ORIGINAL ARTICLE

COMPARISON OF RECURRENT LARYNGEAL NERVE (RLN) PALSY WITH AND WITHOUT INTRAOPERATIVE NERVE IDENTIFICATION DURING THYROIDECTOMY – A CROSS-SECTIONAL STUDY FROM A TERTIARY LEVEL HOSPITAL IN PESHAWAR

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ABSTRACT

Objectives: To determine the frequency of RLN palsy with and without intraoperative nerve identification during thyroidectomy.

Materials and Methods: This is a descriptive cross-sectional study spanning over 9 months during the period from July 2020 to March 2021. Seventy patients were included in the study comprising 18 males and 52 females. Demographic data, clinical and postoperative variables were compared about RLN palsy.

Results: Among the seventy patients of our study, RLN palsy was reported in 7.1%. Intraoperative nerve identification was performed in 81.42% of cases and left out in 18.6% of cases. Omitting nerve identification resulted in a higher 13.04% cases of RLN palsy as compared to only 3.51% cases with intraoperative nerve identification. The frequency of RLN palsy was 14.82% in ages above 45 years, 11.11% in males, 14.29% after total thyroidectomy, and 40% with follicular carcinoma.

Conclusion: Intraoperative identification of the recurrent laryngeal nerve by visualization resulted in a significantly lower rate of RLN palsy. The method described for identification of the nerve during the operation is highly recommended.

Keywords: Recurrent laryngeal nerve, thyroid surgery, intraoperative nerve identification.

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INTRODUCTION

Nodular thyroid diseases and thyroid cancers are common and recent studies cite the global incidence of thyroid cancers at 255,490 and annual deaths at 41,240. [1] Based upon the indication, thyroidectomy may be performed in various capacities as thyroid lobectomies to total thyroidectomies.[2] Thyroid surgeries are associated with complications just like any other surgery. One of the most prevalent and dreaded complications of thyroid and parathyroid surgeries is recurrent laryngeal nerve paralysis.[2-5] Decades ago, the risk of RLN palsies with thyroid surgery used to be high with incidences reported at 3 - 14%.[5] A recent cross-sectional review has cited thyroid surgeries as the cause in 36.9% of cases of RLN Palsy.[6] Researchers from around the world have reported the rate of RLN injuries due to thyroid surgeries at 0.3 to 38%.[4, 7-13] A significant level of variability exists in the statistics relating to RLN injuries resulting from thyroid surgeries which have been attributed to several factors like expertise, operating conditions, and technique of surgery, the technique of RLN identification as well as the nature and type of thyroid disease.[4, 5, 9, 11] Variability of statistics is because some dies were produced before the advent of intraoperative nerve monitoring (IONM).[14-17] Decades ago, RLN palsy was averted by simply avoiding dissection of thyroid tissue in proximity to the nerve.[22] However, this conservative approach was discouraged by many out of the fear of leaving behind any residual cancerous tissue.[18] Visualization of the RLN with the naked eye and use of surgical landmarks such as Berry's ligament and the Joll's, Riddle's, or Beahr's triangle to tackle variations in the course of RLN is one of the earliest techniques of preventing RLN palsy.[18] Another recent study has shown a lower risk of RLN palsy with various RLN preserving methods as compared to the 7.9% cases where nerve identification techniques were not utilized.[23] Luckily, the risk of RLN palsy has reduced substantially due to the advancements in nerve identification techniques.[18, 19]

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This study was conducted with the intent of emphasizing the complete exploration of the nerve from within the vicinity of the thyroid till its entry into the larynx by comparing the outcomes to thyroidectomies where this technique was not practiced.

MATERIALS AND METHODS

This study employed a descriptive cross-sectional design and non-probability convenient sampling, including 70 patients who underwent thyroidectomy at the department of ENT in Khyber Teaching Hospital, a tertiary care hospital of Peshawar over 9 months from July 2020 to March 2021. All the patients either had nodular disease or cancer of the thyroid with euthyroid status as reported by thyroid function test. Normal vocal cord function was ensured before thyroid operation using laryngoscopy. Patients with preoperative hoarseness of voice, end-stage hepatic or renal disease, advanced thyroid malignancy also involving the carotid artery, recurrent thyroid disease, or previous radiotherapy were excluded from the study. Consent was obtained from the patients after being briefed about the nature and intended benefits of the study. Intraoperative, identification of the recurrent laryngeal nerves was done using surgical landmarks described earlier as the Joll's, Riddle's, and Beahr's triangles. These surgical landmarks could be mapped appropriately after the surgical dissection was extended to the level of Berry's ligament. Follow-up examination was done after 1 week, 1 month, 3 months, and 6 months to assess vocal cord mobility and function using fiber-optic laryngoscopy (FODL). The primary outcome of interest in this study was RLN palsy appearing within a week of the thyroid surgery which has been defined by the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) as the appearance of hoarseness or vocal cord dysfunction after the first postoperative day with or without confirmation by laryngoscopy or severe vocal cord dysfunction leading to sudden airway obstruction warranting a tracheostomy.[10]

Data acquired from the study were analyzed using SPSS® version 23 (IBM, New York, USA). Statistical differences of demographic, clinical, and post-thyroidectomy variables about RLN palsy were determined using an independent sample t-test, and comparisons were made by chi-square.[22,27] Two-sided P value of 0.05 or less was considered as the significance level.

RESULTS

Above 70 patients were initially selected for this study, seven were excluded; one due to the previous radiotherapy, two due to preoperative hoarseness, and four patients did not appear for follow-up visits. The remaining 70 patients had ages from 37 to 53 years with the mean age at presentation being 44.43 ± 4.11 years, mostly appearing in their fifties. 74.3% of the subjects were female while 25.7% were male giving a male to female ratio of 1:2.9. Majority of the cases that warranted surgery were of multi-nodular goiter (78.6%, n=55) followed by papillary carcinoma (11.4%, n=8), follicular carcinoma (7.1%, n=5), and medullary carcinoma (2.9%, n=2). The nature of these cases was confirmed by histopathological studies as well. The most frequently performed procedures were hemi-thyroidectomies (78.6%, n=56) followed by total thyroidectomies (10.0%, n=7), near-total thyroidectomies (7.1%, n=5), and thyroid lobectomies (2.9%, n=2). Recurrent laryngeal nerve was identified in 81.4% (n=57) cases. It was accurately identified on the right side in 38.6% (n=27) cases, on the left side in 27.1% (n=19) cases and on both sides in 15.7% (n=11) cases. Recurrent laryngeal nerve palsy was found in 7.1% (n=5) cases. All five RLN palsies were transient. Three of these recovered to normal functional capacity within the first month of the thyroid procedure, one recovered within three months while one recovered in six months. Out of 57 cases where the nerve was identified, RLN palsy was found in 3.5% (n=2) cases. On the other hand, among the 13 cases where the nerve was not identified, RLN palsy was found in 23.1% (n=3) cases. This concluded the fact that intraoperative identification of the recurrent laryngeal nerve is associated with a considerably lower risk of RLN palsy.

Bivariate analysis indicated significantly lower rates of RLN palsy in patients of ages ≤ 45 years ($p = 0.04$). No significant difference was observed in the rate of palsy against both genders ($p = 0.45$) and various procedures ($p = 0.78$). Higher rates of RLN palsy were also observed in cases of follicular carcinoma as compared to benign multi-nodular goiter ($p = 0.02$).

DISCUSSION

Weighing out the need for thyroidectomy and its extent as indicated for thyroid disease against the subsequent risk of RLN paralysis has been a matter of controversy for some time.[13, 24] This issue is fueled further by the disparity found in the statistical information regarding the incidence of RLN palsy after thyroid surgeries which may be attributed to the variation among surgeons' expertise, approach, and technique of thyroidectomy, indication for surgery, and operating conditions.[4, 5, 9-11] However, over the past few decades, advances in surgical procedures and operation theatre practices have led to more favorable outcomes of surgeries. Regarding thyroid operations, advanced instruments meant for accurate nerve identification combined with the novel approach of 'capsular dissection' from 'lateral dissection' have resulted in a significant decline in the incidence of RLN Paralysis and post-thyroidectomy hoarseness.[3, 13]

Previous studies on the rate of RLN palsy with and without means for nerve identification and monitoring have revealed a magnitude of disparity. Our study observed a statistically significant difference among the rates

Table 1: Stratification of RLN Palsy against study variables

Parameters	RLN Palsy				p
	Total (n=70)	No (n=65)	Yes (n=5)	Rate of Injury	
Age					
Mean (years)	44.43				0.04
≤ 45 years	43	42	1	2.33%	
> 45 years	27	23	4	14.82%	
Gender					
Male	18	16	2	11.11%	0.45
Female	52	49	3	5.77%	
Surgery performed					
Total thyroidectomy	7	6	1	14.29%	0.78
Subtotal thyroidectomy	5	5	0	0%	
Hemithyroidectomy	56	52	4	7.14%	
Lobectomy	2	2	0	0%	
Thyroid Disease					
Goiter	55	52	3	5.45%	0.02
Papillary carcinoma	8	8	0	0%	
Follicular carcinoma	5	3	2	40.0%	
Medullary carcinoma	2	2	0	0%	
RLN Identified					
Yes	57	55	2	3.51%	0.04
No	23	20	3	13.04%	

of RLN palsy which showed a poor negative correlation between nerve identification and RLN palsy, $r(1) = -.29$, $p = .013$. Two different meta-analyses conducted by Cirocchi and Jeannon had revealed RLN palsy at rates of 2.8 and 9.8%, respectively.[7, 11] In studies conducted by Jiang, Gunn, and Schneider, RLN palsy was found at rates of 4.98%, 5.95%, and 4.7%, respectively.[10, 25] Several authors had also conducted comparisons of the rates of RLN palsy with and without nerve identification. Zakaria et al found a significantly lower rate of 2.6% with RLN identification as compared to the 7.6% that occurred without nerve identification ($p= .039$).[13] A significant difference was found with nerve identification measures in the study by Anuwong et al where RLN palsy was found at rates of 3.8% and 82% in the presence and absence of perioperative nerve identification, respectively.[26] No significant difference in the rates of RLN palsy was found in the retrospective study by Bergenfelz et al where the rate of RLN palsy with and without nerve identification was 13.81% and 10.54%, respectively.[21] Higgins et al conducted a meta-analysis comprising of 64,699 nerves-at-risk from a clinical trial, [7] comparative trials, and 34 case series where intraoperative nerve monitoring (IONM) was compared against visual identification alone, and surprisingly, the rate of RLN palsy with visual identification alone was 3.12% that was comparatively less than the 3.52% rate found with IONM, (OR 0.93; 95% confidence interval [CI], 0.76-1.12).[18] Calo et al reported no significant difference in the rates of RLN palsy found with routine identification and IONM which were 2.82% and 2.21%, respectively.[27] This study concluded that age was independently related to the rate of RLN palsy occurrence after thyroid surgeries as patients of ages above 45 years had a higher tendency to develop RLN palsy as compared to the patients having ages below 45 years, $r(1) = -.24$, $p = .049$. These findings are consistent with previous studies conducted by Gunn et al and Francis et al where both authors determined a higher risk of RLN palsy in patients above 65 years.[8, 10] However, the reason why the older age groups are associated with an increased risk for RLN palsy is not clear.[8] A study conducted by Serpell et al showed comparable findings as left RLN palsy was mostly reported in cases of unilateral involvement at a rate of 3% ($p= .007$) while right RLN palsy was found at a rate of 1.8% ($p < .001$) in cases of bilateral involvement.[2] According to the study by Bergenfelz et al, the side of the nerve having palsy did not show any significant relationship to intraoperative nerve identification. His study found bilateral RLN palsy in 0.1% of the cases and unilateral palsy in 1.4% of the cases with equal involvement of the right and left nerves.[21] Sturniolo et al had studied the identification of different anatomical variations of the RLN relating to its course and dimensions. Bilateral identification was possible in the majority of the cases (77.2%) while the right and left RLN were independently identified less frequently.

This study claimed that the relative ease of identifying the right RLN may be attributed to the less tortuous course followed by the right RLN in the furrow of the trachea-esophageal groove.[17] The surgical procedures most frequently performed in this study were hemi-thyroidectomies followed by subtotal thyroidectomies, total thyroidectomies, and lobectomies. However, the rate of RLN palsy reported after these hemi-thyroidectomies was 7.14% which was significantly lower than the rate of 14.29% reported with total thyroidectomies. Gunn et al had also determined the comparative rates of RLN palsy for different thyroid procedures. Most patients had gone through a total thyroidectomy (63.2%). Similar to our study, their study reported high rates of RLN palsy with total thyroidectomy (6.9%) as compared to lobectomies (4.3%) ($p < 0.001$).[10]

Dralle et al and Riddell et al provided explanations for the occurrence of RLN palsy despite intraoperative RLN identification. According to these authors, such cases of RLN palsy occur due to the inevitable stress incurred by the nerve in the form of stretch, heat, or de-vascularization. These factors usually lead to a transient form of palsy resulting from neuropraxia which uses usually relieves within 6 months.[14, 19]

CONCLUSIONS

The rate of RLN palsy was significantly lower in patients where intraoperative nerve identification had been performed as compared to the thyroid operations where intraoperative identification of the RLN was not performed.

RECOMMENDATION

Intraoperative nerve identification is an essential step in any thyroid surgery and has proven beneficial in reducing the occurrence of RLN palsy.

LIMITATIONS

This study was limited only by the variation in the course or location of the recurrent laryngeal nerve which led to a lack of uniformity regarding the use of surgical landmarks for identification of the recurrent laryngeal nerve.

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Following authors have made substantial contributions to the manuscript as under

Khan I:	Main Idea data collection Manuscript writing.
Din IU:	Statistical Analysis.
Khan FS:	Bibliography
Orakzai KA:	Overall supervision and approval of the final version.
Tarand AA:	Computer Writing
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Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.