

## Original Research Article

# Incidental presence of non recurrent laryngeal nerve in our series of thyroidectomy

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**Received:** 07 March 2019

**Revised:** 22 March 2019

**Accepted:** 23 March 2019

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## ABSTRACT

**Background:** Recurrent laryngeal nerve (RLN) injury is one of the most important and preventable complications of thyroidectomy which is the cause of post-operative iatrogenic vocal cord paralysis. The non-recurrent laryngeal nerve (NRLN), which is found in 0.25–0.99 of the patients who undergo thyroid surgery, is a rare embryologically-derived variant of the recurrent laryngeal nerve (RLN). Identification and prevention of injury to the laryngeal nerve is very important in thyroid surgery. The objective of the study was to highlight the incidence of Non-recurrent laryngeal nerve in our series of thyroidectomy cases.

**Methods:** In the Department of Otorhinolaryngology, Pondicherry a retrospective analysis of all the thyroid surgeries that were operated between August 2006–November 2018 for various indications on a total of 1006 patients was done with specific interest in the lookout for anatomical variant of recurrent laryngeal nerve and findings were recorded.

**Results:** Among all the cases, two patients with MNG who had underwent Total thyroidectomy were found to have anatomical variants of recurrent laryngeal nerve (non recurrent laryngeal nerve) intra operatively.

**Conclusions:** The NRLN is a rare finding and is associated to an increased risk in iatrogenic injury especially during thyroid surgeries unless thorough anatomical knowledge and cautious dissection is not done.

**Keywords:** Non-recurrent laryngeal nerve, Anatomical variants of recurrent laryngeal nerve, Recurrent laryngeal nerve injury

## INTRODUCTION

Goiters are managed universally using medications to make it euthyroid and then surgically removed. Among the complications of thyroidectomies, the most dreaded and commonly encountered ones are vocal cord paralysis and post-operative hypocalcaemia. The thyroid surgeon should be familiar with the anatomy of the RLN, including all its anatomical variations.

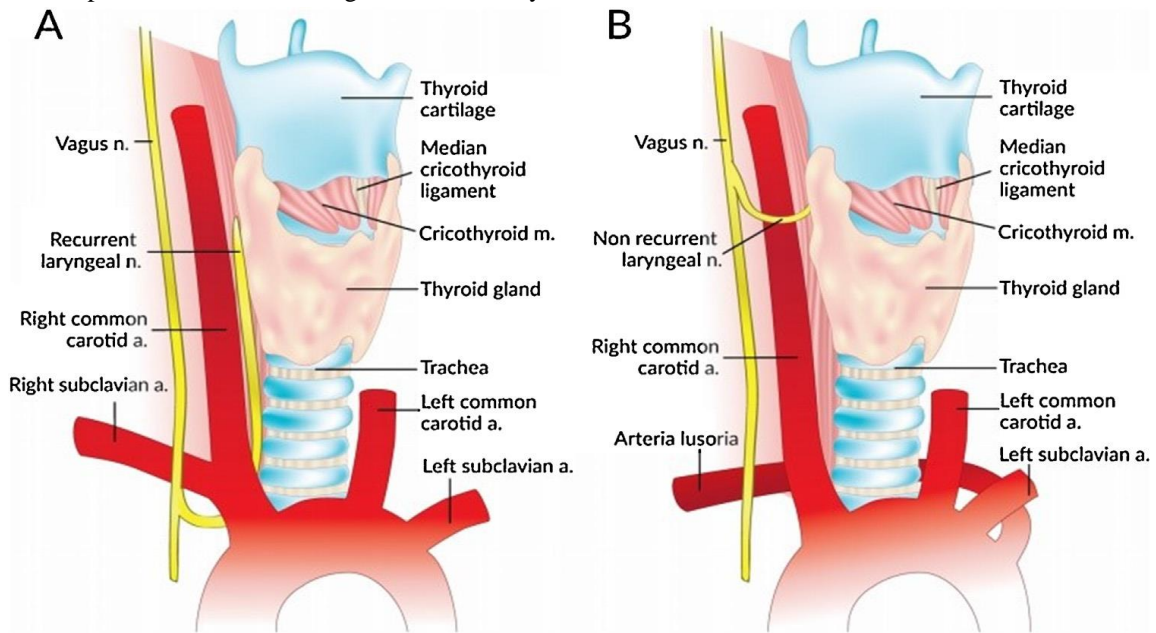
Recurrent laryngeal nerve (RLN) injury is one of the most important and preventable complications of thyroidectomy which is the cause of post-operative

(iatrogenic) vocal cord paralysis.<sup>1</sup> It is also one of the common reasons for litigation after thyroid surgery in the West.<sup>2</sup>

The RLN arises from the vagus nerve that supplies all the intrinsic laryngeal muscles, except for the crico-thyroid muscles. In thyroid surgery, RLN identification and preservation are fundamental steps. Non-recurrent laryngeal nerve (NRLN) is known as a rare anatomical variant of RLN with the proportion of 0.3%–0.8% on the right side, and 0.004% (exceptionally rare) on the left side.<sup>3</sup>

The preservation of proper nerve activity has paramount importance for safer thyroid surgery. Its intra-operative identification and preservation can be a challenge even for the most experienced endocrine surgeons. Thus, early

identification of the non-RLN at the beginning of thyroid surgery may minimize the risk of its injury during surgery.



**Figure 1: (A) Normal right recurrent laryngeal nerve and (B) Right non-recurrent laryngeal nerve in the presence of an aberrant sub-clavian artery.<sup>4</sup>**

**Objectives**

To highlight the incidence of NRLN in our series of thyroidectomy cases.

**METHODS**

In the department of Otorhinolaryngology, Pondicherry a retrospective analysis of all the thyroid surgeries that were operated between August 2006-November 2018 for various indications on a total of 1006 patients was done with specific interest in the lookout for anatomical variant of recurrent laryngeal nerve and findings were recorded.

**Inclusion criteria**

Inclusion criteria were all the patients with thyroid swelling/goiter irrespective of benign or malignant status as per FNAC; all the patients were in Euthyroid state after confirming with Thyroid profile before surgery.

**Exclusion criteria**

Exclusion criteria were patients who were not in Euthyroid state; patients who were not fit to undergo the procedure because of severe systemic comorbidities.

All the patients were completely informed regarding the possible outcome and complications and accordingly consent was obtained. Routine blood tests, along with thyroid function tests, thyroid ultrasonography, serum

calcium and fine needle aspiration cytology were performed. 96 patients were found to be in hyperthyroid state with toxic features for which anti-thyroid medications were used before surgery to attain the euthyroid state.

Indirect laryngoscopies as well as video-laryngoscopic examinations were performed to evaluate the vocal cord functions 24 hours prior to surgery, immediate post-operative and 48 hours later, in all the patients.

Thyroidectomies were performed by a standard technique of extra capsular dissection. The total thyroidectomy technique involved the removal of the entire gland while in hemi-thyroidectomy, the affected lobe of gland was removed along with the isthmus. Dissection was done avoiding the sharp instruments while tracing the nerve using the brush technique. After identification of the recurrent laryngeal nerve (RLN), it was routinely traced until its entry into cricothyroid membrane. Superior and inferior thyroid vessels were ligated close to the gland and every attempt was made to identify and preserve the parathyroid glands and their blood supply. Wound was closed in layers and finger glove was used as a drain. In the absence of any collection, the drain was removed on an average 2<sup>nd</sup> postoperative day and the patient was discharged on the 3<sup>rd</sup> day and was asked to report after 7 days for removal of the sutures.

All surgical specimens were routinely subjected to histopathology. Post-operative serum calcium levels were

estimated routinely after 48 hours of surgery and then subsequently as required. Transient hypocalcaemia when encountered was treated accordingly. An assessment of symptom relief, RLN injury, transient hypocalcaemia and permanent hypoparathyroidism was noted. Post-operative hypocalcaemia was defined as serum calcium level less than 8.2 mg/dl (normal range 8.2–10.1 mg/dl) in our laboratory. Thyroid hormonal replacement therapy was started postoperatively. A standard dose of 100 µg was administered to both the groups and thyroid function tests were monitored in an interval of every month. Based on their reports, titration of the dosage of L-thyroxine was done on monthly review.

**RESULTS**

Among the 1006 patients operated, 946 (≈94%) were females and 60 (6%) were males. Age ranged from 21 to 60 years with a mean age of 39 years (Tables 1, 2). A total of 200 patients had difficulty in breathing and 340 had difficulty in swallowing (Table 3). These 540 (53.67%) patients with pressure symptoms were considered for total thyroidectomy and the rest 466 (46.33%) patients which involved only one lobe of the thyroid were considered for hemi-thyroidectomy.

**Table 1: Age distribution of patients.**

Age group (in years)	Total Thyroidectomy (n=540)	Hemi Thyroidectomy (n=466)
21-30	20	200
31-40	90	170
41-50	198	60
51-60	232	36
<b>Total</b>	<b>540</b>	<b>466</b>

**Table 2: Gender distribution of patients.**

Gender of patient	Total thyroidectomy (n=540)	Hemi thyroidectomy (n=466)	Total (n=1006)
	N (%)	N (%)	
<b>Male</b>	40 (66.66)	20 (33.34)	60
<b>Female</b>	500 (52.85)	446 (47.15)	946

**Table 3: Distribution of patients according to compression symptoms.**

Compressive symptoms	No of patients	Percentage (%)
<b>Difficulty in swallowing</b>	340	62.96
<b>Difficulty in breathing</b>	200	37.03
<b>Total</b>	<b>540</b>	<b>100</b>

The decision to either do a total thyroidectomy or hemi-thyroidectomy was based on the symptomatology. In compressive symptoms with massive multi nodular goitre involving both the lobes, total thyroidectomy was

preferred and hemi-thyroidectomy in others. Also the patients who were diagnosed with Hashimoto’s thyroiditis depending on the FNAC and anti-thyroid antibodies also underwent total thyroidectomy. Bleeding during surgery was variable in both the groups since some of the glands were very vascular. Meticulous dissection was used to minimize the blood loss. We did not use blood or blood products in any of the cases. We did not encounter any case of post-operative temporary or permanent RLN Palsy. No permanent hypoparathyroidism was recorded.

**Table 4: Distribution of patient undergoing TT and HT.**

Procedure	No of patients	Percentage (%)
<b>Total thyroidectomy (TT)</b>	540	53.67
<b>Hemi thyroidectomy (HT)</b>	466	46.33
<b>Total</b>	<b>1006</b>	<b>100</b>

**Table 5: Distribution of patients according to various complications.**

Post-operative complications	Surgical procedure		Total (n=1006)
	TT (n=540)	HT (n=466)	
<b>RLN Palsy</b>	0	0	0
<b>Transient hypocalcaemia</b>	142	12	154
<b>Hematoma</b>	6	12	18
<b>Stitch granuloma</b>	7	10	17
<b>Pain in the scar site</b>	62	56	118
<b>Uneventful</b>	323	376	699



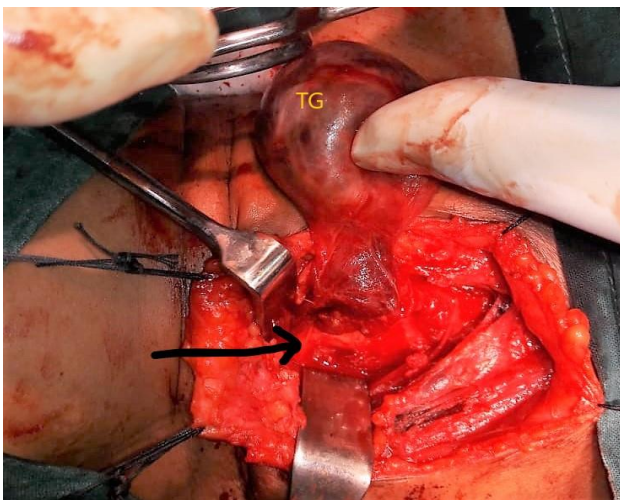
**Figure 2: Non recurrent laryngeal nerve in case 1.**

Among all the cases, two patients with MNG who had underwent total thyroidectomy were found to have anatomical variants of recurrent laryngeal nerve (non-recurrent laryngeal nerve) intra operatively (Table 6). In both the patients intraoperatively, on the right side, after careful dissection, the surgeons found that the right recurrent laryngeal nerve was not recurrent and it originated directly from the vagus nerve turning medially

into the crico-thyroid membrane (Figure 2) it was isolated and both the thyroid lobes and the isthmus were removed preserving the para-thyroids. Post operatively the patients did not have any complications and the voice was normal.

**Table 6: Distribution of patients according to the incidence of NRLN.**

Procedure	No of patients	Percentage (%)
Recurrent laryngeal nerve	1004	99.8
Non recurrent laryngeal nerve	2	0.2 (0.199)



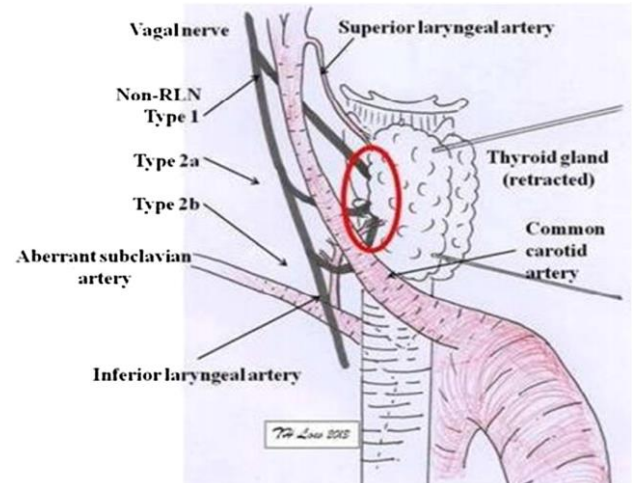
**Figure 3: Non recurrent laryngeal nerve in case 2.**

**DISCUSSION**

Non-recurrent laryngeal nerve was first reported by Stedman in 1823.<sup>5</sup> The incidence of the right NRLN is 0.3–1.6% and that of the left NRLN is about 0.04%.<sup>6</sup> In terms of embryology, the presence of NRLN is closely related to sub-clavian artery anomaly. Normally, the right sub-clavian artery originates from the 4<sup>th</sup> arch structure and the RLN originates from the 6<sup>th</sup> arch structure. When the heart descends during embryo-genesis, it drags the 6<sup>th</sup> arch structure along. Therefore, when it comes to the anomaly of the right sub-clavian artery, the failure in the descending of RLN would occur.<sup>7,8</sup> In 80% of the cases, the right sub-clavian artery travels behind the oesophagus, 15% between the oesophagus and trachea, and in 5% of the cases it courses in front of the trachea. This is called arteria lusoria (Figure 1B).<sup>9</sup> Its prevalence is estimated around 0.5–2% of the population.<sup>10,11</sup>

According to Toniato’s assessment from 31 cases of NRLN (2004), there are 2 types of NRLN, with respect to their origin.<sup>10</sup> Type 1 indicates that the NRLN is closely related to the superior thyroid vessels. Type 2 is further divided into sub-types A and B. Type 2a shows that NRLN is parallel and over the trunk of the inferior thyroid artery, meanwhile in type 2b, the NRLN runs parallel to but under or between the branches of the

inferior thyroid artery, as shown in Figure 4. In our study, both the cases can be categorized into type1 NRLN and the percentage also amounted to 0.2% and is concurrent with the literature. According to a study done by Hisham, Sarojah, Alvin et al in Malaysia, the overall incidence of non-recurrent laryngeal nerve in their study was 0.2% out of 585 patients in a period of 3 years which was similar to the findings in our study.<sup>11</sup> However, in all variations of the NRLN and RLN, the nerve travels to the larynx at the level of cricothyroid joint, close to berry ligament. Therefore, identification of NRLN at this site could minimize the risk of NRLN injury during thyroidectomy.



**Figure 4: Types of NRLN.<sup>12</sup>**

**CONCLUSION**

The NRLN is a rare, but clinically relevant structure and is associated with an increased risk in iatrogenic injury especially during thyroid surgeries. Thorough anatomical knowledge and cautious dissection are essential to identify anatomical variants of RLN especially during the beginning of the surgery in order to minimize the risk of post-operative vocal cord paralysis to the patient. Additionally, in embryological terms, the presence of NRLN is mostly associated with right sub-clavian artery anomalies.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Bage AM, Muthuvel LB, Akshaya AC, Bage NN. Incidental presence of non recurrent laryngeal nerve in our series of thyroidectomy. *Int J Otorhinolaryngol Head Neck Surg* 2019;5:563-7.