

Anatomical Variations of Recurrent Laryngeal Nerve (RLN) in Relation with Inferior Thyroid Artery (ITA) in the Patients Undergoing Thyroid Surgeries: A Descriptive Study

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Abstract

Aim: Injury to recurrent laryngeal nerve (RLN) is the complication of thyroid surgery. Hoarseness, aspiration and even respiratory difficulty due to vocal cord palsy are major sufferings of thyroid surgery to the patients. Anatomical knowledge about relevant important structures in vicinity is important that is RLN pathway, its relationship to inferior thyroid artery and its extra laryngeal branching pattern is important for the delivery of thyroid lobe. Morbidity after thyroidectomy is also related to the injuries to the parathyroids and external branch of superior laryngeal nerves (EBSLN), these are due to variations in the surgical anatomy.

To analyse the intraoperative anatomical relation of recurrent laryngeal nerve and its variations with respect to inferior thyroid artery in patients undergoing open thyroid surgeries.

Methodology: This Study was conducted between November 2020 to June 2021 with 50 patients who underwent thyroid surgeries in Department of ENT, Head and Neck Surgery at Medical College and Hospital, Bengaluru, and intraoperatively anatomical variations of recurrent laryngeal nerve with respect to inferior thyroid artery was analyzed.

Results: In our study incidence of thyroid diseases is more common in females than in males. Third decade is the peak age group in which patients presented to the hospital. Solitary nodular Goitre is the commonest clinical diagnosis in patients with goitre in Euthyroid status. Multinodular Goitre is the commonest histopathological diagnosis in the specimens. Total of 69 recurrent laryngeal nerves were identified with 37(53.6%) on right side, which showed 14(37.8%) RLN anterior to artery, 22(59.5%) posterior to artery, and 1(2.7%) between the branches of artery. On left side of 32(46.4%) nerves identified, 9(28.1%) RLN was anterior to artery, 21(65.6%) posterior to artery and 2(6.3%) were between the branches of artery.

Conclusion: By searching, identifying, and following the course of recurrent laryngeal nerve with care iatrogenic injury to recurrent laryngeal nerve or its branches is best avoided. The deep knowledge on surgical anatomy of varying course of recurrent laryngeal and inferior thyroid artery and their relation decreases the morbidity after thyroid surgery.

Keywords: RLN (Recurrent laryngeal nerve); Surgical anatomy; Recurrent laryngeal nerve ;(ITA) Inferior thyroid artery.

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Introduction

Thyroid surgery was associated with high mortality rates in the early nineteenth century. The high mortality (20%) was attributed to the lack of meticulous dissection techniques and asepsis [1]. So much so, in the year 1850 the French Academy of Medicine banned thyroid surgery [2]. With the advent of antiseptic techniques and antibiotics the mortality due to sepsis has disappeared. So also, the refinement in surgical techniques, recognition of the presence of parathyroids, RLN, and need to protect the EBSLN resulted in lesser morbidity. Injury to recurrent laryngeal nerve is the major complication of thyroid surgery. Hoarseness, aspiration and even respiratory difficulty due to vocal cord palsy are

major sufferings of thyroid surgery to the patients. Anatomical knowledge about relevant important structures in vicinity is crucial especially the RLN pathway, its relationship to inferior thyroid artery and its extra laryngeal branching patterns. The present study is undertaken to analyse the Recurrent laryngeal nerves its anatomical variations in position and pathway in relation to inferior thyroid artery in patients undergoing thyroid surgeries in Rajarajeswari medical college and hospital.

Materials and Methods

Data for the study was collected from patients undergoing thyroid surgeries in Department of ENT,

Head and Neck Surgery at Rajarajeswari Medical College and Hospital, Bangalore.

Method of Collection of Data:

This is a Descriptive study. Period of study is from November 2020 to June 2021 with a sample size of 50 patients. All patients with thyroid swellings undergoing thyroid surgeries attending ENT OPD.

Inclusion Criteria: Patients who are posted for thyroid surgery and who gave informed consent.

Exclusion Criteria: Patients who refuse to give consent for surgery and recurrent goitre and advance thyroid cancers, pregnancy, lactation, a history of previous neck surgery or radiation, pre-existing RLN impairment on preoperative laryngoscopy, patients with co-morbidities and unfit for surgery.

Method:

The chief complaints were recorded in a chronological order and the history asked in detail along with past history familial history personal history. The mode of onset of Goiter, its progression, whether associated with pain, sudden enlargement of the swelling were asked in detail. Special preference was given to the symptoms suggestive of hyper/hypothyroidism, symptoms suggestive of pressure effects like dysphagia, stridor, dysphonia. The medication history was also taken and history of previous irradiation was also taken. General Physical Examination was done, anemia, icterus,

clubbing, lymphadenopathy, edema, height, weight, BMI, facies etc. After examination the patient was subjected to relevant investigations. Routine investigations like Hb%, bleeding time, clotting time, RBS, Urea, Creatinine, Urine Routine, Chest X-ray, Electrocardiogram were done. Plain X-ray of the neck in antero-posterior views and lateral views were taken to look for tracheal deviation or compression. Chest X-ray for retro-sternal extension was done. Thyroid Profile (T3, T4, TSH) were done to know about the hormonal status. FNAC was done in all cases to establish the histological diagnosis. Ultrasound neck was done. Indirect Laryngoscopy was done routinely in all cases to look for vocal cord status. Depending on the diagnosis appropriate surgery was done. During surgery utmost precaution was taken to preserve the nerves and the parathyroid glands. Attention was paid to meticulous hemostasis and whether the trachea was softened (in long standing goiters). Drains were kept in all cases.

Operative Procedure

All operations were performed under general anesthesia. The operative technique was performed according to following steps: Patient put in supine position with neck extended parts painted and draped. Then horizontal skin incision is made almost 2cm above the sternal notch and laterally it is extended on both sides upto anterior border of sternocleidomastoid muscle.



Figure 1: Skin incision



Figure 2: Elevation of flaps- Subplatysmal flap raised superiorly till thyroid cartilage and inferiorly to the Sternal notch.

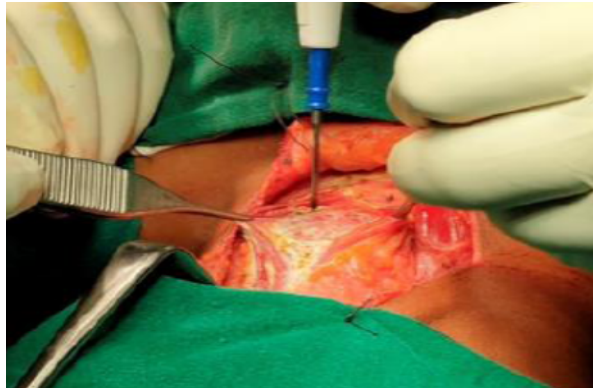


Figure 3: Dividing strap muscles-Deep cervical fascia divided in midline and strap muscles retracted laterally



Figure 4: Exposing the gland- Pretracheal fascia opened vertically and thyroid gland is exposed.



Figure 5: Identifying RLN in relation to ITA

Intraoperative Findings

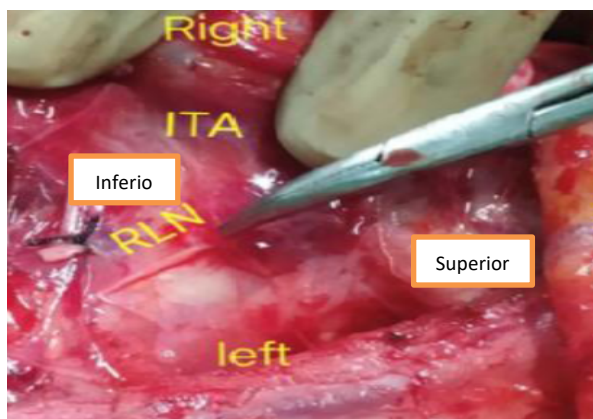


Figure 6: Left hemithyroidectomy→showing RLN posterior to ITA

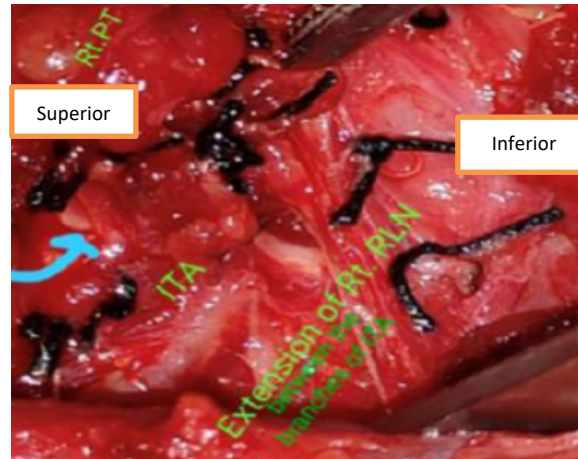


Figure 7: Right hemi thyroidectomy→showing RLN between the branches of ITA

Movements of the vocal cords were noted at the end of operation. The operated specimen was sent for histopathological examination for confirmation of the clinical diagnosis in every case. All patients were treated with antibiotics postoperatively. Suction drains were placed in all cases and usually removed after 48 hours. Routinely sutures were removed in all cases by 7th or 8th postoperative. All patients were followed up regularly to look for signs of hyper/hypothyroidism. In those patients who had

evidence of voice change or hoarseness, Indirect Laryngoscopy was done.

Results

This study was conducted in the Department of ENT from November 2020 to June 2021, Rajarajeswari Medical College and Hospital, Bengaluru. Based on Inclusion criteria 50 patients undergoing thyroidectomy were selected.

1) Distribution of gender

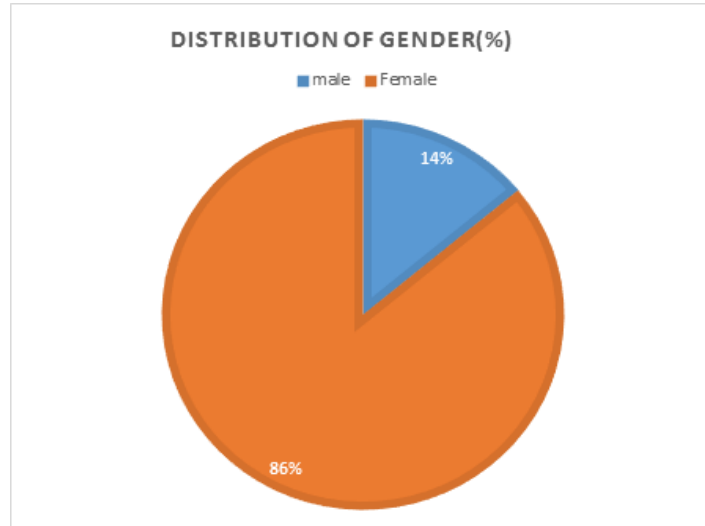


Figure 8: Distribution of gender

2) Distribution of age:

Age group (Years)	Total (%)
0-10	0
11-20	1(2%)
21-30	13(26%)
31-40	19(38%)
41-50	11(22%)
51-60	5(10%)
61-70	1(2%)
Total	50(100%)

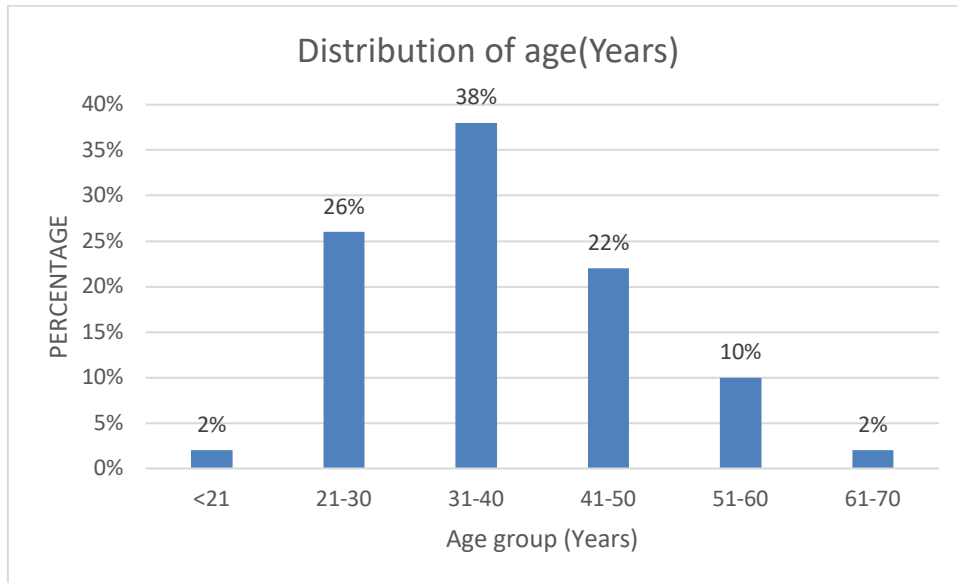


Figure 9: Distribution of age

Among the 50 patients who underwent thyroid surgery the peak age group of individuals undergoing surgery was in the 3rd decade. The youngest patient was 20 years of age and the oldest was 64 years of age.

Clinical Diagnosis

SL	Clinical diagnosis	Number of patients (%)
1	Right Solitary nodular goiter	18(36%)
2	Left Solitary nodular goiter	13(26%)
3	Multinodular goiter	13(26%)
4	Toxic Multinodular goiter	6(12%)
	Total	50(100%)

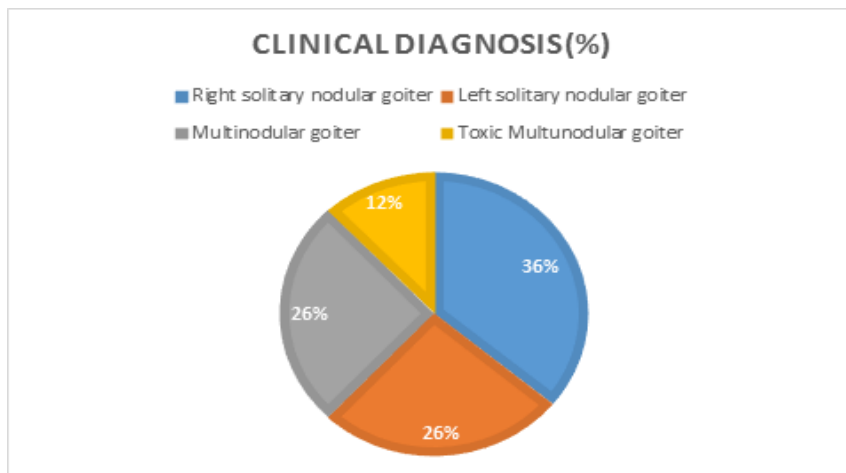


Figure 10: Clinical diagnosis

In the present series, most of the goitres were clinically diagnosed as solitary nodular goiters (36% on right side and 26% on left side). Next most common diagnosis was Multinodular nodule goiter (26%).

Type of Surgical Procedure

Operative procedure	Number of patients (%)
Right hemithyroidectomy	18(36%)
Left hemithyroidectomy	13(26%)
Total thyroidectomy	19(38%)
Total	50(100%)

Number of recurrent laryngeal nerve identified.

RLN identified on right side =18 right hemithyroidectomy +19 total thyroidectomy

(18nerves +19nerves =37)

RLN identified on left side= 13 left hemithyroidectomy+19 total thyroidectomy

(13nerves + 19nerves =32)

Side	RLN identified (%)
Right side	37(53.6%)
Left side	32(46.4%)
Total	69(100%)

Relation of Recurrent laryngeal nerve with respect to Inferior thyroid artery			
Position of nerve to the artery	Right (%)	Left (%)	Total (%)
Anterior to artery	14(37.8%)	9(28.1%)	23(33.3%)
Posterior to artery	22(59.5%)	21(65.6%)	43(62.3%)
Between the branches of the artery	1(2.7%)	2(6.3%)	3(4.4%)
Total	37(100%)	32(100%)	69(100%)

- Relation of RLN with respect to ITA on right side

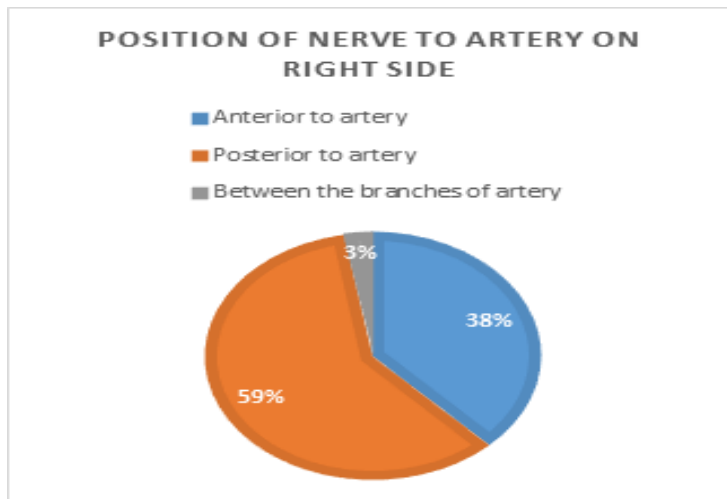


Figure 11: Position of nerve to artery on right side

- Relation of RLN with respect to ITA on Left side

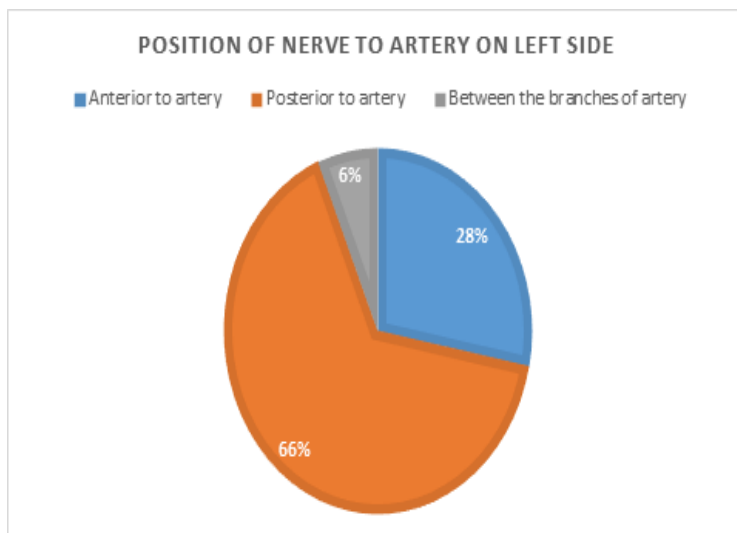


Figure 12: Position of nerve to artery on left side

- Relation of RLN with respect to ITA including both sides

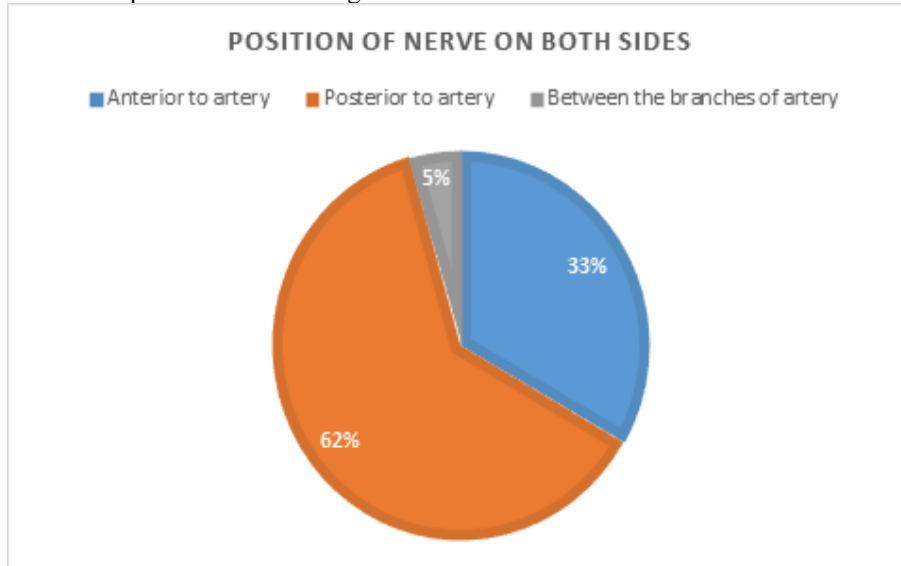


Figure 13: Position of nerve on both side

Discussion

Identification and preservation of recurrent laryngeal nerve is vital in thyroid surgeries. It is better to carefully identify and dissect the nerve as it avoids high risk (10%) of damaging the nerve permanently. The inferior thyroid artery used as a reliable landmark to identify the nerve. It divides into many branches and the nerve can pass either anterior, posterior or between the branches of the artery.

In our study out of 50 patients who underwent thyroid surgery (18 right hemithyroidectomy, 13 left hemithyroidectomy, 19 total thyroidectomy), total of 69 recurrent laryngeal nerves were identified with 37(53.6%) on right side, which showed 14(37.8%) RLN anterior to artery, 22(59.5%) posterior to

artery, and 1(2.7%) between the branches of artery. On left side 32(46.4%) nerves were identified where 9(28.1%) RLN was anterior to artery, 21(65.6%) posterior to artery and 2(6.3%) were between the branches of artery. So considering right and left side together of total 69 recurrent laryngeal nerve identified in our study were mainly posterior to inferior thyroid artery that is 43(62.3%) nerves, then 23(33.3%) nerves were anterior to artery, and 3(4.4%) were in between the branches of artery with no significant differences according to the sides. These results were similar to those of operative series reported by several authors. The comparisons of results of various relationships of RLN to ITA considering both right and left together is shown below.

SL	Year	Author(year)	No.of nerves identified	RLN anterior to ITA (%)	RLN posterior to artery (%)	RLN between branches of ITA (%)
1	1935	Berlin[3]	140	32.14	53.57	14.29
2	1943	Reed[4]	506	18.6	30.1	36.5
3	1943	Simon[5]	86	17.44	75.58	6.98
4	1955	Bowden[6]	58	18.97	41.38	34.48
5	1955	Wade[7]	200	10.5	47.5	34.5
6	1980	Chang-Chien[8]	100	24	56	20
7	1992	Hirata[9]	784	18.65	46.25	35.1
8	1992	Lekacost et al[10]	191	16	51	33
9	1997	Costa et al[11]	98	37.76	93.08	22.44
10	1999	Sturniolo et al[12]	280	31.1	43.2	25.7

A similar observation was made by Ardito et al [13] where 61% of the cases had RLN posterior to artery, 12% cases had anterior to artery, 27% cases had between branches of artery on right side while on left side 77%of nerve was posterior to artery, 1.9%

anterior to artery. The general consensus based on different series suggests that the authors have accepted that recurrent laryngeal nerve most commonly lies posterior to inferior thyroid artery.

The experiences of surgeon in dissection of RLN is known to account for differences in frequency of vocal cord paralysis. Other factors to nerve injury are dissecting or stripping the nerve of its ensheathing fascia, using bipolar cautery at the site of entry of nerve into cricothyroid joint area or excessive traction on gland. When the nerve is not identified inferiorly, a search for it near upper part of gland at ligament of berry or inferior inferior cornu of thyroid cartilage is made. If RLN is not found in its normal position the possibility of nonrecurrent laryngeal nerve should be kept in mind.

Conclusion

The incidence of thyroid diseases is more common in females than in males and the peak age group in which patients presented to the hospital was in 3rd decade. The commonest clinical diagnosis in patients with goiter was solitary nodular Goitre in Euthyroid status. The most common surgery performed in goiter cases was total thyroidectomy. Considering right and left side together recurrent laryngeal nerve in our study were mainly posterior to inferior thyroid artery that is 43(62.3%) nerves, then 23(33.3%) nerves were anterior to artery, and 3(4.4%) were in between the branches of artery with no significant differences according to the sides. The anatomical relationship between recurrent laryngeal nerve (RLN) and inferior thyroid artery (ITA) is highly variable. The recurrent laryngeal nerve passes upward generally posterior, but occasionally anterior to inferior thyroid artery. This makes it vulnerable to injury during surgery that involves ligating the artery, excision of lower pole of gland. So for all the head and neck surgeons to perform safe surgery on thyroid, it is necessary to have a sound knowledge of these variable relationships between recurrent laryngeal nerve and inferior thyroid artery. This study concludes that relationship of recurrent laryngeal nerve with inferior thyroid artery is consistent and can be used during thyroid surgery as reliable landmark in identification of the nerve.

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