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OBSERVATIONAL STUDY OF CORRELATION BETWEEN RLN INJURY WITH THYROIDITIS IN PATIENT UNDERGOING TOTAL THYROIDECTOMY IN A TERTIARY CARE CENTRE

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Abstract

Introduction

The study's aims are to determine modifiable risk factors, classify patients according to thyroid pathology, and propose surgical decision-making for decreased morbidity secondary to RLN injury.

Material and Methods

This was a prospective observational study carried out at a department of General Surgery of a tertiary care teaching hospital in India for 18 months, from January 2024 to June 2025. Patients of either sex 18 years of age or older scheduled for total thyroidectomy for different thyroid lesions were included in the study. Inclusion criteria were patients looked-forward to being benign or malignant thyroid disease clinically or radiologically which needs total thyroidectomy. Patients who had previously undergone thyroid or neck surgery, those undergoing hemithyroidectomy or subtotal thyroidectomy, and those with preoperative vocal cord palsy were excluded to avoid confounding factors.

Results

This was a prospective observational study of 120 patients undergoing total thyroidectomy, and a strong relationship was seen between thyroiditis and recurrent laryngeal nerve (RLN) injury. Of 46 patients with history-pathologically proven thyroiditis, 10(21.7%) developed RLN injury, whereas only 4(5.4%) of 74 without thyroiditis developed RLN injury. This percentage difference was also statistically significant ($p = 0.012$) and highlights the fact that thyroiditis significantly increases the risk of RLN injury in thyroidectomy. It is noteworthy that temporary RLN palsy was observed more frequently in the thyroiditis group (15.2% vs. 4.0%, $p = 0.045$), while the permanent RLN palsy rate was higher, albeit without statistical significance (6.5% vs. 1.4%; $p = 0.176$), possibly result of relatively small number of subjects.

Significantly longer surgical time was noted in the thyroiditis (mean, 112.3 ± 14.7 minutes) group compared with the non-thyroiditis group (93.4 ± 12.1 minutes) with a p-value, <0.001.

Conclusion

This analysis provides evidence of the significant association between thyroiditis and higher risk for recurrent laryngeal nerve (RLN) injury in patients treated with total thyroidectomy.

Keywords

Thyroid surgery, recurrent laryngeal nerve, laryngeal branches, vocal cord palsy

INTRODUCTION

Thyroidectomy is one of the most frequently performed endocrine surgical procedures in the world. It is used in many thyroid disorders that are not cancer, such as benign goiters, thyroid nodules, and hyperthyroidism.[1] Total thyroidectomy is the procedure often utilized in diffuse multinodular goiter, Graves' disease, and differentiated thyroid cancers. Despite improvements in surgical skills and perioperative management, injury to the recurrent laryngeal nerve (RLN) remains one of the most feared complications of thyroid surgery because it can lead to considerable morbidity and a reduction of the quality of life in the postoperative period.[1]

The RLN is a branch of the vagus nerve and supplies all of the intrinsic laryngeal muscles except the cricothyroid.[2] Due to its proximity to the thyroid gland, especially as it has a varied path in the tracheoesophageal groove and around the inferior thyroid artery, the nerve is frequently injured during thyroid surgery. Hoarseness, voice fatigue, aspiration, or even airway obstruction can occur due to injury to RLN based on its laterality and the extent of the nerve injury.[2] RLN injury can be transient or permanent (the transient form being resolved within 6 months and the permanent one being a nonreversible impairment, necessitating years of voice rehabilitation or anterior adduction (AD) surgery).

One of the foremost causes of higher rates of RLN injury is the existence of thyroiditis, especially chronic lymphocytic thyroiditis (Hashimoto's thyroiditis) and subacute granulomatous thyroiditis (De Quervain's thyroiditis). Inflammatory disease leads to a distortion of normal anatomical and vascular anatomy of the thyroid gland, requiring more meticulous surgical dissection.[3] Thyroiditis results in fibrosis, adhesion, and tissue friability which often preclude the perception of surgical planes, and is technically challenging in identifying the location and preservation of RLN. Additionally, chronic inflammation can also cause reactive lymphadenopathy and aberration of the paratracheal anatomy, enlarging the risk for unintentional nerve injury during neck dissection. The non-focal nature involved of the thyroid, as well as heightened vascularity and tissue edema, between other factors play a role in increased operative time as well as an increased difficulty in preserving vital structures such as the RLN.[3] Although the relationship is described in most studies, the number of clear, prospective observational studies that relate the amount or presence of thyroiditis with injury to the RLN is limited.

The identification of high-risk patients may allow for a more tailored surgical approach, greater intraoperative awareness, and a consideration of adjuncts such as intraoperative nerve monitoring (IONM) to minimize nerve injury. Further, if there is a preoperative recognition of the diagnosis of thyroiditis through clinical, biochemical or radiological means, the surgical team will be forewarned of the potential for more involved dissection.[4,5] This study thus purports to address this lacuna by performing a systematic observational study in a tertiary care center to evaluate the association of RLN injury and thyroiditis in patients who have undergone total thyroidectomy. We aim to determine the extent to which thyroiditis may affect nerve injury rates by thoroughly analyzing intraoperative findings, histopathology demonstrating thyroiditis, and postoperative vocal cord assessment. The study's aims are to determine modifiable risk factors, classify patients according to thyroid pathology, and propose surgical decision-making for decreased morbidity secondary to RLN injury.

MATERIALS AND METHODS

This was a prospective observational study carried out at a department of General Surgery of a tertiary care teaching hospital in India for 18 months, from January 2024 to June 2025. The study was conducted after the approval from the Institutional Ethics Committee (IEC) and all participants provided informed written consent prior to the initiation of the study. Patients of either sex 18 years of age or older scheduled for total thyroidectomy for different thyroid lesions were included in the study. Inclusion criteria were patients looked-forward to being benign or malignant thyroid disease clinically or radiologically which needs total thyroidectomy. Patients who had previously undergone thyroid or neck surgery, those undergoing hemithyroidectomy or subtotal thyroidectomy, and those with preoperative vocal cord palsy were excluded to avoid confounding factors.

Considering an expected incidence of injury of the RLN from thyroiditis (10–12% in previously published reports) and an estimated prevalence of thyroiditis in resected thyroids (30–40%), the required sample size was 120 patients, a number that is expected to provide adequate power (95% confidence level and 5% error). All the patients were systematically examined and they had standard thyroid function tests, T3, T4, and TSH besides antithyroid peroxidase (anti-TPO) antibodies and ultrasound of the neck. Imaging (CT/MRI), and FNAC were undertaken as required. Indirect laryngoscopy was performed preoperatively to evaluate vocal cord mobility and exclude preexisting RLN palsy. All patients were treated with general anesthesia and total thyroidectomy by experienced endocrine surgeons using standard dissection techniques. Bilateral intraoperative identification of the recurrent laryngeal nerve was performed in all the cases and nerve preservation was attempted delicately. The

intraoperative findings of fibrosis, adhesions, and vascularity were recorded as surrogate markers of underlying thyroiditis. Vocal cord mobility was examined at 24-48 hours after surgery in all patients by means of indirect laryngoscopy. Patients with voice change or hoarse voice were evaluated by follow-up laryngoscopy at 1- and 6-months to confirm RLN palsy was transient or permanent. Resected thyroid glands were histopathologically evaluated in all cases by determining the presence or absence of thyroiditis.

Demographics, clinical diagnosis, intraoperative findings (fibrosis, dissection difficulty), operative time, and postoperative RLN function were all evaluated. After classifying the patients according to the histopathological findings of thyroiditis (thyroiditis and non-thyroiditis group), RLN injury was also compared. The data were analyzed using SPSS software version 26.0. Categorical variables were assessed using Chi-square or Fisher's exact test, whereas quantitative variables were analyzed using Student's t-test or Mann–Whitney U test, when appropriate. P value < 0.05 was considered as statistically significant.

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RESULTS

This was a prospective observational study of 120 patients undergoing total thyroidectomy, and a strong relationship was seen between thyroiditis and recurrent laryngeal nerve (RLN) injury. Of 46 patients with history-pathologically proven thyroiditis, 10(21.7%) developed RLN injury, whereas only 4(5.4%) of 74 without thyroiditis developed RLN injury. This percentage difference was also statistically significant ($p = 0.012$) and highlights the fact that thyroiditis significantly increases the risk of RLN injury in thyroidectomy. It is noteworthy that temporary RLN palsy was observed more frequently in the thyroiditis group (15.2% vs. 4.0%, $p = 0.045$), while the permanent RLN palsy rate was higher, albeit without statistical significance (6.5% vs. 1.4%; $p = 0.176$), possibly result of relatively small number of subjects.

Significantly longer surgical time was noted in the thyroiditis (mean, 112.3 ± 14.7 minutes) group compared with the non-thyroiditis group (93.4 ± 12.1 minutes) with a p-value, <0.001. This may imply that thyroiditis itself, with its subsequent fibrosis and altered tissue planes, can make surgery technically more challenging and time-consuming. Consistently, 76.1% of thyroiditis cases and 21.6% of non-thyroiditis cases showed intraoperative fibrosis ($p < 0.001$). Difficult dissection, defined as the loss of the normal tissue plane associated with meticulous dissection, was also much more common among patients with thyroiditis (65.2% vs 16.2%, $p < 0.001$).

The average age and sex distribution of the groups did not significantly differ, which eliminated the confounding variables of age and sex in this correlation between thyroiditis and RLN injury. Taken together, these results are all the evidence we need in support of the hypothesis that thyroiditis is a significant risk for RLN injury during thyroidectomy owing to associated inflammation, fibrosis, and distortion of the anatomy. Thus, early detection of thyroiditis in either clinical or radiological can be important in the planning and risk assessment of surgery.

Table 1. Correlation Between RLN Injury and Histopathological Thyroiditis in Patients Undergoing Total Thyroidectomy (N = 120)

Variable	Thyroiditis Present (n = 46)	Thyroiditis Absent (n = 74)	p-value
RLN Injury – Total	10 (21.7%)	4 (5.4%)	0.012*
• Transient RLN palsy	7 (15.2%)	3 (4.0%)	0.045*
• Permanent RLN palsy	3 (6.5%)	1 (1.4%)	0.176
Mean Age (years)	42.5 ± 10.3	40.2 ± 9.8	0.219
Female Gender	38 (82.6%)	59 (79.7%)	0.692
Surgical Duration (min)	112.3 ± 14.7	93.4 ± 12.1	<0.001*
Intraoperative Fibrosis	35 (76.1%)	16 (21.6%)	<0.001*
Difficult Dissection Noted	30 (65.2%)	12 (16.2%)	<0.001*

DISCUSSION

Injury to the recurrent laryngeal nerve (RLN) continues to be one of the most dreaded complications of thyroid surgery as it can affect phonation, airway sphincter function, and quality of life. It would show a higher incidence of injury of the RLN in patients with thyroiditis compared to those without it. This is in line with the literature previously published, which states that thyroid inflammation, particularly chronic lymphocytic thyroiditis (Hashimoto's thyroiditis), makes the surgical anatomy difficult to identify and bring additional operative risk.

In a subset of our series, intraoperative RLN injury was noted in 21.7% of patients with histopathologic-confirmed thyroiditis compared with 5.4% without histopathologically confirmed thyroiditis ($p = 0.012$). This finding is

consistent with findings of Gandhi et al. found an increased incidence of RLN palsy in patients with Hashimoto's thyroiditis who received a thyroidectomy, stating that dense fibrosis and adhesions by which anatomical structure are concealed led the nerve identification to become difficult.[6] Similarly, Feng et al. performed a meta-analysis which found that the presence of thyroiditis significantly increased the incidental risk of transient RLN palsy as well as hypoparathyroidism especially associated with total thyroidectomy.[7]
Similarly, the potential pathogenetic role of fibrosis and vascularity as intraoperative risk factors has been reported in the literature. We observed in our study intra-operative fibrosis in 76.1% of thyroiditis, and in 21.6% of non-thyroiditis. This is in agreement with what reported by Lombardi et al, who found a higher percentage of RLN lesion when the dissection is complex with fibrosis as we can find the one due to thyroiditis.[8] Furthermore, a longer duration of operation was noted in the thyroiditis group (mean 112.3 ± 14.7 min vs 93.4 ± 12.1 min) than the non-thyroiditis group, in line with studies such as \(for example\) Suh et al. (2016) who recorded longer durations of surgery in those with thyroiditis secondary to challenging dissection and different tissue planes.[9]

While most of the RLN injuries in our study were transient, a small number of permanent palsy was seen in the thyroiditis group (6.5%), as reported previously. Permanent nerve injury, although rare, may be caused by traction, devascularization, or transection in the setting of a densely inflamed field (Shindo and Chheda et al).[10] More specifically, the strength of this association is not consistent across all studies. Huang et al., in a retrospective series, did not observe any difference concerning RLN palsy between patients with and without Hashimoto's thyroiditis although they mainly performed subtotal resections and included low-grade inflammation patients, possibly underestimating the risk.[11] Our study concentrated only on total thyroidectomies and, thus, may have encompassed a more inflammatory phenotype that could partly explain the higher complication rate.

Barczyński et al showed that IONM can significantly lower the temporary RLN palsy rates especially in high-risk patients (thyroiditis) so supporting its application especially when anatomical distortion is anticipated.[12] Although ours was an IONM-free series due to institutional constraints, we emphasize the importance of IONM for future practice, particularly for complicated inflammatory thyroid cases.

The present results emphasize the importance of preoperative identification of thyroiditis on the basis of clinical parameters (e.g., firm gland, neck discomfort), laboratory values (elevated anti-TPO antibodies), and sonographic features (heterogeneous echotexture, increased vascularity). This may allow for improved preoperative risk stratification, patient counseling and planning for increased operative times and possible complications.

LIMITATIONS

This study has several limitations. The first limitation is being a single-center study in a tertiary care center, which could have restricted the broader application of the results in other surgical services with other surgeon expertise and patient characteristics. Secondly, this study did not adopt the intraoperative nerve monitoring (IONM) for institutional reasons, and IONM could contribute to the rate of RLN detection and preservation. Third, the diagnosis of thyroiditis was confirmed through postoperative pathology and intraoperative suspicion alone was not objectively standardized or scored. Thirdly, albeit reduced, it is theoretically possible for variability in surgeon-based technique and experience to have an impact which cannot be fully discounted.

CONCLUSION

This analysis provides evidence of the significant association between thyroiditis and higher risk for recurrent laryngeal nerve (RLN) injury in patients treated with total thyroidectomy. Inflammatory and fibrotic changes in thyroiditis lead to challenging dissection, longer operation, as well as increased rates of transient and permanent nerve palsy. These results highlight the significance of preoperative detection of thyroiditis and organized surgical strategy when dealing with such cases. Although RLN injury is a potentially preventable complication, the risk in thyroiditis is much higher. Increased intraoperative vigilance and use of nerve monitoring may lead to better results for the patient. Larger, multicenter, prospective studies are needed in the future to confirm these results and establish standard risk reduction strategies for inflammatory thyroid diseases in surgery condition.

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