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A Clinical Study on Recurrent Laryngeal Nerve Injury in Patients Undergoing Thyroid Surgery

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Abstract

Background: This study was conducted to evaluate the incidence of recurrent laryngeal nerve injury in patients undergoing thyroidectomy and identify the factors influencing recurrent laryngeal nerve injury in patients undergoing thyroidectomy. **Material and Methods:** This was a hospital based prospective study conducted among 50 patients who underwent thyroid surgery at the PSG Institute of Medical Sciences and Research Centre, from November 2018 to August 2020, after obtaining clearance from institutional ethics committee and written informed consent from the study participants. **Results:** The chi-square test showed that there was a significant association with respect to histopathology and palsy and between clinical diagnosis and palsy; it was also found that there was a significant association between identification of nerve and palsy. The independent 't' test results proved that there was a significant difference in mean of haemorrhage with respect to the palsy. The chi-square test showed that there was a significant association between experience of surgeon and palsy and it also proved that there was a significant association between histopathology and paresis. **Conclusion:** Disease factors including solitary/multinodular goiter, malignancy etc., technical factors like blood loss, nerve identification, surgeons experience etc., and the factors like non-identification of nerves during surgery, significant blood loss, malignancy, Graves' disease, multinodular /diffuse goiter and experience of surgeons (< 5 years) found during the study were the most important factors that influenced the incidence of recurrent laryngeal nerve injury. The importance of identification of nerves during surgery, meticulous technique and surgical experience as the most important factors in preventing injury to recurrent laryngeal nerves during thyroid surgery.

Keywords: Recurrent, Laryngeal, Nerve Injury, Thyroid Surgery.

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Introduction

Thyroidectomy is the most common endocrine surgical procedure. Various complications may arise during thyroidectomy. These are the results of either surgical technique or metabolic disturbances. Primary complications associated with thyroidectomy include haemorrhage, recurrent laryngeal nerve injury, parathyroid insufficiency, superior laryngeal nerve injury, less commonly postoperative seroma and sympathetic nerve injury. The recurrent laryngeal nerve, a branch of vagus nerve1 innervates all intrinsic muscles of the larynx except cricothyroid which is supplied by superior laryngeal nerve. It also supplies sensation to the larynx below the vocal cords. It is the nerve of sixth pharyngeal arch. The existence of RLN was first documented by the physician Galen. There are two recurrent

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laryngeal nerves in the right and left of the body. The right and left nerves are not symmetrical, RIGHT RLN looping under the right subclavian artery and arching upwards whereas LEFT RLN is relatively anterior looping under the aortic arch and travelling upwards.[1-3] Both are identified in the tracheo-oesophagal groove. Injury to recurrent laryngeal nerve is one of the major complications in patients undergoing thyroidectomy. It may occur by severance, ligation, traction or electrocautery injury. According to the studies the incidence of recurrent laryngeal nerve injury is between 0 to 14 %.[2] The recurrent laryngeal nerve is most vulnerable to injury during the last 2-3 cm of its course but also may be damaged if the surgeon is not alert to the possibility of nerve branches and the presence of nonrecurrent laryngeal nerve.[4-6] Mechanisms of injury to the nerve may include complete or partial transection of nerve, traction and handling of the nerve. It can also occur due to contusion, crush, cautery injury, clamping of the nerve, misplaced ligature, and more importantly compromised blood supply. Due to nerve injury there will be vocal cord paresis or paralysis which may be unilateral or bilateral. In unilateral recurrent laryngeal nerve injury, the voice becomes husky because of vocal cords not approximating with each other. Patients will typically present with new onset hoarseness of voice, change in pitch of voice or sometimes noisy breathing. Dysphonia on the 2^{nd} – 5^{th} post-operative day occurs commonly because of edema, whereas injury of the nerve caused by traction and damage of axons may result in dysphonia lasting up to 6 months. Dysphonia lasting after 6 months is commonly permanent and it is caused by cutting, ligature or cauterization of the nerve which can be confirmed with video laryngoscopy. Bilateral nerve injury is much more serious, here both vocal cords may assume a median/ paramedian position and cause airway obstruction causing respiratory distress and may need tracheostomy if warranted. Accidental transaction of nerve commonly occurs at the level of upper two tracheal rings, where the nerve is in close approximation with thyroid lobe in the area of Berry's ligament.[7,8] In this study the incidence and various factors influencing recurrent laryngeal nerve injury were studied. Patient factors, disease factors and surgeon's factors were also taken into consideration.

Aims and Objectives

To study the incidence of recurrent laryngeal nerve injury in patients undergoing Thyroidectomy.

To identify the factors influencing recurrent laryngeal nerve injury in patients undergoing Thyroidectomy.

Methodology

This was a hospital based prospective study conducted among 50 patients who underwent thyroid surgery at the PSG Institute of Medical Sciences and Research Centre, from November 2018 to August 2020, after obtaining clearance from institutional ethics committee and written informed consent from the study participants.

Inclusion Criteria

All patients undergoing thyroidectomy.

Minimum follow up of 6 months.

Exclusion Criteria

Patients who are not willing to participate in the study.

Patients with preoperative recurrent laryngeal nerve palsy (By Video Laryngoscopy).

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Statistical Methods

Date was entered in MS Excel and analysed using SPSS software. Results were presented in tables.

RESULTS

Table 1: Association between Histopathology and Palsy

			Palsy		Total
			Yes	No	
Histopathology	Colloid Goitre	Count	0	23	23
		% within Diagnosis	0.0%	100.0%	100.0%
	Follicular Adenoma	Count	0	5	5
		% within Diagnosis	0.0%	100.0%	100.0%
	Follicular Carcinoma	Count	0	1	1
		% within Diagnosis	0.0%	100.0%	100.0%
	Graves' disease	Count	1	1	2
		% within Diagnosis	50.0%	50.0%	100.0%
	Hashimoto's Thyroiditis	Count	0	12	12
		% within Diagnosis	0.0%	100.0%	100.0%
	Hurthle Cell Neoplasm	Count	0	1	1
		% within Diagnosis	0.0%	100.0%	100.0%
	Papillary CA	Count	2	4	6
		% within Diagnosis	33.3%	66.7%	100.0%
Total		Count	3	47	50
		% within Diagnosis	6.0%	94.0%	100.0%
Chi-Square Value = 17.494 P value = 0.008 Significant					

The chi-square test shows that there is a significant association between Histopathology and Palsy (p=0.008).

Table 2: Association between Clinical Diagnosis and Palsy

			Palsy		Total
			Yes	No	
Clinical Diagnosis	Diffuse Goitre	Count	1	1	2
		% within Disease Factor	50.0%	50.0%	100.0%
	MNG	Count	2	25	27
		% within Disease Factor	7.4%	92.6%	100.0%
	SNG	Count	0	21	21
		% within Disease Factor	0.0%	100.0%	100.0%
Total		Count	3	47	50
		% within Disease Factor	6.0%	94.0%	100.0%
Chi-Square Value = 8.3 P value = 0.016 Significant					

The chi-square test shows that there is a significant association between Clinical Diagnosis and Palsy (p=0.016).

Table 3: Association between Haemorrhage and Palsy

			Palsy		Total
			Yes	No	
Identification of Nerve	Identified	Count	1	45	46
		% within Identification of Nerve	2.2%	97.8%	100.0%
	Non-	Count	2	2	4

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	identified	% within Identification of Nerve	50.0%	50.0%	100.0%
Total		Count	3	47	50
		% within Identification of Nerve	6.0%	94.0%	100.0%
Association between Identification of Nerve and Palsy					
Chi-Square Value = 14.924 P value = < 0.001 Significant					
Palsy	N	Mean	SD	t Value	P Value
Yes	3	273.333	46.188	2.481	0.017*
No	47	150.000	84.725		
*-Significant					

The chi-square test shows that there is a significant association between Identification of Nerve and Palsy (p< 0.001).

The independent 't' test results shows that there is a significant difference in mean of Haemorrhage with respect to the Palsy (t value=2.481, P=0.017*).

Table 4: Association between Experience of Surgeon and Palsy

			Palsy		Total
			Yes	No	
Experience of Surgeon	More than 5 years	Count	3	19	22
		% within Experience of Surgeon	13.6%	86.4%	100.0%
	Less than 5 years	Count	0	28	28
		% within Experience of Surgeon	0%	100.0%	100.0%
Total		Count	3	47	50
		% within Experience of Surgeon	6.0%	94.0%	100.0%
Chi-Square Value = 4.062 P value = 0.044 Significant					

The chi-square test shows that there is a significant association between Experience of Surgeon and Palsy (p=0.044).

Table 5: Association between Histopathology and Paresis

			Paresis		Total
			Yes	No	
Histopathology	Colloid Goitre	Count	1	22	23
		% within Diagnosis	4.3%	95.7%	100.0%
	Follicular Adenoma	Count	0	5	5
		% within Diagnosis	0.0%	100.0%	100.0%
	Follicular Carcinoma	Count	0	1	1
		% within Diagnosis	0.0%	100.0%	100.0%
	Graves' disease	Count	0	2	2
		% within Diagnosis	0.0%	100.0%	100.0%
	Hashimotos Thyroiditis	Count	0	12	12
		% within Diagnosis	0.0%	100.0%	100.0%
	Hurthle Cell Neoplasm	Count	1	0	1
		% within Diagnosis	100.0%	0.0%	100.0%
	Papillary CA	Count	0	6	6
		% within Diagnosis	0.0%	100.0%	100.0%
Total		Count	2	48	50
		% within Diagnosis	4.0%	96.0%	100.0%
Chi-Square Value = 25.091 P value = < 0.001 Significant					

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The chi-square test shows that there is a significant association between histopathology and paresis ($p < 0.001$).

DISCUSSION

In this study, various factors influencing the risk of recurrent laryngeal nerve injury and their incidence were analyzed. Fifty patients who fulfilled the inclusion and exclusion criteria and who underwent thyroid surgery were included in the study.

It was found that five patients had recurrent laryngeal nerve injury. All patients who had nerve injury were analyzed for a period of 6 months. Three of them had nerve palsy and two of them had paresis of the nerve. Thus the incidence of recurrent laryngeal nerve injury in our study was 10% --6% had palsy and 4% had paresis.

The median age of the patients involved in the study was 45 years. The median age of patients with palsy and without palsy was 37.3 years 45.3 years respectively. However, the difference was not statistically significant (Independent "T "test value: -1.064 and p-value: 0.293).

92% of our study group constituted female patients. AlI five nerve injury patients were females. None of the male patients had nerve injury. The incidence of nerve palsy in female patients was 6.5 % and zero in case male patients. However, the difference was not statistically significant (Chi-square test: p-value was 0.598).

In our study trachea was in midline in 94% of the patients, 4% had deviation to right and 2 % to the left. All patients who had nerve palsy had trachea in the midline. However, the difference was not statistically significant (Chi-square test: p value was 0.903).

On assessing the thyroid function, 84% of the patients were euthyroid, 6% were hypothyroid and 10% hyperthyroid. Two patients in the euthyroid group (4.8%), one patient in the hyperthyroid group (20%) and none in the hypothyroid group (0%) had nerve palsy. The difference between these groups was not statistically significant (Chi-square test: p value was 0.36).

Patients underwent thyroidectomy for both benign and malignant thyroid diseases. Eight (16%) of the patients who underwent thyroid surgery had a malignant cause of which two patients (25%) developed vocal cord palsy, so the contribution of malignancy to recurrent laryngeal nerve palsy was 4% out of 6%, nearly two-thirds. Another thyroid pathology associated with recurrent laryngeal nerve injury in this study was Grave's disease (two patients out of which one developed nerve palsy), which contributed to 2% of the 6%, one-third. Only patients with Graves' disease and papillary carcinoma had statistically significant nerve palsy as compared to other groups (p-value 0.008). So patients with malignant thyroid disease and Graves' disease are more at risk of nerve injury as compared to other patients.

In this study, twenty-nine patients (58%) underwent total thyroidectomy, nine patients (18%) underwent right hemithyroidectomy and twelve patients (24 %) underwent left hemithyroidectomy. Of which, 3 patients (10.3%) who underwent total thyroidectomy developed nerve palsy; of these one patient had left nerve palsy and two patients had right nerve palsy. None of the patients who underwent hemithyroidectomy had nerve injury.

In patients undergoing surgery, recurrent laryngeal nerve was identified in forty-six patients (92%). The incidence of nerve injury in the first group was 2.2% (one patient), and in the second group it was 50% (two patients). This difference was found to be statistically significant (p-value less than 0.008). So identification of recurrent laryngeal nerves is an important factor that prevents nerve injury and it is strongly recommended that every effort should be made to identify nerves in all patients.

The average blood loss in patients undergoing thyroid surgery in our study was 150ml. But in patients who developed palsy the median blood loss during surgery was 273ml. There was a statistically significant association between blood loss during surgery and the risk of recurrent

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laryngeal nerve palsy (p-value 0.017). So meticulous surgical technique with association to haemostasis is an important factor in preventing nerve injury.

Majority of the surgeries which ended with nerve injury were performed by surgeons with experience of less than 5 years. The difference was found to be statistically significant (p-value 0.044).

There is also a statistically significant association between clinical diagnosis and palsy. Multinodular goiter and diffuse goiters when operated have a higher risk of palsy than solitary nodular goiter. The overall study highlighted the significant factors associated with recurrent laryngeal nerve palsy which are as follows:

Non identification of nerve during surgery
Significant blood loss
Malignancy
Graves' Disease
Multinodular goiter / Diffuse goiter and
Surgeon's experience.

Our study reiterates the importance of identification of nerves during surgery, meticulous technique and surgical experience as the most important factors in preventing injury to recurrent laryngeal nerves during thyroid surgery.

CONCLUSION

According to various studies, the incidence of recurrent laryngeal nerve injury in thyroid surgery is between 0-14%2. In our study too the incidence of recurrent laryngeal nerve injury was within the range of - 10% (6 % had palsy and 4 % had paresis). Recurrent laryngeal nerves should be preserved for patients undergoing thyroid surgery, so that the quality of life of patients will not get affected. All patients who are undergoing thyroid surgery should be explained clearly about the risk involved in recurrent laryngeal nerve injury as the incidence of recurrent laryngeal nerve injury in various studies ranges from 0-14%. Other factors like age, BMI of the patient increases the risk of recurrent laryngeal nerve injury. Disease factors including solitary/multinodular goiter, malignancy etc., technical factors like blood loss, nerve identification, surgeons experience etc., non-identification of nerves during surgery, significant blood loss, malignancy, Graves' disease, multinodular /diffuse goiter and experience of surgeons (< 5 years) found during the study are the most important factors that influence the incidence of recurrent laryngeal nerve injury. In conclusion, this study reiterates the importance of identification of nerves during surgery, meticulous technique and surgical experience play a most important role in preventing injury to recurrent laryngeal nerves during thyroid surgery.

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