

A Comparative Study on Functional Status of Recurrent Laryngeal Nerve with or without Exploration of the Nerve during Thyroid Surgery in a Tertiary Care Centre of Eastern India

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ABSTRACT

BACKGROUND

From the last century to modern days, there has been a paradigm shift in the field of thyroid surgery. Initially what was a dreadful surgery with multi fold serious complications, now with the advent of modern surgical technique (bipolar to nerve monitoring & emerging use of microscope), and better knowledge of anatomy, it has become one of the most frequently performed surgeries worldwide with very few complications. In spite of all these, postoperative complications like recurrent laryngeal nerve (RLN) palsy is still mostly feared by surgeons and still is one of the most frequent complications.

METHODS

This was a prospective nonrandomised controlled trial conducted among 60 study participants in the Department of Otorhinolaryngology and Head & Neck Surgery, of a tertiary care centre in West Bengal from July 2016 to June 2018. In this study two different surgical techniques were applied in two patient groups. In one group subcapsular dissection of thyroid gland was done without exploration of recurrent laryngeal nerve course in neck; and in another group, the complete course of the aforesaid nerve in the neck was explored and preserved. The postoperative functional status of RLN was assessed by fiberoptic laryngoscopy immediately after recovery from anaesthesia and in postoperative follow ups. We wanted to compare the outcome (in terms of functional status of RLN) in these two groups.

RESULTS

3 patients (10 % cases) of nerve palsy were seen among 30 patients of subcapsular dissection group, whereas only one case (3.3 %) of nerve palsy was seen amongst 30 cases of complete exploration of recurrent laryngeal nerve.

CONCLUSIONS

Thyroidectomy with meticulous exploration of the recurrent laryngeal nerve was found to be a superior method as compared to the subcapsular dissection.

KEYWORDS

Recurrent Laryngeal Nerve, Subcapsular Dissection, Complete Exploration, Thyroidectomy

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BACKGROUND

Talking of the dreaded postoperative complications of thyroid surgeries, incidence of recurrent laryngeal nerve palsy seeks attention. Symptomatic recurrent laryngeal nerve palsy not only leads to significant voice and airway problems but also causes impairment of quality of life. Mechanisms of RLN injury include stretch or traction, compression or crush (by haematoma, or ligature entrapment) and lack of identification due to poor anatomical knowledge regarding course of RLN in neck and its variable branching pattern¹. One way to ensure the integrity and function of the recurrent laryngeal nerve (RLN) is to explore the entire course of RLN in neck during thyroidectomy. There are studies to support this school of thought that routine complete exposure of recurrent laryngeal nerve minimises chances of injury.^{2,3,4} In this method the nerve is identified in the region of thoracic inlet in the recurrent laryngeal nerve triangle i.e. Lore's triangle⁵ first and then all branches are traced after wards & entire course is exposed. There is another school of thought that exposure itself may increase the rate of RLN palsy because of mechanical alteration or impairment of the nutrition by the surrounding tissue dissection so routine identification and exploration of RLN course in neck has no benefit in preserving its integrity⁶. The recurrent laryngeal nerve can be preserved below the thyroid capsule by doing subcapsular dissection and tying the capsular branches of inferior thyroid artery only thus leaving behind the RLN intact. Moreover, preservation of parathyroid gland is much easier in subcapsular dissection.^{7,8} We wanted to compare the outcome (in terms of functional status of RLN) in the two study groups.

METHODS

A prospective nonrandomised controlled trial was conducted in the Department of ENT and Head & Neck Surgery, of a tertiary care centre in West Bengal over a study population of 60 patients attending ENT OPD. The patients diagnosed as cases of thyroid swelling requiring surgeries (in the form of hemithyroidectomy or total thyroidectomy) were selected based on inclusion and exclusion criteria. The study was conducted from July 2016 to June 2018. We included 60 patients in our study because we had previous records stating that average 75 thyroidectomy operation were performed each year in our department. Patients were distributed into 2 groups with 30 patients in each group. We blindly placed every alternative patient attending our OPD in each group.

Inclusion Criteria

1. Patients with benign thyroid swelling who needed operation.
2. Patients with malignant thyroid swelling.
3. Euthyroid state during surgery.

Exclusion Criteria

1. Patients with biochemically hypo and hyperthyroid state.
2. Previous neck dissection.
3. Patients who have undergone radiation preoperatively.
4. Thyroid swelling in pregnant woman.
5. Puberty goiter.
6. Diagnosed case of medullary carcinoma (CA) thyroid.
7. Diagnosed cases of anaplastic CA thyroid.
8. The cases which needed completion thyroidectomy.

Parameters to Be Studied

Both pre & post operatively functional status of the recurrent laryngeal nerve has been assessed by – indirect laryngoscopy & fibre-optic laryngoscopy. If any abnormality of movement of vocal cord (palsy) were found it was followed up for next 6 months to ascertain whether the palsy was transient or permanent in nature.

Operative Technique

All the operations were done using standard operative technique under general anaesthesia. The patient was positioned with the neck extended. The surgical field was draped from sternal angle up to the chin. Standard Kocher's incision was made. The incision was carried out through the skin and the subcutaneous layer through the platysma muscle. The two skin flaps were elevated by dissecting at subplatysmal level away from the strap muscles upward to the hyoid bone and downward up to the sternal notch. Strap muscles were split in the midline. First sternohyoid and then sternothyroid were freed from thyroid gland. By predominantly blunt dissection, the anterior aspect of the thyroid gland was exposed. If necessary, the strap muscles may be divided to enhance the exposure.

Subcapsular dissection refers to the development of a plane between the true thyroid capsule and the false capsule (pretracheal fascia). The tertiary branches of the inferior thyroid artery were ligated individually directly on the surface of the thyroid gland. This method, which was followed in group A patients is widely practiced today and considered to minimise surgical damage to both the parathyroid glands and the RLN shown by many studies.⁹ Truncal ligation of the inferior thyroid artery was avoided. Dissection of thyroid gland was started by incising the false capsule over the gland directly as the next step of strap muscle retraction and completed by strictly keeping in the plane between the pretracheal fascia and thyroid true capsule keeping close to the gland (hugging) and recurrent laryngeal nerve was not identified.

Complete exposure of RLN in group B patients was done. The RLN was identified and thoroughly dissected starting from the thoracic inlet using the RLN triangle described by Lore et al.⁵ made by trachea (medial wall) carotid artery (lateral wall) lower edge of retracted inferior pole of thyroid (superior base) an apex at thoracic inlet then it was dissected and traced through its entire course up to entry into larynx identifying all its branches and if not found in this way then possibility of non-recurrent should be kept in mind. Special attention was given at following vulnerable sites

while exposing the RLN (a) tubercle of Zuckerkandl^{10,11} (b) ligament of Berry (c)¹² where the nerve crosses inferior thyroid artery.^{13,14} Next using Langenbeck retractors, lateral retraction of the upper pole of the thyroid lobe was applied in order to open up the avascular space between the lobe and the cricothyroid muscle, thus exposing the external branch of the superior laryngeal nerve. The superior vessels were usually ligated with 2 transfixing sutures keeping away from the nerve.

Delivery of thyroid gland into the wound mostly proceeded by blunt dissection which was enhanced by continuous traction to already mobilised superior pole.

The transection of the vessels going towards lower pole was done and gland was mobilised. But in cases where exploration of the RLN was being done the lower pole vessels were ligated after the exploration of RLN was completed; taking proper precaution.

Then by blunt dissection, the isthmus was freed from the underlying trachea and divided between transfixing ligatures. In total thyroidectomy the division of the isthmus was not done, and same procedure repeated on the other lobe. During the final steps of the thyroidectomy, when lobes were dissected away from the trachea, posterior suspensory ligament (Berry) usually dealt with sharp dissection. The use of thermal dissection device is best avoided at this step as there was potential for thermal injury of the RLN which lies in close proximity to the ligament of Berry.

A suction drain was placed under the muscle layer and in paratracheal gutter after proper fixation and wound closed in layers. All the patients were followed up using standard treatment protocol. Status of RLN was assessed just after surgery then weekly for one month. Assessment of RLN was done in every monthly follow up to six months postoperatively.

Statistical Analysis

The data was analysed by online social science statistics website and Microsoft Excel. Chi square test was done using 2 x 2 contingency table and P value was also calculated. P-value was significant if P was < .05.

RESULTS

Total number of 60 patients were divided in two group consisting of 30 patients in each group. The group A had undergone subcapsular dissection without exploration of RLN whereas group B has undergone complete exploration of RLN. The results were as follows-

	Subcapsular Dissection	Complete Nerve Exploration	Total
Male	7	9	16 (26.67 %)
Female	23	21	44 (73.33 %)
M:F ratio	1:3.3	1:2.3	1:2.75

Table 1. Distribution According to Sex

(Table 1) The chi-square statistic is 0.3409. The P-value is .559305. Not significant at P < .05. The chi-square statistic

with Yates correction is 0.0852. The P-value is .770335. Not significant at P < .05.

Overall and in both the groups, number of male patients were less than females but the ratio of male: female is little higher in complete exposure group.

Age Distribution	Subcapsular Dissection (N = 30)	Complete Nerve Exploration (N = 30)
11 - 20 yrs.	2	1
21 - 30 yrs.	3	6
31 - 40 yrs.	12	9
41 - 50 yrs.	8	9
51 - 60 yrs.	4	2
61 - 70 yrs.	1	3

Table 2. Distribution According to Age

(Table 2) It was observed that maximum no of cases done by subcapsular dissection belonged to the age of 31 to 50 years similar result was found in complete exploration method also.

Side	Subcapsular Dissection (N = 30)	Complete Nerve Exploration (N = 30)
RT sided	13 (hemi) + 7 (total) = 20	12 (hemi) + 6 (total) = 18
LT sided	10 (hemi) + 7 (total) = 17	12 (hemi) + 6 (total) = 18

Table 3. Distribution According to Laterality

(Table 3) The chi-square statistic is 0.1202. The P-value is .728863. Not significant at P < .05. The chi-square statistic with Yates correction is 0.0126. The P-value is .910556. Not significant at P < .05.

Table 3 shows that operation of thyroid was done more or less equal for both sides in both the groups.

	Hemithyroidectomy	Total Thyroidectomy
Subcapsular dissection	23	7
Complete nerve exploration	24	6

Table 4. Distribution According to Type of Surgery

(Table 4) The chi-square statistic is 0.0982. The P-value is .754001. Not significant at P < .05. The chi-square statistic with Yates correction is 0. The P-value is 1. Not significant at P < .05. Table 4 shows that total no of data has been divided into two major groups according to the type of surgery they have undergone. Here in both groups hemithyroidectomy was done in most of the cases.

	RLN Palsy
Subcapsular dissection	3 (10 %) N = 30 cases
Complete nerve exploration	1 (3.3 %) N = 30 cases
Total cases	4 (6.67 %) N = 60 cases

Table 5. Distribution of Nerve Palsy among the Total No. of 60 Cases

(Table 5) Total 3 (10 %) cases of permanent nerve injury occurred during subcapsular dissection of thyroid, whereas only 1 (3.3 %) case of permanent RLN injury was encountered in cases where complete exploration of nerve was done. If we consider total cases (N = 60) we got 4 patients with nerve palsy which was about 6.6 %. (Table 5).

Side	RLN Palsy
RT sided	3 (75 %)
LT sided	1 (25 %)

Table 6. Distribution According to the Side of Nerve Injury

Out of total 4 cases of permanent recurrent laryngeal nerve injury 3 cases (75 %) of palsy were seen on the right side and one case (25 %) of RLN palsy was found on left side (Table 6).

DISCUSSION

Symptoms of unilateral recurrent laryngeal nerve palsy may range from total asymptomatic to severe hoarseness of voice, dysphagia, sudden coughing paroxysm, dyspnoea on exertion etc. RLN palsy may be of many types -

- Transient (50 – 80 %) or permanent
- Unilateral or bilateral
- Partial or complete transection

Complete unilateral injury to RLN causes immediate vocal fold palsy and acute loss of ability to phonate, paradoxical uncoordinated movements of vocal cords leading to general laryngeal dysfunction in long term. Unilateral RLN palsy is usually well tolerated but it can be life threatening if associated with superior laryngeal nerve injury which may cause aspiration pneumonia especially in elderly individual. Whereas bilateral RLN nerve injuries lead to more dreadful consequences like severe upper airway obstruction requiring urgent tracheostomy. Hence, various dissection techniques have been developed by surgeons during the last few decades aiming preservation of anatomical integrity and functional integrity of RLN. Some prefer to identify the nerve in the region of thoracic inlet in the Lore's triangle⁵ which is made by-apex in thoracic inlet, medial border by carotid artery, lateral border by retracted strap muscles. Here recurrent laryngeal nerve is identified first and then all branches are traced after wards & entire course is exposed. It is believed that lack of identification of RLN in its entirety may increase chance of inadvertent injury at various anatomical landmarks such as-

1. While crossing inferior thyroid artery-ligation of inferior thyroid artery branches may lead to injury to nerve specially while using electrocautery
2. At the entry point into the larynx-nerve may get injured while controlling bleeding at ligament of Berry.
3. Extra laryngeal branching-nerve may branch extra laryngeally 3 - 4 cm below inferior border of cricoid, if the main trunk in lower neck not identified before and mostly anterior branch get injured while doing subcapsular dissection^{15,16}

In contrary to that concept some believe in minimal handling of RLN. The RLN can be preserved below the thyroid capsule by doing subcapsular dissection and tying the capsular branches of inferior thyroid artery only thus leaving behind the RLN intact. A study by Procaccianti et al.¹⁷ showed dissection of RLN course inevitably results in more bleeding hence, during haemostasis chance of inadvertent injury to the nerve increases proportionately.

In this study total 60 patients with thyroid swelling (requiring surgery) were studied as per the inclusion and

exclusion criteria. Half of them (N = 30) underwent subcapsular dissection without nerve (RLN) exploration and rest of them (N = 30) underwent identification and complete exploration of RLN course in neck. Among the total no of study population (N = 60), 44 (73.33 %) cases were females and 16 (26.67 %) cases were males as we know goitre has female predisposition. In the year of 1984 a study was conducted on the prevalence of thyroid disorders in a middle-aged female population, with special reference to the solitary thyroid nodule by Christensen SB et al.¹⁸ among the 477 middle aged woman of non-endemic area 178 (37.3 %) were diagnosed with goitre. In the present study also most of the cases were found to belong in the age group of 31 to 50 yrs. In this study 10 % cases of nerve injury (in terms of permanent palsy) were made during subcapsular dissection and only 3.3 % nerve injury were made during complete exploration of recurrent laryngeal nerve. A recent study in 2013 done by Chenling Shen et al. over 10,100 patients spanning total 6 years has showed that only 2 % nerve injury was encountered in cases of nerve identification and exploration and 10.7 % nerve injury was observed in those cases where nerve was not identified.¹⁹ The incidence of nerve injury in both the methods of our study are near as the previous research workers.

The next observation which has been made in this study was maximum no of RLN palsy occurred on right side (3 cases or 75 %) and only one case (25 %) of nerve injury was on the left side. The high incidence of nerve injury on the right side is due to asymmetry of course of RLN where right one passes obliquely (45 degree) over the tracheo-oesophageal groove which makes it more vulnerable to injury. Our study corroborates with the study of Serpell JW et al.²⁰ who showed in his study that significant difference exists in recurrent laryngeal palsy if side of palsy is concerned. In his study the rate of palsy in left side was 0.9 % whereas right sided RLN palsy was 1.8 % almost double than left side.

CONCLUSIONS

In our study, we found that incidence of thyroid swelling was more in female patients. Next observation was that the incidence of injury to the recurrent laryngeal nerve was more in thyroidectomy by subcapsular dissection. Meticulous exploration of the recurrent laryngeal nerve with special attention to the vulnerable anatomical sites mentioned already preserves the integrity of nerve. Thyroidectomy with meticulous exploration of the nerve is a superior method than the subcapsular dissection. Incidence of right sided RLN injury was much more due to the anatomical asymmetry of the nerve. Further large-scale studies are recommended.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

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