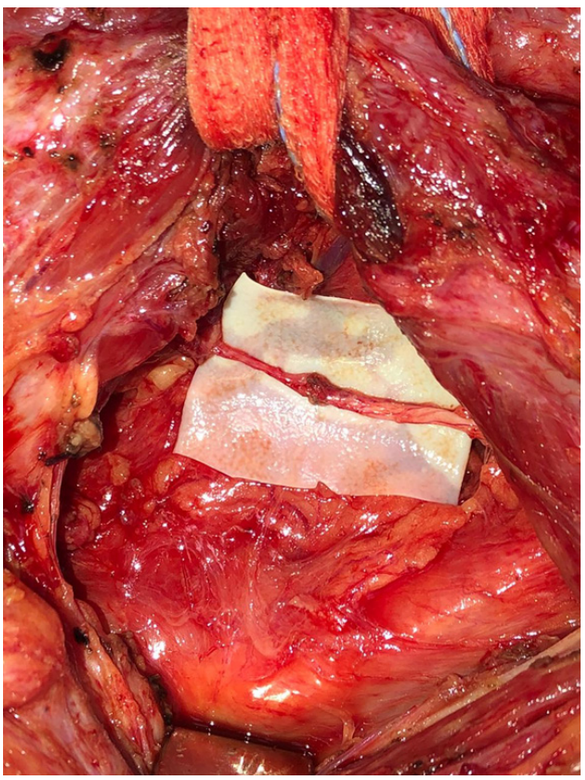

Fig. 2: Intraoperative image of an iatrogenic transection of the recurrent laryngeal nerve with direct primary repair using microsurgery techniques.

After primary repair, the vocal fold fails to abduct and some vocal-fold adduction may be noticed with phonation, as a result of the action of the inter arytenoid muscle, which receives bilateral innervation and returning thyroarytenoid muscle tone and bulk. For this reason, recovery of the reinnervated cord from atrophy, restoring its tension during voice production and reducing capability of aspiration and possible ordinary or close typical voice[8,9,15].

Many methods of peripheral nerve reconstruction have been identified such as micro suturing, gluing, and grafting. One of the previously proposed gluing materials is synthetic Cyanoacrylate glue, this is because its application for nerve repair is relatively simple, it retains the anastomosis even when under tension, and it is relatively inexpensive, and it eliminates the possibility of viral transmission. Despite this, Cyanoacrylate glue has been criticized for its toxicity, overly slow resorption, and the potential for inducing an inflammatory response in the perineural tissues. The preferable method of repair is a direct microsurgical repair of RLN especially when the defect is no longer than 5 mm in cases of benign thyroid lesion or iatrogenic injury and can be done without tension[1,10,14]. But in cases with thyroid cancer and due to malignant invasion and

infiltration of the nerve discovered during surgery and oncological safety nesisate resection part of recurrent laryngeal nerve the defect was 20 mm ± 7 mm[10,14] and RLN reconstruction require surgical precision; however, most surgeons who treat thyroid cancer and RLN should be experienced enough to perform the procedure. In the present study, a direct microsurgical technique was proposed for RLN repair.

Most of the patients in group A had their phonatory function restored significantly following immediate RLN reconstruction especially noted 3–6 months after the repair and continued up to 9 months postoperative. But in group B, significant improvement of phonatory function was noted at 9 months after reconstruction. The explanation for that in case of malignancy we use a long nerve graft to gap the defect after resection of tumer including part of the nerve in the majority of cases. Another possible explaniation was treating this cases with post operative radiotheraby which may delay the nerve groth and recovery. Reconstruction of the RLN may result in partial or complete recovery of vocal fold atrophy and thyroarytenoid muscle tone during phonation.

As regard aspiration, significant improvements of aspiration in group A noted 3–6 months after the repair and continued up to 9 months postoperative, but at 9 months postoperative in group B.

Miyauchi A, *et al*.[10] concluded that marked improvement of voice quality after primary repair of RLN during thyroidectomy with nerve injury[12]. This coincides with our results that reveal that Voice quality improved in both groups but better in group A ($p = 0.02$).

Gurrado A, *et al*.[4] reported improvement of the subjective rating of aspiration at 9 months ($p = 0.02$) after the primary repair of RLN palsy. This resembles our results that identified significant improvements in the subjective rating of aspiration in both groups ($p < 0.05$).

CONCLUSION

Favorable patients outcomes of intraoperative repair of the recurrent laryngeal nerve, utilizing aspiration and voice improvement as subjective tests, Fibro optic direct laryngoscopy as an objective test. Immediate RLN reconstruction during thyroidectomy gave excellent postoperative voice quality, especially after iatrogenic transection.

CONFLICT OF INTEREST

There are no conflicts of interest.

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