

Original Research Article

## Undescended Inferior Laryngeal Nerve: A Cadaveric Study

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### ABSTRACT

**Objectives:** The inferior laryngeal nerve is the main motor & sensory nerve of the larynx. Several anatomical variations of inferior laryngeal nerve may be found. The non recurrent inferior laryngeal nerve is one of them. It arises directly from the vagus and passes medially from its origin to the larynx. Due to its abnormal course and position in relation to the thyroid gland, the risk of injury to this nerve with resultant paralysis of the vocal cord is high during thyroid surgery.

**Methods:** 60 specimens of the thyroid gland were studied. Configuration of inferior laryngeal nerve and inferior thyroid artery in each specimen was noted and documented.

**Results:** Recurrent laryngeal nerve was found to be nonrecurrent on right side in two cases and the course of the nerve on the left side was found to be normal in them.

**Conclusion:** Non recurrent inferior laryngeal nerve represents a major surgical risk in thyroid and parathyroid surgeries. Intimate knowledge of normal and anatomical variants of inferior laryngeal nerve will reduce the potential for nerve injury during surgery in the neck.

**Key words:** inferior laryngeal nerve, non recurrent laryngeal nerve, thyroid gland.

### INTRODUCTION

Non recurrent inferior laryngeal nerve (NRILN) is a well known but relatively rare anatomical variant of recurrent laryngeal nerve (RLN). Prevalence of it is less than 1% based on surgical reports and 1-2% based on anatomical reports with most occurring on the right side. [1] A non recurrent nerve arises directly from the vagus nerve high in cervical part of neck and run transversely towards the cricothyroid membrane in contrast to the normal retrograde entry into the larynx from the thoracic vagus. [2] It takes a position which is at right angles to the normal recurrent laryngeal nerve. [3] This anomalous position of the NRILN predisposes it to

compression or significant trauma during thyroid & parathyroid surgery. [4] Intimate knowledge of this anatomic variant will reduce the potential for nerve injury and resultant vocal cord paralysis. [5] The embryological derivation and surgical importance of recognising this aberrant anomaly is discussed.

### MATERIALS & METHODS

60 specimens of the thyroid gland obtained from 60 cadavers (52 male, 8 female) from department of anatomy of Seth GS Medical College were analysed. These cadavers were used by the medical students for dissection purpose. In each cadaver the thyroid gland was looked for any gross deformity, tumour or trauma.

Dissection of the thyroid gland was done systematically and configuration of RLN and inferior thyroid artery in each specimen was noted and documented.

## RESULTS

A total of 120 RLN were dissected in this study. Recurrent laryngeal nerve was found to be non recurrent in 2 cases on right side and left side was found to be normal in these.

### Case 1

In one specimen the NRILN was arising in the cervical region from the vagus nerve behind the common carotid artery. The course of the nerve was downwards medially towards the larynx parallel to and in close contact with the trunk of the inferior thyroid artery as shown in figure 1. The RLN was seen in usual position in the tracheo-oesophageal groove on left side.

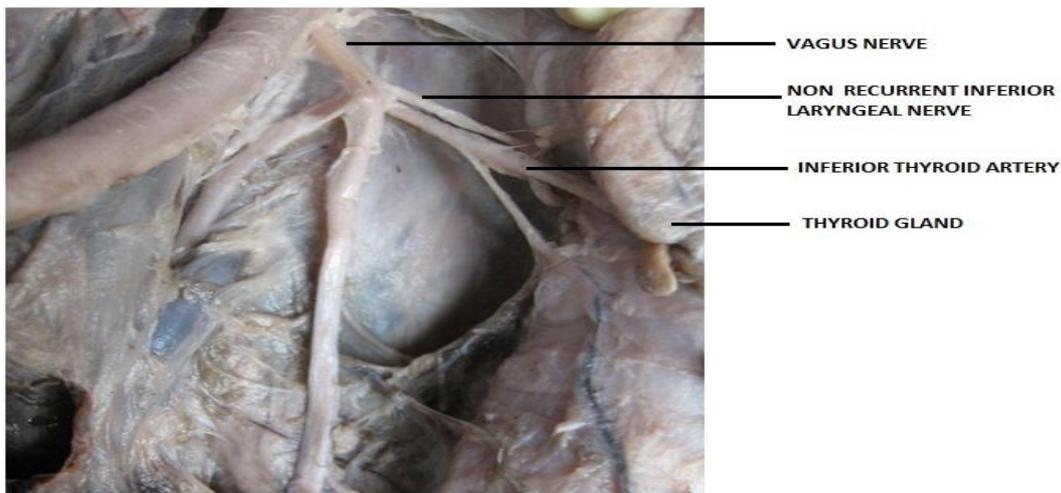


Fig 1: Illustration showing non recurrent laryngeal nerve in case 1

### Case 2

The NRILN in another specimen was arising high opposite the upper part of the right lobe of the thyroid gland. It was directed downwards parallel to inferior

thyroid artery but had no vascular contact with inferior thyroid artery as shown in figure 2. The RLN was seen in the tracheo-oesophageal groove on left side.

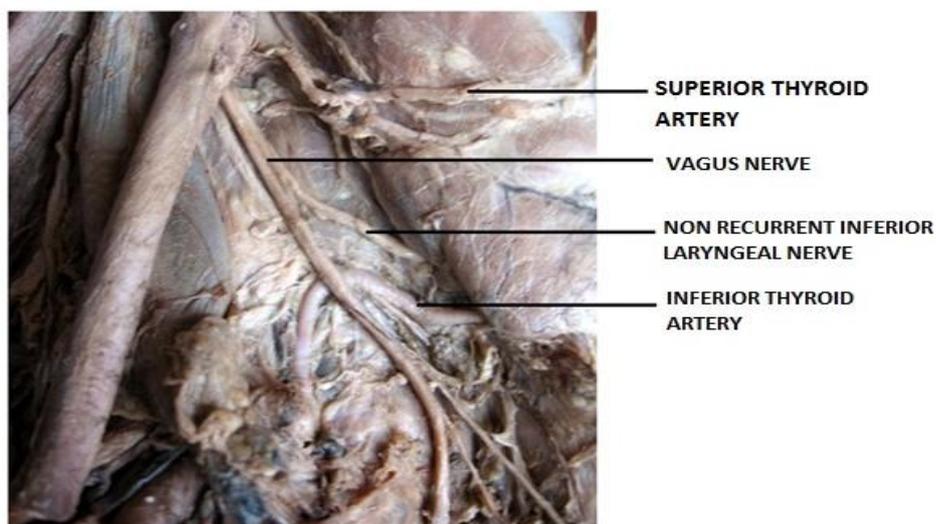


Fig 2: Illustration showing non recurrent laryngeal nerve in case 2

## DISCUSSION

Stedman was the first to describe the NRILN in 1823. Later Hart & Hilton followed further reports of the same [5] but its surgical interest was pointed out only in 1932 by Pemberton & Beaver. [6] Later on other investigators have reported sporadic cases of nonrecurrent laryngeal nerves. [7-11] Non recurrence of the recurrent inferior laryngeal nerve has its primary basis in embryologic development.

The vagus nerve is developed by the end of fifth week of embryonic development and the branch that will originate as recurrent laryngeal nerve becomes prominent by the end of sixth week. RLN is associated with sixth branchial arch of embryonic pharynx & it passes directly to the larynx. [12] As the embryo elongates and the heart descends the inferior laryngeal nerve assume its recurrent course wrapping around the sixth arch bilaterally. [1] Distal portion of the sixth & fifth aortic arch disappear on the right side and the RLN moves up to lie below the fourth arch, which forms a portion of the subclavian artery. [13] The sixth aortic arch on left side remains as ductus arteriosus till birth and later in adults as the ligamentum arteriosum. [1] If a regression of the fourth right aortic arch occurs then RLN comes directly from the cervical part of the vagus nerve without taking a recurrent course resulting in a NRILN. The right NRILN is associated with an anomaly of origin and course of the right subclavian artery. Rarely a right sided NRILN may also be associated with a recurrent branch in absence of vascular malformations. [5] NRILN is extremely rare on the left side because it requires the coexistence of a right aortic arch associated with dextrocardia, left subclavian artery with a lusoria course and the absence of an arterial ligament on left side. [13]

Three types of NRILN have been described as follows, [14]

Type 1 – Directly arises from vagus and runs together with the vessels of superior thyroid pedicle

Type 2 A – It follows a transverse path parallel to & over the trunk of the inferior thyroid artery

Type 2B – It follows a transverse path parallel to and under the trunk or between the branch of inferior thyroid artery

We found 2A type of non recurrent laryngeal nerves in both the cases.

Williams suggests that a thyroid surgeon may find 1-4 aberrant nerves in 100 thyroidectomise. Reeve et al described [14] NRILNs (0.58%) in 1200 thyroidectomies. Stewart et al found 6 out of 1776 right recurrent nerves were non recurrent. Shelton et al found two cases of NRILN on right side in 203 thyroidectomies i. e. 0.9%. [3] Incidence of right NRILN was 0.8% for Proye CAG et al [2] and 0.63% for Henry JF et al. [6] in the present study the incidence of right NRILN was 3.33%.

No reliable clinical symptoms & signs indicate the possibility of a non recurrent nerve preoperatively. Several preoperative imaging techniques for this anomaly have been proposed like barium swallow study, MRI, angiography and oesophagoscopy. Some of them have poor accuracy and some are invasive rendering them less useful as a screening test. [13] CT of the neck allows the diagnosis of arterial lusoria of subclavian artery, which alerts the radiologists & surgeons that a NRILN is present. However it is not consistently found.

During thyroid & parathyroid surgery the best way to avoid morbidity is to identify the nerve on both sides with a systemic dissection based on usual anatomic landmarks. When RLN is not found in a usual position the presence of NRILN is suspected. [14] This anomalous nerve takes a very similar course as the inferior thyroid artery and could easily be mistaken for the vessel and ligated. Stewart et al. mentioned that any

transverse bond should not be cut between carotid artery and larynx except middle thyroid vein. If the presence of NRILN is unknown nerve injury can easily occur during surgery resulting in vocal cord paralysis. [3]

## CONCLUSION

With the advent of minimally invasive thyroidectomy one needs to be aware of the variations of the recurrent laryngeal nerve. Since a small variation not identified may lead to catastrophic functional loss postoperatively.

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