



RETROGRADE IDENTIFICATION OF RECURRENT LARYNGEAL NERVE IN THYROID SURGERIES

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ABSTRACT

Introduction: Identification of the recurrent laryngeal nerve and preserving nerve integrity during surgery is the key to prevention of injury to the nerve and avoid post-operative palsy. Several anatomical landmarks have been described in relation to the recurrent laryngeal nerve. The most reliable anatomical landmark still remain questionable. **Methods:** It was a Randomised Control Trial study. 60 patients with surgical thyroid disease undergoing thyroid surgery were included in the study. Two techniques of identification of recurrent laryngeal nerve were compared. Comparison of the two techniques were done in terms of 3 parameters : 1) successful identification of nerve during surgery 2) post-operative vocal cord status checked 24 hours after surgery and 3) time taken in identification of nerve. **Results:** Total number of recurrent laryngeal nerve at risk in the study was 76 with total number of patients being 60. Percentage of nerve identified in case of conventional and retrograde technique were 89.5% and 94.7% respectively. Vocal cord palsy was noted in 6 nerve in group B and 2 palsies were noted in group A. The difference in the time taken using these techniques were found to be statistically significant. **Conclusion:** Both the techniques have their own advantages and disadvantages. In order to utilize the maximum advantage of each technique, prior case selection has to be done.

KEYWORDS : Cricothyroid joint; Recurrent laryngeal nerve; retrograde technique; surgical landmarks; thyroid surgeries

INTRODUCTION

Surgical management of benign and malignant thyroid disease involves undertaking either total or hemithyroidectomy, subtotal thyroidectomy or more rarely isthmusectomy. Complications such as bleeding, hypothyroidism and RLN injury consists of the majority of all the complications associated with thyroid surgery.¹

The incidence of recurrent laryngeal nerve ranges from 0.5% (permanent) to 5% (temporary).^{2,3,4,5} The course of recurrent laryngeal nerve can be described in relation to various structures : trachea-oesophageal groove, inferior thyroid artery, Berry's ligament, tubercle of Zuckerkandl, cricothyroid joint. These relationships of the nerve with various structures have shown wide variability.^{6,7}

Because of the numerous variability in relation to the neurovascular structure, identification may be difficult in some cases. The cricothyroid joint is a relatively constant anatomical landmark in relation to the recurrent laryngeal nerve. Using a more reliable landmark for identification of the nerve and ensuring identification using different landmarks are important to prevent nerve injury.

METHODS

Randomised control trial study. The study was conducted in the Department of Otorhinolaryngology and Head and Neck Surgery, Maulana Azad Medical College and associated Lok Nayak Hospitals, New Delhi for a period of two years. 60 patients with benign and malignant thyroid surgical disease undergoing thyroid surgeries were taken for study with total number of 76 nerves at risk. Patients with deranged thyroid profile, with history of previous neck irradiation, with history of previous laryngeal surgeries, thyroid or anterior neck surgeries, patients with pre-operative vocal cord palsies excluded.

Indirect laryngoscopic assessment was done prior to surgery and repeated 24 hours and 48 hours post-surgery.

Cases were divided into two groups: group A and group B randomly. Randomisation was done using random permuted blocks and group assignments were sealed in sequentially opaque envelopes which were opened immediately before surgery. In group A, recurrent laryngeal nerve was identified by retrograde technique using cricothyroid joint

as landmark. In group B, recurrent laryngeal nerve was identified using inferior thyroid artery as the landmark and termed the technique as conventional technique.

Time taken for identification of nerve as an indicator for ease of surgery was taken as soon as thyroid gland was adequately exposed after retracting or cutting the strap muscles. [fig 1] The end point time was taken as the moment the nerve was identified.

Statistical analysis done using SPSS software.

OBSERVATION AND RESULTS:

3 types of thyroidectomies were performed : Hemithyroidectomy, total thyroidectomy without neck dissection, total thyroidectomy with neck dissection.

Intraoperative Recurrent Laryngeal Nerve Identification

Total 76 RLN were included in the study with total number of 38 nerves exposed in each group. Number of unidentified nerve in group A was 2 (5.3%) and in group B was 4 (10.5%)

Time Taken For Identification Of Nerve

Mean time taken for identification of nerve was 34.51 ± 8 minutes in group A whereas in group B it was 39.50 ± 6.89 minutes.

Post Operative Vocal Cord Status

In group A, 6 out of 38 nerves and 2 out of 38 nerves in group B had post-operative palsy.

Factors Affecting Time Taken For Identification Of Nerve

Size of lesion : the average time taken was found to be maximum in cases with lesion size > 5 cm (42.19 ± 8.38 min) and minimum with lesion size < 3 cm (33.35 ± 6.9 min).

Nature of lesion : the mean time taken in case of benign lesion was 37.10 ± 7.68 min and 36.11 ± 9.35 min in case of malignant lesions

Technique of identification : the mean time taken using conventional technique was 39.50 ± 6.89 minutes and by conventional technique it was 34.51 ± 8 minutes.

Factors Affecting Post Operative Vocal Cord Status

Size of lesion: no significant correlation was found between the size of lesion and the post-operative vocal cord status.

Nature of lesion: number of nerves associated with a malignant pathology was 13 out of which 4 developed palsy post operatively. The correlation between nature of lesion and post op vocal cord status was established and p value was found to be 0.025.

Technique of identification: 2 nerves developed palsy in conventional group and 6 nerves developed palsy in retrograde group, examined post 24 hours of surgery.

Co-Relation between Identification of Nerve and Post-Operative Vocal Cord Status

Out of 6 nerves which could not be identified, 3 developed palsy whereas 5 out of 70 nerves which were identified developed palsy. The difference in the two was found to be statistically significant ($p=0.001$).

Various Factors Affecting the Parametres in the Study : As shown in table 1. **Table 1**

FACTORS		Correlation (p value)
Time taken	Size of lesion	0.727
	Nature of lesion	0.002
	Technique of identification	0.007
Post op vocal cord status	Size of lesion	0.759
	Nature of lesion	0.025
	Technique of identification	0.262

DISCUSSION

Recurrent laryngeal nerve injury is one of the complications of thyroid surgery. Identification and preservation of RLN is important to prevent injury to the RLN. This study was designed to compare two techniques for identification of RLN and included both benign and malignant thyroid surgical cases.

Size Of Lesion And Effect On Recurrent Laryngeal Nerve Identification

In our study, no significant correlation between the tumour size and effect on the identification of RLN and vocal cord status could be established. A large thyroid can compress the trachea and cause pressure symptoms. As long as the nerve is not involved by the disease, tumour size does not have any bearing in the overall function of the nerve. However, difficulties arise during the dissection of the gland if it is very bulky and causes unwanted stretching of the nerve.

Recurrent Laryngeal Nerve Identification Technique and Post Operative Vocal Cord Status

Identification of the RLN is the mainstay in avoiding injury to the nerve by ensuring the integrity of the nerve.^{2,3} The overall RLN palsy rate in the study was 10.5%, calculated in terms of number of nerves (8 out of total 76 nerves). We find it more logical to calculate the rate of palsy in terms of nerve rather than number of patients, as a single patient can have total thyroidectomy which puts both the RLN at risk. Out of this figure, 5 nerves are associated with malignancy in which either we had to sacrifice the nerve or the nerve was not identifiable due to altered anatomy. If we exclude the 5 cases, we get a RLN palsy rate of 4.2%.

The cases were divided into two groups: Group A (RLN was identified by retrograde technique) and Group B (RLN was identified by conventional technique). Out of 38 nerves at risk in group A, 36 nerves were identified (94.8%). The only condition in which the nerve was not identified was in case of extra-thyroidal infiltration of tumour. A high identification rate could be because of the cricothyroid joint taken as the anatomical landmark for the identification of the RLN. Despite identification of the nerve there were cases in which post operative vocal cord palsy was noted. There were 6 cases of palsy despite identification. 4 nerves were associated with malignant lesion and nerves were found involved or surgical plane was absent. 2 nerves were associated with benign lesion and were identified despite of which they developed palsy. One reason for this can be due to distal branching and identification of only one of the terminal branches [fig 2].

Another reason could be due to stretch injury while rotating the thyroid medially from its cervical attachment. Therefore one should not apply excessive traction while searching for the nerve in distal segment. Another possible reason could be due to thermal injury while using

electro-cautery for achieving hemostasis near the vicinity of the nerve. In the study we found that the ease of identification of recurrent laryngeal nerve was easier using retrograde technique compared to conventional technique. However, the difference was not significant.



Fig 1 shows thyroid gland after exposure



Fig 2 show distal branching of recurrent laryngeal nerve

According to **Randolph**, the lateral approach (in our case, conventional technique) is applicable to most cases except in case of large cervical or substernal goitre or previous surgery.⁸

The time taken in identifying the nerve was more in group B. One reason could be repeated oozing around the region of inferior thyroid artery and hence more time taken in achieving a clear field for further dissection. Another reason could be due to more extensive dissection involved in this technique.

Before coming to a conclusion regarding the incidence of recurrent laryngeal nerve palsy we should consider the nature of disease also, as malignant disease has more propensity to involve the nerve thereby rendering identification difficult.

The incidence of RLN palsy reported in literature ranges from 1% to 12%, with temporary nerve palsy being more common than permanent palsy. The most important risk factor for postoperative RLN palsy was malignant thyroid disease.^{9,10,11,12,13}

The time taken in identifying the recurrent laryngeal nerve was another parameter which was measured in our study. The only significant factors were the size of lesion and technique adopted. Longer time was taken when the lesion size was greater than 5 cm and those with retrosternal extension. In these cases more dissection was required and a large thyroid often obscures the tracheoesophageal groove. The mean time taken in these cases was 42.19 ± 8.38 minutes. The time taken was lesser in lesions having size less than 3 cm (33.35 ± 6.9) minutes.

The technique used in identifying the nerve was another significant factor on the time taken. The time taken was more in group B compared to group A. The mean time taken in group A was 34.51 ± 8 minutes and in group B it was 39.50 ± 6.8 minutes. The difference between the two was significant ($p=0.007$). One study conducted by **Miyauchi et al** compares the time taken in identifying the RLN when identified in tracheo-oesophageal groove in Beahr's triangle and when identified in RLN triangle.¹⁴ They noted a time of 9.6 ± 16.6 seconds and 31.2 ± 24.4 seconds when identified in Beahr's triangle and RLN triangle respectively. If we compare the duration between their study and current study, the time difference is a large value. They noted the time after identification of the landmarks for RLN till just the identification of RLN. They did not note the time till the entire dissection of the nerve. In our study longer time was taken because we start noting the

time just after exposure of the gland.

Chiang et al conducted two studies using the same technique. They found a 5.1% and 0.9% temporary and permanent RLN injury. With same technique, they made use of IONM(intraoperative neuromonitoring) and found a 5.1% and 0.6% temporary and permanent RLN injury.^{12,15} **Veisellar et al** in their study comparing the two techniques noted no post operative vocal cord palsy using the retrograde technique. 1.5% post operative vocal cord palsy was noted in cases in which nerve was identified in tracheo-esophageal groove and no nerve injury was seen in those cases where retrograde technique was used.¹⁶ **Sykes et al** conducted a study on identification of the RLN in cricothyroid joint. They found a 2.2% temporary palsy rate and 0.4% permanent palsy rate. They also confirmed that identifying the nerve by this technique does not increase the risk of other operative complications including hypocalcaemia, primary haemorrhage or wound complication.¹⁷

Out of 4 nerves which could not be identified one nerve was involved by tumour other two cases had retrosternal extension of tumour.

The time taken in identifying the nerve was more in group B. One reason could be repeated oozing around the region of inferior thyroid artery and hence more time taken in achieving a clear field for further dissection. Another reason could be due to more extensive dissection involved in this technique. There was no significant difference between the two studies if post-operative vocal cord status is concerned ($p=0.262$). A significant difference was found in the time taken for identification of the nerve ($p=0.007$).

CONCLUSION

Both the techniques of RLN identification have its advantages and disadvantages. Retrograde technique is better for quick identification of RLN due to use of a constant anatomical landmark. It can be used for difficult large thyroid lesions in which the Conventional technique proves to be difficult. One should be careful about the distal branching pattern of the nerve (figure 2). The sample size of the study was too small to make a strong statement for either of the techniques. Further studies can be done with a larger sample size and with stratified patient selection.

Summary

- This study compares two techniques of identification of recurrent laryngeal nerve using two different surgical landmarks; one using the cricothyroid joint (retrograde technique) and the other using inferior thyroid artery (conventional technique).
- The parameters compared were: rate of recurrent laryngeal nerve identification, postoperative vocal cord palsy and time taken for identification of the nerve.
- Both benign and malignant surgical cases were included.
- The total recurrent laryngeal nerve palsy rate in our study was 10.2%.
- Retrograde technique was found to be associated with higher rate of nerve identification (94.7%) compared to conventional technique (89.5%). the difference was not statistically significant (p value=0.674)
- Retrograde technique was found to have higher rate of post-operative vocal cord palsy (15.8%) compared to conventional technique (5.3%). (p value=0.262)
- The difference in time taken between the two technique was statistically significant. (p value=0.007)

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