



# A New Anatomical Variation and Course of RLN Described: A Rare Case Report of a Lateral and Superiorly Placed Bilateral RLN Over the Thyrohyoid Muscle

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Received: 8 September 2021 / Accepted: 2 October 2021 / Published online: 13 October 2021  
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**Abstract** Ling XY described 3 variations of RLN in relation to Inferior thyroid artery (ITA), with the RLN either being anterior to ITA, in between the branches of ITA or posterior to ITA. We add to these variations and present a new anatomical variation and course of RLN in which it lies in a lateral position and descends from a superior position on the thyrohyoid muscle to enter the larynx medially.

**Keywords** Recurrent laryngeal nerve · Thyroidectomy · Non recurrent laryngeal nerve · Inferior thyroid artery

## Introduction

The identification of recurrent laryngeal nerve (RLN) during thyroidectomy significantly reduces the risk of postoperative recurrent laryngeal nerve injury [1]. Ling XY described 3 variations of RLN in relation to ITA (Inferior thyroid artery), with the RLN either being anterior to ITA, in between the branches of ITA or posterior to ITA. We add to these variations and present a new anatomical variation and course of RLN in this rare case report.

## Case Report

A 48 year old male presented with multi nodular goiter. The patient was in a clinically euthyroid state. He was taken up for near total thyroidectomy. Under GA a skin crease incision was given and a subplatysmal flap was raised. The deep cervical fascia was incised and the strap muscles were retracted. Dissection was started on the left side and inferior thyroid and superior thyroid pedicels were ligated. Subsequently the dissection for identification of RLN in relation to inferior thyroid artery pedicel and the tracheo-oesophageal groove was undertaken. The RLN however was not found in its anatomical position (Fig. 1). The same dissection procedure was done on the contralateral side with same anatomical anomaly. The authors subsequently placed the thyroid gland back in its position and started the exploration laterally under the outer strap muscle sternohyoid. The nerve was eventually found in a significantly lateral position than its usual position in the tracheo-oesophageal groove. The nerve was traced upward before turning medially and following a oblique descending course over the inner strap muscle thyrohyoid before eventually entering the larynx medially (Fig. 2). Subsequently after safe identification and retraction of RLN the thyroidectomy was completed. Post op recovery was uneventful with no stridor or change of voice.

## Discussion

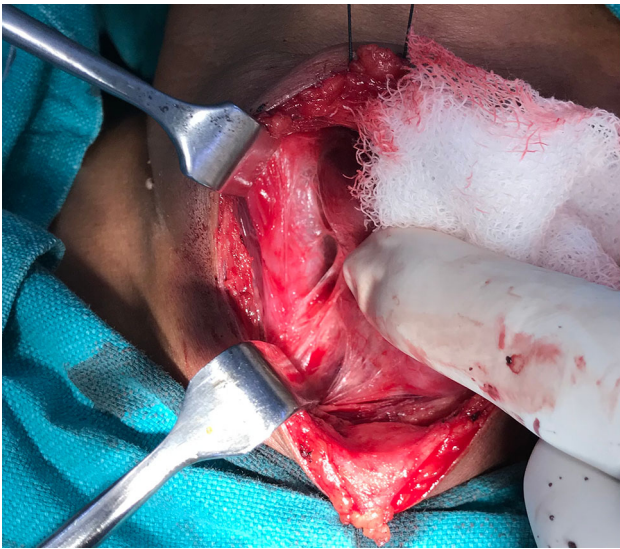
The first anatomist to describe the recurrent laryngeal nerve as a branch of a cranial nerve was Galen of Pergamon (AD 129–199). The first description of recurrent laryngeal nerve as in most textbooks was given by Willis (1621–1675). The right recurrent laryngeal nerve is described as hooking

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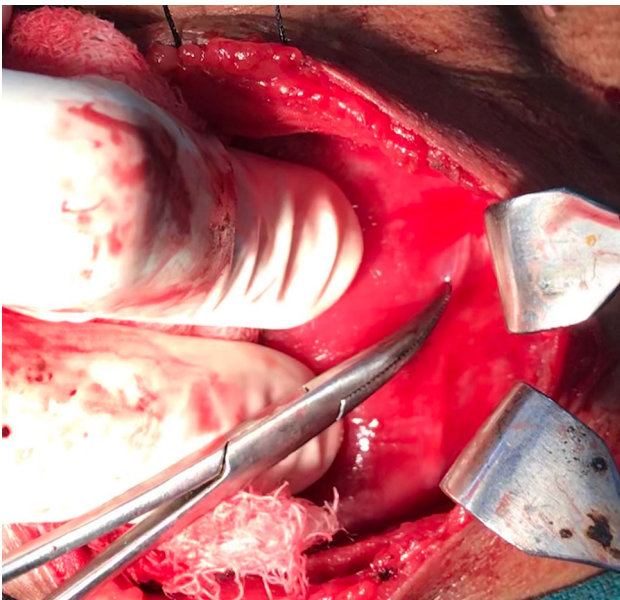
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**Fig. 1** The empty tracheo-oesophageal groove with RLN not in its anatomical position



**Fig. 2** The RLN descending obliquely downward over the thyrohyoid muscle

below the right subclavian artery and ascending in the tracheo-oesophageal groove. The left recurrent laryngeal nerve hooks below arch of aorta to ascend in the tracheo-oesophageal groove [2].

Ling XY et al. described three variations of RLN:

Type A: RLN anterior to ITA.

Type B: RLN between branches of ITA.

Type C: RLN posterior to ITA [3].

The recurrent laryngeal nerves arise embryo-logically from the vagus nerve in close proximity to the fourth branchial arch and the fourth primitive aortic arch vessels and if the proximal part of the right fourth arch vessel fails to develop no vessel is present to draw the nerve down to its usual recurrent position. It therefore passes directly to the larynx as a non-recurrent or undescended right laryngeal nerve (NRLN). Thus, the anomaly of the NRLN is related to and dependent upon the presence of an abnormal right subclavian artery. Stewart et al. 1972 performed 2101 thyroid operations and identified 3496 recurrent laryngeal nerves and 6 non recurrent laryngeal nerves. All the 6 identified non-recurrent laryngeal nerve arose from the cervical trunk of the vagus nerve. Out of the 6, in 2 patients it arose at the level of the inferior thyroid artery, passing to the tracheo-oesophageal groove at the level of the inferior pole of the thyroid gland and then following the normal recurrent laryngeal nerve course. In the remaining 4 patients, however, it arose at the level of the thyroid cartilage or superior pole of the thyroid gland and passed directly to the larynx [4].

In the case presented, a new variation of RLN was identified bilaterally. The RLN instead of lying in the tracheo-oesophageal groove, was identified in a significantly more lateral position below the outer strap muscle sternohyoid. The nerve ascended below the muscle and then turned medially toward the larynx like NRLN however the medial turn occurred much more superiorly. The RLN descended obliquely over the thyrohyoid muscle and then passed into the larynx medially. The identified RLN was distinguished from the NRLN as the nerve was identified laterally thus not confirming to the course of NRLN as well as by the absence of vascular malformation. It was also confirmed that the nerve was not communicating with the cervical sympathetic ganglion thus obviating the possibility of a false positive non-recurrent inferior laryngeal nerve [5]. This downward oblique course of RLN lying lateral and superior to its anatomical position has not been documented in literature and thus serves as an important adjunct and filler in surgical knowledge of this important nerve.

**Funding** No funds, grants, or other support was received.

**Declarations**

**Conflict of interest** The authors have no conflicts of interest to declare that are relevant to the content of this article.

**Ethical Approval** All procedures performed were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from the individuals included in the study.

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