



## RESEARCH ARTICLE

### RELATIONSHIP BETWEEN THE RECURRENT LARYNGEAL NERVE AND THE INFERIOR THYROID ARTERY: A STUDY IN CADAVERS

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#### ABSTRACT

**Introduction:** Iatrogenic lesions of recurrent laryngeal nerve may occur during thyroid surgery and may cause paralysis of the vocal cords. The aim of the present study is to determine the relationship between recurrent laryngeal nerve and the inferior thyroid artery to identify and save the nerve during surgery.

**Material and Methods:** 60 specimens (120 sides) of thyroid gland of both sexes were studied. Configuration of recurrent laryngeal nerve and inferior thyroid artery in each specimen was noted and documented.

**Results:** Three types of relationship between the recurrent laryngeal nerve and inferior thyroid artery were found. On the right side the nerve was frequently in front of the artery and on the left side nerve was often behind the artery. The relationship between artery and nerve were similarly occurred in opposite sides in 35% of cases.

**Conclusion:** Thorough knowledge of anatomic configuration between recurrent laryngeal nerve and inferior thyroid artery can reduce the potential for nerve injury and resultant vocal cord paralysis.

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## INTRODUCTION

Galen was the first to discover (Kratz, 1973) and describe (Cerena, 2009) recurrent laryngeal nerve (RLN) in second century. The recurrent laryngeal nerves arise from the vagus nerve and further course of it differs on each side. Right RLN passes anterior to the first part of subclavian artery and curves below and behind it to ascend to the side of trachea. The left RLN curves around aortic arch immediately behind the attachment of the ligamentum arteriosum to reach tracheoesophageal groove. After leaving the superior mediastinum the nerve ascends towards the larynx on both sides (Coady *et al.*, 2000). RLN is in close anatomical relationship with the thyroid gland, branches of inferior thyroid artery (ITA) and parathyroid gland before entering into the larynx. This peculiar anatomical relationship predisposes it to injury during thyroid and parathyroid surgery (Cerena, 2009) as well as many surgical procedures like tracheoplasty,

mediastinoscopy and neck dissections (Campos, 2000). Vocal, breathing and swallowing difficulties can occur if this nerve is injured (Yalcxin, 2006). Damage to RLN most frequently occurs in thyroidectomy and incidence of it varies from 0 to 12% (Yalcxin, 2006). Right RLN is more prone to injury during thyroid surgery because the nerve is placed more laterally on this side as well as nonrecurrent laryngeal nerve being more common on right side (Bora *et al.*, 2005). The nerve gets injured during the ligation of ITA. The relationship between RLN and ITA is not constant. Reed described 28 different types of relationships between the RLN and ITA. Many authors recognize 3 types of relationships between the RLN and ITA (Idris, 2013). The RLN was in front of or behind the ITA or between its branches. Chances of injury of RLN are more when it is crossed by the branches of the ITA (Yalcxin, 2006). Various studies were performed to know details of the RLN but still there is dearth of literature pertaining to the anatomical configuration of RLN and ITA. In the present study, we revisited the anatomy of the RLN which may be helpful to reduce the potential for nerve injury.

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## MATERIALS AND METHODS

Sixty specimens (8 females & 52 males) of the thyroid gland obtained from sixty cadavers, embalmed using 10% formalin were used for the study. In each cadaver, the thyroid gland was looked for any gross deformity, tumour or trauma. Dissection of the thyroid gland was done systematically. The cervical segment of RLN and ITA were dissected. Configuration of recurrent laryngeal nerve and inferior thyroid artery in each specimen was noted and recorded as shown in Figure 1, 2, & 3. Data was statically analysed using the SPSS – program. The influence of sex of cadavers on the position of nerves was not analysed due to the difference in the number of male and female cadavers. The influence of the side (right or left) on the position of the RLN was analysed. Chi – square test is used to study the distribution of three types of relationships of the RLN with the ITA between right and left side. The results were considered significant at  $p < 0.05$ .

## RESULTS

Out of total 120 RLN identified, the RLN was found anterior to ITA in 44 (36.52 %) cases and posterior to ITA in 68(56.44%) cases. In the remaining 6(4.98%) cases the nerve was serve to be traversing a route within the branches of ITA (Table 1&2). The position of RLN was posterior to ITA in both males and females in maximum number of cases.

On right side the RLN was most frequently anterior to ITA whereas it was posterior to ITA on left side. There was a significant difference ( $p < 0.05\%$ ) in the distribution of the 3 types of relationships of the RLN with ITA between the right and left sides. The relationship found on one side did not always occur on the opposite side. Only in 21(35%) cases the relationship between RLN & ITA were similarly occurred in opposite sides. In the present study the recurrent laryngeal nerve was non recurrent in two cases on right side but absence of the ITA was not found.

## DISCUSSION

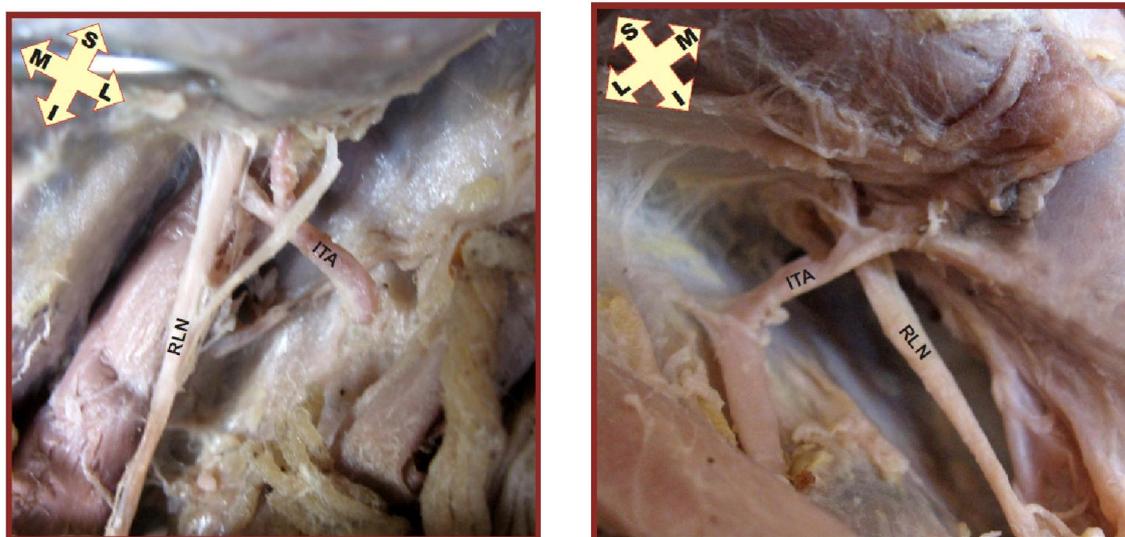
The safety of thyroid operation mainly depends on surgical anatomy of RLN (Gurleyik, 2011). The best way to avoid morbidity is to identify the RLN and its anatomical variations with branches of inferior thyroid artery (Uludag, 2009). The relations of RLN to the ITA can vary. Present study data suggested that the RLN on left side was predominantly posterior to ITA and this strongly supports the findings of Yalcxin, Jauregui *et al* (2000) and Skandalakis, (2004). In the present study the RLN was found predominantly anterior to ITA on right side which is similar to the finding of Idris (2013), Yalcxin and Tang (2012). The RLN was present predominantly posterior to ITA in a study by Jauregui *et al* where as Skandalakis found that RLN was between the branches of ITA in majority of cases on right side.

**Table 1. Gender wise distribution of the relation between recurrent laryngeal nerve (RLN) and inferior thyroid artery on both sides**

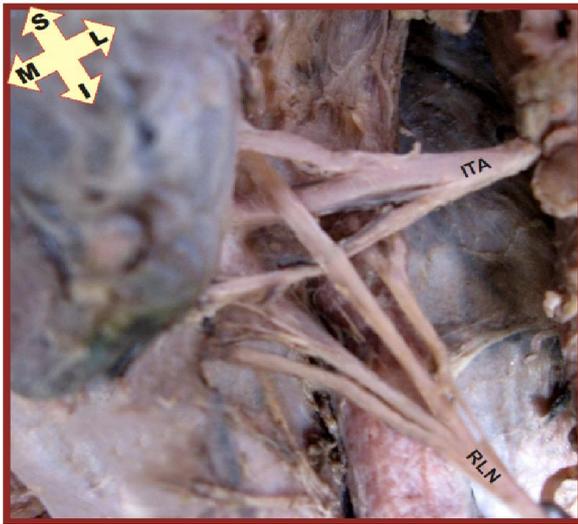
SEX	SIDE	RLN anterior to ITA	RLN posterior to ITA	RLN between branches of ITA	Non Recurrent Laryngeal Nerve
MALE	RIGHT	28(53.76%)	20(38.4%)	02(3.84%)	2
	LEFT	10(19.2%)	40(76.8%)	02(3.84%)	-
FEMALE	RIGHT	5(62.5%)	2(25%)	1(12.5%)	-
	LEFT	1(12.5%)	6(75%)	1(12.5%)	-

**Table 2. The relation between recurrent laryngeal nerve (RLN) and inferior thyroid artery in total cases**

	CASES	PERCENTAGE
RLN anterior to ITA	44	36.52
RLN posterior to ITA	68	56.44
RLN between the branches of ITA	6	4.98



**Fig. 2. illustration showing RLN passing anterior to ITA" RLN -Recurrent Laryngeal Nerve, ITA - Inferior Thyroid Artery**



**Fig. 3. Illustration showing RLN between the branches of ITA  
RLN - Recurrent Laryngeal Nerve ITA – Inferior Thyroid Artery**

In the present study RLN was posterior to ITA in 56.44% of cases when both sides considered together and this supports the finding of Simon (Campos, 2000), Fowler and Hanson<sup>4</sup> and Chang Chin (Campos, 2000). The RLN was anterior to ITA in 36.5% of cases in the present study and this is similar to findings by Costa *et al* , Armstrong and Hilton (Campos, 2000) and Berlin (Campos, 2000). The least common position of RLN in the present study was between the branches of ITA and this was similar to the findings of Simon, Fowler and Hanson and Berlin. Racial variations could contribute to the explanation of the differences observed in the present study and in literature in the relationship between the RLN and the ITA. RLN is most vulnerable where it is crossed by the branches of the ITA (Yalcxin, 2006).

If RLN lies anterior to or between the branches of the ITA, separation of the thyroid gland from its stream bed can result into stretching and withdrawal of the nerve (Campos, 2000). In the present study the relationship between RLN and ITA found on one side did not occur again on the opposing side in 65% of the cases. Campos & Henriques (Campos, 2000) found different relationships on the two sides in 37.12% of the cases and Sturniolo *et al.*<sup>4</sup> in Italy found the same in 48.8 % of cases. Non-recurrent inferior laryngeal nerve was found in two cases on the right side in the current study. This is similar to the findings of study by Defenhereux *et al.*, (2000) and Vallicioni *et al* (Vallicioni, 2003), but differ from Campos and Henriques (Campos, 2000). Surgeons have discovered various procedures to identify and preserve the RLN during thyroid surgery however cases of injury to the RLN still occur. In majority of cases the insufficient anatomical knowledge of RLN and its relationship with ITA is the main cause. A particularly high risk situation occurs when there are distal ramifications of the nerve and intertwining of it with branches of ITA (Yalcxin, 2006).

### Conclusion

Careful dissection and thorough knowledge of all types of relationships between RLN and ITA allows the surgeon to achieve the goal of safe and effective surgery on the thyroid gland.

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