

# Surgical Anatomy of Recurrent Laryngeal Triangle of Neck Seen under Microscope during Thyroid Surgery-Judicious Option

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**Abstract:** Background and Aim: Thyroid surgeries require in-depth knowledge of recurrent laryngeal triangle. It is well known that variation of RLN is prone to iatrogenic injuries due to its various anatomical variation. Injury to recurrent laryngeal nerve (RLN) is one of the major risks of thyroid surgery. Visual identification of RLN remains the gold standard for prevention of RLN injury. We aimed to understand detailed anatomy of recurrent laryngeal triangle using microscope during thyroid surgery so that injury to vital structure can be prevented and thus complication can be reduced improving quality of life of patient post operatively. Materials and Method: This was an intraoperative observational study conducted on 24 patients who underwent thyroid surgeries exclusively using 200x lens microscope between period (October 2019-October 2021). Anatomical variation of RLN and its relationship with inferior thyroid artery and blood supply to parathyroid gland were observed. Postoperatively nerve palsy and hypocalcemia were assessed. All the observational findings were noted. Results: Total 29 Recurrent laryngeal nerve was seen in 24 patients, on both sides majority of cases showed type 1 anatomical variation (extra laryngeal). In most of cases RLN was seen going below ITA and blood supply to parathyroids were observed coming from inferior thyroid artery. Out of 24 cases Only 1 case had transient hypocalcaemia and Vocal cord palsy. Conclusion: Microscope is great teaching tool and magnification tool. With help of microscope iatrogenic injuries to RLN and ITA can be prevented thus reducing postoperative complication and has excellent patient outcome.

**Keywords:** RLN, ITA, nerve palsy, hypocalcemia

## 1. Introduction

The thyroid gland receives its blood supply from superior and inferior thyroid artery. A third vessel thyroidea ima artery in few cases can replace inferior thyroid artery. The recurrent nerve can pass above, below and between branches of inferior thyroid artery. Recurrent Laryngeal Nerve triangle, also called the Beahrs triangle, consists of recurrent laryngeal nerve, inferior thyroid artery, and common carotid artery. RLN is known for anatomical variation and its variable relationship with inferior thyroid artery.

Injury to recurrent laryngeal nerve (RLN) is one of the major risks of thyroid surgery. An accurate anatomic knowledge of the course and variation of this nerve is essential to avoid vocal cord palsy. Operating Microscope is used to see detailed anatomy RLN triangle. Pathologies of thyroid are known to displace the structure in triangle and damage to this structure is very common. Visual identification of recurrent laryngeal nerve remains gold standard for recurrent laryngeal nerve injury prevention. Microscope is routinely used for head and neck surgeries. The routine use of microscope in thyroid surgery can reduce the rate of RLN nerve palsy, injury to parathyroids and blood supply to parathyroid glands. The current study is **Observational intra-operative study** conducted using microscope exclusively for thyroid surgery. This Study accent use of Microscope to see detailed anatomy of triangle and prevent complication during thyroid surgery.

## 2. Material and Methods

This Study was performed at tertiary care hospital which includes all patients coming to the Department of ENT, for thyroid surgery (October 2019-October 2021). Total 24 patients exclusively were operated using microscope. All Patients with anterior neck swelling were screened, detailed history was elicited and thorough ENT examination of patient was done, pre-operative blood serum calcium level and Videolarngoscopy was done to assess status of Vocal cord prior to surgery. Preoperative USG-neck, FNAC of thyroid gland, Xray neck was done, Patients with retrosternal extension of thyroid and Patients with history of neck radiation were excluded. Patients were informed and explained about this study, written informed consent was obtained. Surgical steps for dissection were followed and thyroid gland was exposed. Zeiss Microscope with 200x lens was used after exposing thyroid gland. RLN, variation of RLN (Type I, II, III, IV), Relation of inferior thyroid artery with RLN and blood supply to parathyroid was identified. Postoperatively nerve palsy and hypocalcemia were assessed. Qualitative analysis of data was recorded in excel sheet and. percentage of observational finding were noted.

## 3. Results

Data was collected from total 24 patients who exclusively underwent thyroid surgeries using microscope.

The mean distribution of age in the study group was 40 years and the minimum – maximum age range was 22 – 60 years

Distribution of mean post-operative serum calcium levels differ significantly between two study groups (P-value<0.001)

Calcium level (pre-op and post-op mean level)					
	N	Mean	SD	t-value	p-value
Pre op serum calcium	24	9.35	0.66		<0.00
post op serum calcium	24	8.69	0.83	4.89	1

Of 24 cases studied, preoperatively none had abnormal Video laryngoscopy Post operatively only 1 case (4.2%) had abnormal Video laryngoscopy

Total 29 Recurrent laryngeal nerve was seen in 24 patients, On Right side, total 15 RLN were observed out of which 14

(93.3%) showed type 1 anatomical variation of RLN and 1 showed (6.7%) type 2 anatomical variation of RLN.

On Left side total 14 RLN were observed out of which 10 showed (71.4%) type 1 anatomical variation 4 (28.6%) showed type 2 Anatomical variation of RLN

Table 2

Anatomical variation of RLN (Right)		
	Frequency	Percent
Type 1	14	93.3
Type 2	1	6.7
Total	15	100.0
Anatomical variation of RLN (Left)		
	Frequency	Percent
Type 1	10	71.4
Type 2	4	28.6
Total	14	100.0

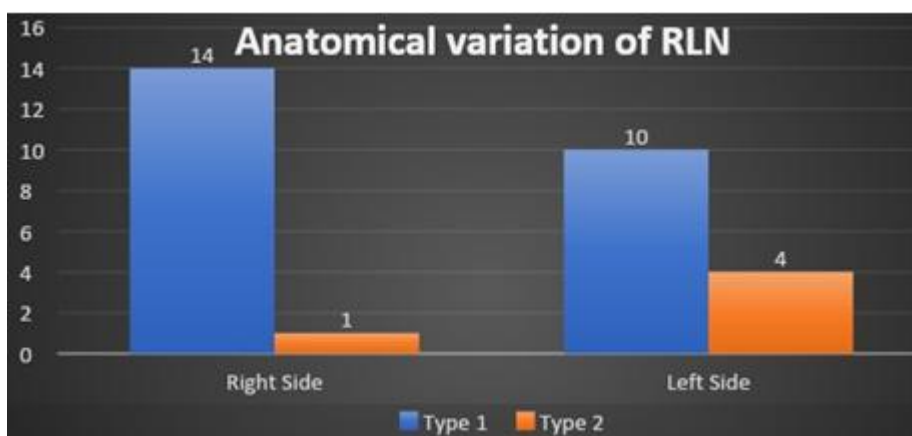


Figure 1

On Right side In 1 case (7.7%) RLN was going below ITA In 8 case (61.5%) RLN was going between ITA In 4 cases (30.8%) RLN was going above ITA. On Left side In 10 cases (71.4%) RLN was going below ITA. In 4 cases (28.6%) RLN was going above ITA.

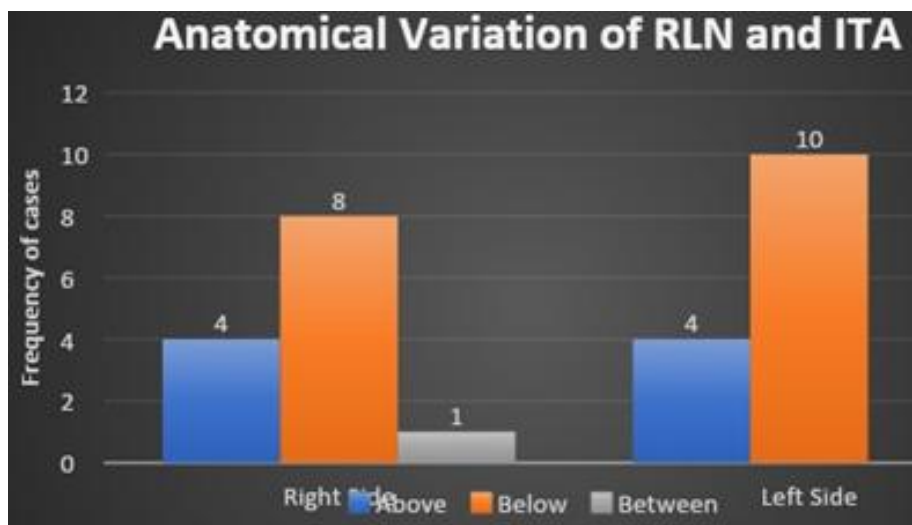


Figure 2

Table 3

Relation between RLN and ITA_ (Right)			
		Frequency	Percent
	Above	4	30.8
	Below	8	61.5
	Between	1	7.7
	Total	13	100.0
Relation between RLN and ITA-(Left)			
		Frequency	Percent
	Above	4	28.6
	Below	10	71.4
	Total	14	100.0

In 19 cases (90.5%) Blood supply to superior parathyroid gland was preserved In 2 cases (9.5%) blood supply to superior parathyroid was not seen and preserved In 18 cases (85.7%) had Blood supply to inferior parathyroid gland was preserved In 3 cases (25.0%) blood supply to inferior parathyroid gland was not seen and preserved.

Table 4

Blood supply of Superior parathyroid gland-preserved (Yes/No)			
		Frequency	Percent
	No	2	9.5
	Yes	19	90.5
	Total	21	100.0
Blood supply of Inferior parathyroid gland – preserved (Yes/No)			
		Frequency	Percent
	No	3	14.3
	Yes	18	85.7
	Total	21	100.0

Out of 24 cases, 13 patients showed (54.2%) single trunk of ITA 7 patients showed (29.1%) bifurcation of ITA 4 cases (16.7%) had multiple branches of Inferior thyroid artery

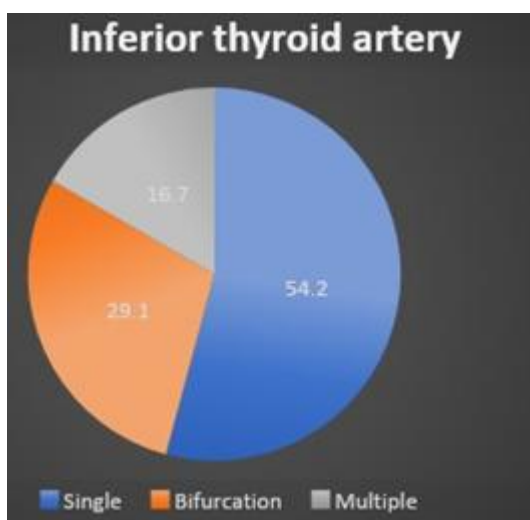


Figure 3

4. Discussion

Microscopic Thyroidectomy is not much explored technique. The routine use of microscope in thyroid surgery can reduce the rate of RLN nerve palsy, injury to parathyroids and blood supply to parathyroid glands

In this Study 24 patients underwent microscopic thyroidectomy, This study was comparable with Study done by **Amit Kumar et al** in which Total 9 patients were operated using microscope. In present Study 24 cases were studied out of which 7 (29.2%) had age between 21 – 30 years, 7 (29.2%) had age between 31 – 40 years, 5 (20.8%) had age between 41 – 50 years and 5 (20.8%) had age between 51 – 60 years, so maximum number of patients with thyroid disease was between 21-30 years.

In Our study the mean pre-op serum calcium levels is 9.35 and the mean post-op serum calcium levels 8.69. Out of 24 patients only one patient postoperatively developed transient hypocalcaemia after total thyroidectomy

Distribution of mean pre op and post-op % change in serum calcium levels differ significantly (P-value<0.001).

This Study was comparable with study done by **Amit Kumar et al** in which out of 9 only one patient developed transient hypocalcaemia.

Similarly, study done by **Huseyin Seven et al** out of 58 patients undergoing thyroidectomy using microscope only one patient developed transient hypocalcaemia and among 40 patients undergoing traditional thyroidectomy 5 patients develop transient hypocalcaemia. Thus, by using microscope during thyroid surgeries chances of damaging parathyroid gland is reduced.

Different explanations have been proposed for the cause of hypocalcaemia, including the removal of one or more of the parathyroid glands, injury to one or more of the parathyroid glands causing devascularisation of glands.

Patients in whom parathyroid was not seen or was not preserved, early postoperative calcium is suggested as a means to predict the occurrence of hypocalcaemia.

Probable cause of hypocalcaemia was removal of parathyroid gland along with thyroid, intracapsular parathyroid, ectopic position of parathyroid gland located anywhere between hyoid and lower mediastinum. In our Study out of 24 cases studied, 14 cases on right side and 10 cases (71.4%) on Left side showed type 1 (extra laryngeal branching) anatomical variation of RLN and only 1 case on right side and 4 cases on left side showed type 2 (single branch) anatomical variation of RLN. This was compared with study done by **W.-J. Tang et al** in which 87.5% of the RLNs gave off multiple branches and one branch of RLN combined with cervical sympathetic chain 26.

Another study by **Yalcin et al.** observed 93.6% with extra laryngeal branching (ELB) in 110 RLN dissections.

According to literature, the incidence of injury to the RLN in thyroidectomies ranges from 0 to 12%.

These variations should be paid extra attention during procedures for exposing and identifying the RLN and to avoid some nerve fibres being neglected, and damaged.

In our Study of 24 cases, 3 anatomical Variation of RLN with ITA was observed. This Study was comparable with **Ozer Makay et al** in which Right RLN was posterior to the ITA 64.1% while 24.1% was anterior to the artery and 8% were found in between the branches of the artery on the right side.

**Page et al and Uen et al also** described the RLN to be deep to the artery in 89% and 92% on the left.

In our Study On right side 1 case has RLN nerve going below ITA (7.7%), in 8 cases RLN was observed going between ITA (61.5%) and in 4 Cases RLN was seen going above ITA (30.8%).

On Left side 10 cases has RLN nerve going below ITA (71.4%), In none of cases RLN was seen in between ITA and in 4 cases RLN was seen above ITA Also 13 cases (54.2%) showed single branch of ITA, 7 cases (29.1%) had bifurcation of ITA and 4 cases (16.7%) had multiple Branches ITA

Our understanding with this Study is that ITA can be considered as important anatomical landmark for identification of RLN. Traction applied on ITA stretches RLN as string which helps in identification.

**Skandalakis et al** observed that injury to the RLN is more likely when it courses in the above or between ITA. He also assert that the RLN is likely to be injured in the anterior pattern owing to stretch induced trauma from the mobilization of the thyroid during its excision. When the nerve courses between the ITA branches, it is most susceptible to injury because of careless ligation of the ITA

Microscope is tool for which provides better be illumination and magnification that can be changed from site to site, depending upon the surgeon requirement, which helps in identification of anatomical variation and can be prevented from injury

Of 24 cases, in 18 cases (85.7.0%) Blood supply to inferior parathyroid gland was seen and preserved and in 3 cases (14.3%) blood supply was not identified

Similarly in 19 cases (90.5%) Blood supply to superior parathyroid gland was seen and preserved and in 2 cases (9.5%) blood supply was not seen.

Preservation of blood supply to parathyroids is very important to prevent postoperative hypocalcaemia. Blood supply to parathyroids is mainly through inferior thyroid artery. In our study blood supply to inferior and superior

parathyroid gland was from inferior thyroid artery. Cases in which blood supply was not seen, cause could be absent inferior thyroid artery. Lack of inferior thyroid artery can result in damage of RLN.

## 5. Conclusion

Microscope is great dissection tool and teaching tool and high-quality data can be recorded. Due to various anatomical variation of recurrent laryngeal triangle, microscope acts as great magnification tool to preserve these structures and can provide excellent patient outcome. There is learning curve for this technique but surgeons using microscope for ear and laryngeal surgeries can Learn this technique easily. With this Study we strongly recommend use microscope during thyroid surgeries.

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