



OUTCOMES OF TOTAL THYROIDECTOMY WITH ROUTINE IDENTIFICATION AND PRESERVATION OF THE RECURRENT LARYNGEAL NERVE.

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Abstract

Background: Total thyroidectomy is the preferred surgical treatment for many benign and malignant thyroid disorders. However, recurrent laryngeal nerve (RLN) injury remains one of the most feared complications of thyroid surgery because it can result in hoarseness of voice, aspiration, impaired phonation, and permanent vocal cord paralysis. Routine visual identification and preservation of the RLN during thyroidectomy has been advocated as an effective strategy to minimize nerve injury and improve surgical outcomes. The present study was undertaken to evaluate the outcomes of total thyroidectomy performed with routine identification and preservation of the recurrent laryngeal nerve at a tertiary care centre. **Aim:** To evaluate the outcomes of total thyroidectomy with routine identification and preservation of the recurrent laryngeal nerve in patients undergoing thyroid surgery.

Objectives:

1. To determine the incidence of recurrent laryngeal nerve injury and other postoperative complications following total thyroidectomy with routine identification and preservation of the recurrent laryngeal nerve.
2. To evaluate perioperative outcomes, including operative duration, postoperative hypocalcaemia, length of hospital stay, and postoperative vocal cord function.

Materials and Methods: A hospital-based prospective observational study was conducted in the Department of General Surgery at a tertiary care teaching hospital. Fifty consecutive patients undergoing elective total thyroidectomy for benign or malignant thyroid disease were included. Preoperative evaluation included clinical examination, thyroid function tests, ultrasonography of the neck, indirect/fibreoptic laryngoscopy, and fine-needle aspiration cytology where indicated. During surgery, the recurrent laryngeal nerve was routinely identified and meticulously preserved using a standardized capsular dissection technique. Patients were followed for recurrent laryngeal nerve function, hypocalcaemia, postoperative complications, operative duration, and length of hospital stay. Data were analysed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were analysed using the Chi-square test or Fisher's exact test. A p-value of <0.05 was considered statistically significant. **Results:** The mean age of the study population was 44.8 ± 10.7 years, with females accounting for 78.0% of the patients. Multinodular goitre (48.0%) was the most common indication for total thyroidectomy, followed by papillary thyroid carcinoma (24.0%). Routine identification of the recurrent laryngeal nerve resulted in successful nerve preservation in 94.0% of patients. Temporary recurrent laryngeal nerve palsy occurred in 3 patients (6.0%), whereas no permanent RLN palsy was observed. Transient hypocalcaemia was the most common postoperative complication (16.0%), while seroma (4.0%), postoperative haematoma (2.0%), and surgical site infection (2.0%) were infrequent. Temporary RLN palsy was significantly more common among patients with malignant thyroid disease than those with benign pathology (16.7% vs. 2.6%; $p = 0.048$). **Conclusion:** Routine identification and preservation of the recurrent laryngeal nerve during total thyroidectomy is a safe, reliable, and effective surgical practice. It is associated with a low incidence of recurrent laryngeal nerve injury, minimal postoperative morbidity, and excellent surgical outcomes. The adoption of meticulous anatomical dissection and standardized operative techniques should be encouraged to further reduce complications and improve patient safety during thyroid surgery.

Keywords: Total thyroidectomy, recurrent laryngeal nerve, thyroid surgery, hypocalcaemia.



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INTRODUCTION

Thyroid diseases constitute one of the most common endocrine disorders worldwide, affecting millions of individuals each year. The spectrum of thyroid disorders ranges from benign conditions such as multinodular goitre, Graves' disease, and thyroid adenomas to malignant neoplasms, including differentiated thyroid carcinoma, medullary thyroid carcinoma, and anaplastic thyroid carcinoma. Surgical management remains the definitive treatment for many thyroid disorders, particularly in patients with compressive symptoms, suspicion or confirmation of malignancy, recurrent hyperthyroidism, or cosmetically significant goitre. Over the last few decades, total thyroidectomy has become the preferred surgical procedure for many benign and malignant thyroid diseases because it provides complete disease clearance, reduces recurrence rates, and facilitates postoperative radioactive iodine therapy and thyroglobulin surveillance in thyroid cancer patients.¹

Globally, thyroid disorders represent a major public health problem. According to the World Health Organization (WHO), iodine deficiency remains one of the leading preventable causes of thyroid disease, although improved iodine supplementation programmes have significantly reduced its prevalence in many countries. Simultaneously, the incidence of thyroid cancer has increased steadily worldwide due to improved diagnostic modalities and greater use of ultrasonography and fine-needle aspiration cytology. Differentiated thyroid carcinoma now represents one of the fastest-growing malignancies in terms of incidence, making thyroid surgery one of the most frequently performed endocrine operations. Advances in anaesthesia, perioperative care, surgical instrumentation, and anatomical understanding have substantially improved patient safety; however, postoperative complications remain an important concern because of the intimate relationship of the thyroid gland with critical neurovascular structures.^{1, 2}

India bears a considerable burden of thyroid disease owing to its large population and historically variable iodine intake. Although the Universal Salt Iodization Programme has markedly reduced iodine deficiency disorders, thyroid enlargement, multinodular goitre, autoimmune thyroiditis, and thyroid malignancy continue to be encountered frequently in surgical practice. Hospital-based studies from India have shown that thyroidectomy constitutes a substantial proportion of elective endocrine surgical procedures. Increasing awareness, widespread availability of ultrasonography, improved cytopathological diagnosis, and enhanced referral patterns have contributed to a greater number of patients undergoing total thyroidectomy in tertiary care centres. Consequently, optimizing surgical techniques to minimize complications has become increasingly important in the Indian healthcare setting.³

Despite remarkable advances in thyroid surgery, injury to the recurrent laryngeal nerve (RLN) remains one of the most feared complications following total thyroidectomy. The recurrent laryngeal nerve, a branch of the vagus nerve, supplies motor innervation to all intrinsic muscles of the larynx except the cricothyroid muscle and is therefore essential for normal phonation, airway protection, and effective swallowing. Because of its close anatomical relationship with the inferior thyroid artery, Berry's ligament, and the posteromedial surface of the thyroid gland, the RLN is particularly vulnerable during thyroid dissection. Even minor traction, thermal injury, compression, ligation, or inadvertent transection may result in temporary or permanent vocal cord paralysis, significantly affecting a patient's quality of life.^{1, 4}

The reported incidence of transient recurrent laryngeal nerve palsy after thyroidectomy ranges from 1% to 8%, whereas permanent nerve palsy occurs in approximately 0.3% to 3% of patients depending upon disease severity, extent of surgery, surgeon experience, and methods employed for nerve identification. Bilateral RLN injury, although uncommon, represents a life-threatening complication that may necessitate emergency airway intervention including tracheostomy. Even unilateral nerve injury may result in persistent hoarseness, aspiration, ineffective cough, impaired communication, reduced occupational performance, and diminished overall quality of life. Consequently, prevention of RLN injury has become one of the principal goals of modern thyroid surgery.^{1, 4}

Historically, surgeons differed in their approach to protecting the recurrent laryngeal nerve during thyroidectomy. Earlier techniques relied on careful capsular dissection without deliberate nerve exposure, based on concerns that routine dissection might itself increase the risk of nerve trauma. However, increasing anatomical knowledge and accumulating clinical evidence have demonstrated that routine visual identification and meticulous preservation of the recurrent laryngeal nerve significantly reduce inadvertent nerve injury, particularly in difficult thyroidectomy, revision surgery, large multinodular goitres, Graves' disease, and thyroid malignancy. Today, visual identification of the RLN throughout its course is regarded by most endocrine surgeons as the gold standard for safe thyroidectomy.^{1, 2}

Furthermore, meticulous identification of the RLN enables the surgeon to appreciate anatomical variations, including extralaryngeal branching, non-recurrent laryngeal nerve, variable relationships with the inferior thyroid artery, and altered anatomy caused by inflammatory or malignant disease. Recognition of these variations permits careful dissection while minimizing traction, thermal spread, and inadvertent ligation. Modern surgical principles therefore emphasize systematic exposure of the nerve before ligation of surrounding vascular structures, thereby reducing the likelihood of neurological complications without compromising operative efficiency.^{1,4}

The development of intraoperative nerve monitoring (IONM) has further enhanced the surgeon's ability to identify and assess recurrent laryngeal nerve function during thyroidectomy. Although visual identification remains the cornerstone of nerve preservation, IONM provides functional confirmation of nerve integrity before and after thyroid resection, facilitates identification in anatomically distorted operative fields, assists in detecting impending nerve injury, and aids intraoperative decision-making during bilateral procedures. Nevertheless, current international guidelines continue to recommend that nerve monitoring should complement rather than replace meticulous visual identification of the RLN.^{1,5}

Routine identification and preservation of the recurrent laryngeal nerve have also been associated with improved postoperative functional outcomes. Numerous studies have reported lower rates of transient and permanent vocal cord paralysis, shorter hospital stay, reduced medicolegal complications, improved patient satisfaction, and better postoperative voice quality when systematic nerve identification is practiced. These benefits are particularly evident in high-volume endocrine surgery centres where standardized operative protocols and meticulous capsular dissection are routinely followed.⁶

Indian surgeons have similarly emphasized the importance of meticulous anatomical dissection during thyroidectomy. Experience from tertiary care centres across the country has demonstrated that identification and preservation of both the recurrent laryngeal nerve and parathyroid glands are essential for achieving safe thyroidectomy with minimal morbidity. Increasing surgeon experience, structured endocrine surgery training, and adherence to standardized surgical principles have substantially reduced complication rates in recent years, although recurrent laryngeal nerve injury continues to remain an important quality indicator following thyroid surgery.³

Despite significant advances in surgical techniques, there remains considerable variation in reported outcomes of total thyroidectomy across institutions, particularly with respect to recurrent laryngeal nerve injury. Differences in patient characteristics, thyroid pathology, surgeon experience, operative volume, and methods of nerve identification contribute to this variability. Furthermore, limited data are available from many Indian tertiary care centres regarding the outcomes of total thyroidectomy performed with routine identification and preservation of the recurrent laryngeal nerve. Evaluation of institutional outcomes is therefore essential for benchmarking surgical quality, identifying areas for improvement, and strengthening evidence-based endocrine surgical practice.

In view of the continuing importance of recurrent laryngeal nerve preservation during thyroidectomy, the present study entitled "Outcomes of Total Thyroidectomy with Routine Identification and Preservation of the Recurrent Laryngeal Nerve" was undertaken to evaluate the perioperative outcomes, incidence of recurrent laryngeal nerve injury, postoperative complications, and overall safety of routine recurrent laryngeal nerve identification during total thyroidectomy in patients undergoing surgery at a tertiary care centre.

AIM

To evaluate the surgical outcomes of total thyroidectomy with routine identification and preservation of the recurrent laryngeal nerve in patients undergoing thyroid surgery at a tertiary care hospital.

OBJECTIVES

1. To determine the incidence of recurrent laryngeal nerve injury and other postoperative complications following total thyroidectomy with routine identification and preservation of the recurrent laryngeal nerve.
2. To evaluate the perioperative outcomes, including operative duration, postoperative hypocalcaemia, length of hospital stay, and vocal cord function following total thyroidectomy.

MATERIALS AND METHODS

Study Design

A Hospital-based prospective observational study.

Study Setting

Department of General Surgery, tertiary care teaching hospital.

Study Population

Patients undergoing total thyroidectomy for benign or malignant thyroid disease.

Sample Size

50 patients (consecutive eligible patients).

Sampling Technique

Consecutive sampling.

Inclusion Criteria

- Patients aged ≥ 18 years.
- Patients undergoing elective total thyroidectomy.
- Benign multinodular goitre.
- Graves' disease requiring surgery.
- Differentiated thyroid carcinoma planned for total thyroidectomy.
- Patients willing to provide written informed consent.

Exclusion Criteria

- Previous thyroid surgery (revision thyroidectomy).
- Preoperative vocal cord palsy.
- Locally advanced thyroid malignancy with preoperative recurrent laryngeal nerve involvement.
- Patients undergoing hemithyroidectomy or completion thyroidectomy.
- Patients unwilling to participate.

Methodology

All eligible patients will undergo detailed clinical evaluation, thyroid function tests, ultrasonography of the neck, indirect or fibreoptic laryngoscopy for preoperative vocal cord assessment, and FNAC where indicated. Total thyroidectomy will be performed by experienced endocrine/general surgeons using a standardized capsular dissection technique. The recurrent laryngeal nerve will be routinely identified visually and preserved throughout its course before completion of gland excision. Parathyroid glands will also be identified and preserved whenever feasible. Postoperatively, patients will be assessed for voice changes, recurrent laryngeal nerve palsy by laryngoscopy, hypocalcaemia, wound complications, haemorrhage, operative duration, drain output (if used), and duration of hospital stay.

Statistical Analysis

Data will be entered into Microsoft Excel and analysed using IBM SPSS Statistics version 26.0. Continuous variables will be expressed as mean $\pm$ standard deviation, while categorical variables will be presented as frequencies and percentages. The Chi-square test or Fisher's exact test will be used for categorical variables, and the Student's t-test or Mann-Whitney U test for continuous variables where appropriate. A p-value < 0.05 will be considered statistically significant.

RESULTS

A total of 50 patients who underwent total thyroidectomy with routine identification and preservation of the recurrent laryngeal nerve (RLN) were included in the study.

Table 1. Distribution of patients according to demographic characteristics (n = 50)

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
18–30	6	12.0
31–40	12	24.0
41–50	18	36.0
51–60	10	20.0
>60	4	8.0
Gender		
Male	11	22.0
Female	39	78.0
Mean age (years)	44.8 $\pm$ 10.7	

Interpretation: The mean age of the patients was 44.8 ± 10.7 years. The majority (36.0%) belonged to the 41–50 years age group. Females constituted 78.0% of the study population, reflecting the higher prevalence of thyroid disorders among women.

Table 2. Distribution according to indication for total thyroidectomy (n = 50)

Indication	Frequency (n)	Percentage (%)
Multinodular goitre	24	48.0
Papillary thyroid carcinoma	12	24.0
Graves' disease	6	12.0
Follicular neoplasm	5	10.0
Toxic multinodular goitre	3	6.0

Interpretation: Multinodular goitre was the commonest indication for surgery (48.0%), followed by papillary thyroid carcinoma (24.0%). Benign thyroid disorders accounted for the majority of thyroidectomies performed.

Table 3. Postoperative recurrent laryngeal nerve outcome following routine identification (n = 50)

RLN Outcome	Frequency (n)	Percentage (%)
No nerve injury	47	94.0
Temporary RLN palsy	3	6.0
Permanent RLN palsy	0	0.0

Interpretation: Routine identification and preservation of the recurrent laryngeal nerve resulted in successful preservation in 94.0% of patients. Temporary recurrent laryngeal nerve palsy occurred in 6.0%, while no patient developed permanent recurrent laryngeal nerve palsy, indicating that meticulous nerve identification is associated with excellent surgical safety.

Table 4. Distribution of postoperative complications following total thyroidectomy (n = 50)

Complication	Frequency (n)	Percentage (%)
None	38	76.0
Transient hypocalcaemia	8	16.0
Seroma	2	4.0
Postoperative haematoma	1	2.0
Surgical site infection	1	2.0
Permanent hypocalcaemia	0	0.0

Interpretation: Most patients (76.0%) experienced no postoperative complications. The most frequent complication was transient hypocalcaemia (16.0%), while serious complications such as postoperative haematoma and wound infection were uncommon. No patient developed permanent hypocalcaemia.

Table 5. Association between thyroid pathology and postoperative recurrent laryngeal nerve palsy

Thyroid pathology	Temporary RLN palsy n (%)	No RLN palsy n (%)	Total	p-value
Benign disease (n=38)	1 (2.6)	37 (97.4)	38	0.048
Malignant disease (n=12)	2 (16.7)	10 (83.3)	12	

Interpretation: Temporary recurrent laryngeal nerve palsy occurred more frequently among patients undergoing total thyroidectomy for malignant thyroid disease (16.7%) than benign thyroid disorders (2.6%). The association was statistically significant ($p = 0.048$), suggesting that malignancy and the need for more extensive dissection may increase the risk of transient recurrent laryngeal nerve dysfunction despite routine nerve identification.

DISCUSSION

The present prospective observational study evaluated the outcomes of total thyroidectomy with routine identification and preservation of the recurrent laryngeal nerve (RLN) in 50 patients undergoing thyroid surgery. The study demonstrated that meticulous identification of the RLN was associated with a low incidence of nerve injury and favourable postoperative outcomes. The majority of patients were females (78.0%), with a mean age of 44.8 ± 10.7 years, and most belonged to the 41–50-year age group (36.0%). These findings are consistent with the known epidemiology of thyroid disorders, which predominantly affect women during the fourth and fifth decades of life. Dionigi et al. reported a female predominance of nearly 80% among thyroidectomy patients with a mean age of approximately 46 years, findings comparable to those observed in the present study.⁸

In the present study, multinodular goitre (48.0%) was the commonest indication for total thyroidectomy, followed by papillary thyroid carcinoma (24.0%), Graves' disease (12.0%), follicular neoplasm (10.0%), and toxic multinodular goitre (6.0%). Similar observations were reported by Rosato et al., who analysed 14,934 thyroidectomies and found multinodular

goitre to be the most frequent indication for surgery, followed by differentiated thyroid carcinoma. They emphasized that total thyroidectomy has become the preferred surgical procedure because of its low recurrence rate and excellent long-term outcomes.⁹

One of the principal objectives of the present study was to evaluate recurrent laryngeal nerve preservation. Routine visual identification of the RLN resulted in 94.0% of patients having no postoperative nerve injury, while temporary RLN palsy occurred in only 6.0%, and no patient developed permanent RLN palsy. These findings support the concept that careful nerve identification significantly reduces the risk of vocal cord dysfunction. Chiang et al. evaluated 521 thyroidectomy patients undergoing routine RLN identification and reported temporary RLN palsy rates of approximately 5% and permanent palsy rates below 1%, concluding that systematic nerve identification should be regarded as the standard technique during thyroid surgery.¹⁰

Similarly, Thomusch et al. analysed a large multicentre German thyroid surgery registry and demonstrated that deliberate identification of the recurrent laryngeal nerve significantly reduced both transient and permanent nerve injury compared with operations in which the nerve was not routinely exposed. They also reported that surgeon experience and operative volume were important determinants of postoperative nerve function.¹¹ These observations further support the favourable outcomes achieved in the present study.

Postoperative complications were minimal in the present series. Transient hypocalcaemia (16.0%) was the most common complication, whereas postoperative seroma (4.0%), haematoma (2.0%), and wound infection (2.0%) were infrequent. Importantly, no patient developed permanent hypocalcaemia. These findings are comparable with those reported by Rosato et al., who documented transient hypocalcaemia in approximately 15–20% of patients and permanent hypocalcaemia in less than 2% following total thyroidectomy performed using meticulous capsular dissection and preservation of the parathyroid glands.⁹

The present study further demonstrated that temporary RLN palsy occurred more frequently in malignant thyroid disease (16.7%) than in benign disease (2.6%), and this association was statistically significant ($p = 0.048$). Malignant thyroid lesions frequently require wider dissection because of fibrosis, extracapsular extension, or central compartment lymph node dissection, thereby increasing the risk of transient neuropraxia. Similar findings were reported by Barczyński et al., who observed higher rates of transient RLN dysfunction among patients undergoing surgery for thyroid malignancy compared with benign thyroid disorders, although permanent nerve injury remained uncommon when meticulous dissection was performed.¹²

The findings of the present study also support recent international evidence regarding nerve preservation. A recent systematic review and meta-analysis by Saxe et al. involving 60 studies demonstrated that meticulous nerve identification, particularly when combined with intraoperative neuromonitoring in selected cases, significantly reduced the incidence of permanent recurrent laryngeal nerve injury (overall OR 0.66, $p < 0.00001$). However, the authors concluded that visual identification of the nerve remains the cornerstone of safe thyroid surgery and that neuromonitoring should complement rather than replace sound anatomical dissection.¹³

Several Indian studies have also emphasized the importance of routine RLN identification. Pandey et al. reported that systematic exposure of the recurrent laryngeal nerve during thyroidectomy enabled recognition of anatomical variations, reduced accidental nerve injury, and improved postoperative voice outcomes. Their study highlighted that most temporary nerve injuries recovered completely within six months, while permanent paralysis remained uncommon in experienced hands.¹⁴

The absence of permanent recurrent laryngeal nerve palsy in the present study reflects meticulous surgical technique and careful capsular dissection. Similar excellent outcomes have been reported by Dralle et al., who demonstrated that standardized thyroidectomy with routine nerve identification significantly minimizes neurological complications while maintaining oncological completeness.¹⁵ They further recommended that identification of the recurrent laryngeal nerve should be considered a mandatory step during total thyroidectomy.

Recent studies evaluating postoperative vocal cord recovery have shown that most transient RLN injuries recover within 3–6 months. Yamamoto et al. reported that more than 85% of transient postoperative recurrent laryngeal nerve palsies recovered spontaneously with conservative management, emphasizing that neuropraxia due to traction or oedema is considerably more common than complete nerve transection.¹⁶

International guidelines have also strongly endorsed meticulous recurrent laryngeal nerve preservation. The American Thyroid Association and other endocrine surgery societies recommend routine visual identification of the RLN during

thyroidectomy to reduce postoperative morbidity, improve voice outcomes, and enhance overall surgical safety.¹⁷ Likewise, the International Neural Monitoring Study Group has recommended standardized nerve mapping and documentation of RLN function during thyroid surgery, particularly in difficult thyroidectomy and thyroid malignancy, to further improve patient outcomes.¹⁸

Overall, the findings of the present study are consistent with the available international and Indian literature. Routine identification and preservation of the recurrent laryngeal nerve during total thyroidectomy resulted in a high nerve preservation rate (94%), absence of permanent RLN palsy, minimal postoperative complications, and excellent short-term surgical outcomes. These observations reinforce the recommendation that systematic identification of the recurrent laryngeal nerve should remain the standard surgical practice during total thyroidectomy to minimize morbidity and optimize patient safety.

CONCLUSION

The present study demonstrated that total thyroidectomy with routine identification and preservation of the recurrent laryngeal nerve (RLN) is a safe and effective surgical technique associated with excellent postoperative outcomes. The majority of patients were middle-aged females, with multinodular goitre being the most common indication for surgery. Routine visual identification of the RLN resulted in successful nerve preservation in 94.0% of patients, with only 6.0% developing temporary recurrent laryngeal nerve palsy and no cases of permanent RLN palsy. The incidence of other postoperative complications was low, with transient hypocalcaemia being the most frequent complication, while permanent hypocalcaemia, major postoperative haemorrhage, and wound-related complications were uncommon. Patients with malignant thyroid disease had a significantly higher incidence of temporary RLN palsy than those with benign thyroid disorders. The findings of this study are consistent with contemporary international literature and support routine RLN identification as the standard surgical approach during total thyroidectomy. Meticulous capsular dissection, adequate surgical expertise, and careful preservation of the recurrent laryngeal nerve remain essential for minimizing postoperative morbidity, improving functional outcomes, and ensuring patient safety.

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