

## A case of the right non-recurrent laryngeal nerve in the thyroid cancer

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### Abstract

The right non-recurrent laryngeal nerve (NRLN) in patients with papillary thyroid cancers is an under-reported entity. This case study is about a 26-year-old female who presented with papillary thyroid cancer. Physical examination showed involvement of the right lobe of the thyroid with no other abnormalities. Intraoperatively, with the aid of electromyography and nerve monitoring, the right non-recurrent laryngeal nerve was identified and preserved. Total thyroidectomy with inferior parathyroidectomy was done. Injury to the NRLN can lead to significant postoperative morbidity. As per meta-analysis, these nerve-related complications in minimally invasive techniques are comparable to or even less frequent than in the open approach, especially when combined with nerve monitoring and adequate training. This case report aims to raise awareness about the presence of non-recurrent laryngeal nerve in patients undergoing operative thyroid procedures and ensure its intraoperative preservation. There is also a necessity to analyse the patient to look for associated vascular anomalies.

**keywords:** Non-Recurrent Laryngeal Nerve; Thyroid Cancer; Electromyography; Nerve Monitoring; Vascular Anomalies

### 1. Introduction

Non-recurrent laryngeal nerve (NRLN) is rare and is proposed to occur due to the involution of the right fourth arch on the right side, thus causing the right subclavian artery to arise from the aortic arch [1]. The nerve arises higher in the neck instead without a recurrent course around the right subclavian artery, thus running a more direct course to innervate the larynx. The nerve provides the sensory innervation to vocal cords and the mucosa of the laryngeal inlet below the level of the vocal cords. Not identifying this variant intraoperatively may lead to inadvertent injury to the nerve, causing hoarseness of voice and postoperative respiratory distress [2]. There are three types of NRLN. Type-1: courses closely to the superior thyroid vessels. Type-2 (Type-2A): courses parallel to the inferior thyroid artery and transversely above the artery. Type-3 (Type-2B) courses parallel to the inferior thyroid artery, and transversely between branches of or under the inferior thyroid artery [3]. The presence of an aberrant subclavian artery may be associated with the nerve. Anomalies accompanying the left NRLN are situs-inversus and right-sided aortic arch [4]. 5% of the patients may experience dysphagia [1]. Our patient, like the majority, was asymptomatic. During thyroidectomies, the surgeon should diligently identify and preserve the recurrent laryngeal nerve, and be prepared to encounter its variations. It is commonly identified as a structure passing along the trachea-oesophageal groove after the thyroid gland is mobilised intraoperatively. If the nerve is not identified along its usual expected course, the surgeon must consider the possibility of NRLN and search for any structure traversing into the larynx in a more horizontal course. The usual practice is to not ligate any transverse structure except the middle thyroid vein on either side until the nerve is delineated on either side [1]. Intra-operative monitoring is ideally recommended for careful delineation and preservation of the nerve, especially in cases of large goitres, long-standing goitres and malignancies, where the chances of injury to the nerve are expected to be more than usual.

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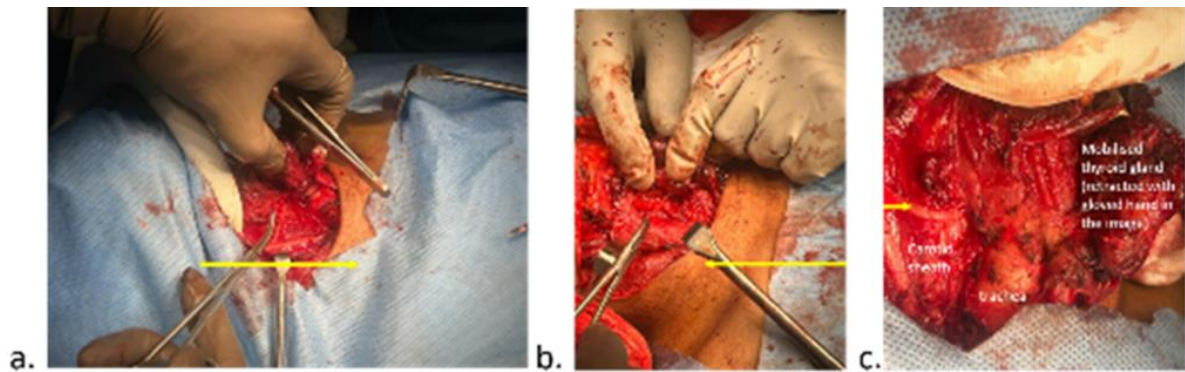
It is seen that the nerve injury is comparable or, at times even less frequent in minimally invasive techniques compared to the open approach to thyroid surgeries [5].

## 2. Case Presentation

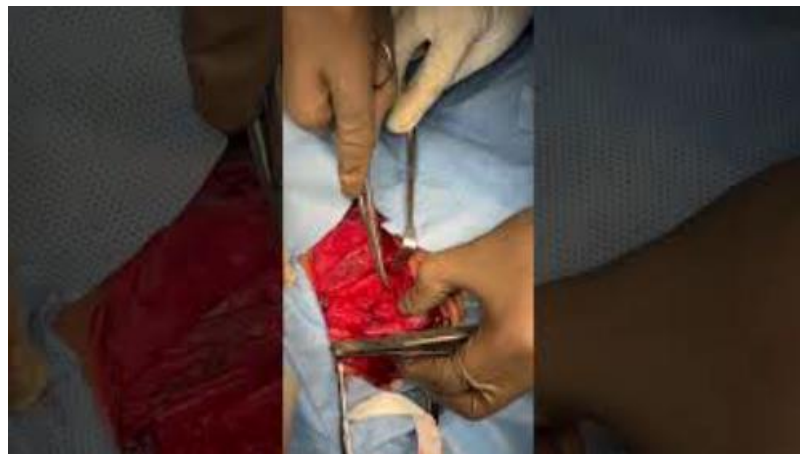
A 26-year-old female presented to our department with complaints of swelling in the front of the neck for a month. The swelling has progressively increased in size since first noticed. The patient had no history of ingestion of medications, or radiation exposure or prior surgeries to the neck. The vitals were stable and a head-to-toe examination revealed a level 2 lymph node palpable on the right side. Genetic studies were not performed as the family could not afford it.

The thyroid function test was normal. Ultrasonography of the neck revealed a heterogenous, lobulated, solid iso to hyperechoic wider than taller nodule in the right lobe of the thyroid measuring 20 x 29 x 26mm with calcifications in the posterior aspect of the lesion-TIRADS 5 and another 13 x 7mm TIRADS 4 lesion. Bilateral cervical lymphadenopathy was noted. Ultrasonography-guided fine needle aspiration cytology of the swelling yielded papillary thyroid carcinoma.

Based on the clinical, radiological and cytological findings, a diagnosis of papillary thyroid cancer was made and the patient was posted for total thyroidectomy with cervical lymph node dissection. Intraoperatively, a branch of the right Vagus nerve, entering the larynx beside Berry's ligament, almost at the right angle was identified (FIGURE 1 a, b and c, VIDEO 1). The diagnosis of the right NRLN was made and the nerve was preserved using electromyography intraoperatively. The inferior parathyroids were noted to be adherent to the malignancy in the thyroid. Total thyroidectomy with bilateral inferior parathyroidectomy, central and right side modified radical neck dissection was performed.



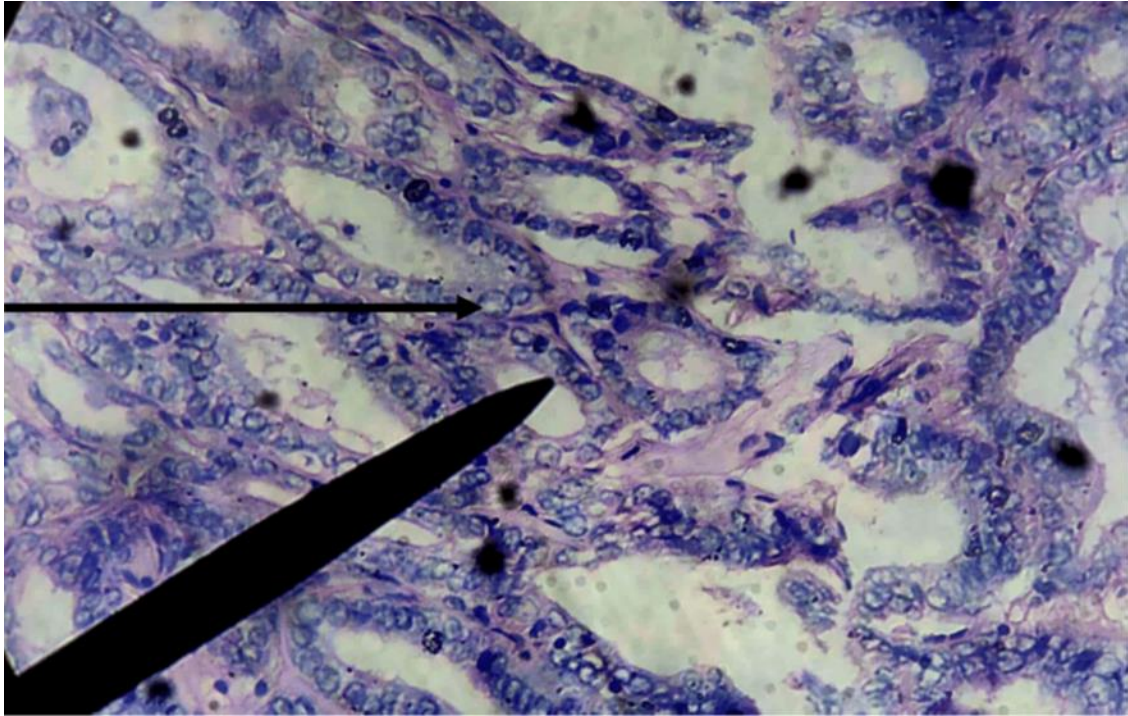
**Figure 1 a, b** Intra-operative picture with the yellow arrow pointing towards the NRLN arising from the right Vagus nerve following mobilisation of the right lobe of the thyroid. **c.** magnified intra-operative view of the right NRLN (yellow arrow).



**Figure 2** Intraoperative video of demonstration of the right NRLN during total thyroidectomy. View the video here: <https://youtu.be/yeA1EnspXqI>

## 2.1. Outcome and follow-up

Postoperatively, there were no signs of recurrent laryngeal nerve injury. However, the patient developed hypocalcemia with serum calcium levels of 6.8mg/dL. She developed features of hypocalcemia including the Trousseau's sign and the Chvostek's sign. The patient's postoperative course was otherwise uneventful and was discharged with oral calcium supplements. Angiography of the patient to confirm associated vascular anomalies could not be performed due to lack of patient consent. The histopathological report of the excised specimen confirmed papillary thyroid cancer (FIGURE 2) with nodal metastasis to right level 3 and 6 nodes. The patient was then subjected to radioactive iodine therapy as per protocols to treat the micrometastases. The patient is currently under regular follow-up.



**Figure 2** Histopathology slide of the specimen demonstrating features of papillary cell carcinoma with Orphan Annie-eye nuclei (black arrow) in the malignant cells.

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## 3. Discussion

Reports of right NRLN in cases of thyroid malignancies are rare. They are usually asymptomatic and patients often remain unaware of the condition. Pre-operative identification of NRLN is difficult, even with sophisticated investigations including the Magnetic resonance imaging of the neck. Angiographic evidence of the origin of the right subclavian artery from the aortic arch on the left side may be indirect evidence of association with NRLN.

This, emphasises the importance of awareness of the entity and the diligent need to suspect, identify and preserve NRLN in such cases. Diagnosis is dependent on the identification and intraoperative demonstration of the nerve arising from the Vagus nerve along with the absence of the nerve in its normal expected pathway in the tracheoesophageal groove. Its presence on the opposite side, though less common, should be verified in all cases. This, if routinely implemented, can decrease the incidence of postoperative hoarseness of voice and vocal cord paralysis which contribute to significant postoperative morbidity.

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## 4. Conclusions

NRLN is rare. However, while there are no definitive pre-operative investigations to confirm its presence, the need to suspect and identify the NRLN intraoperatively remains of paramount importance. Also, the possible presence of other anomalies in surgeries of the head and neck, the most common being the thyroid, needs to be investigated in these patients.

## **Compliance with ethical standards**

### *Acknowledgments*

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### *Disclosure of conflict of interest*

No conflicts of interest to be disclosed.

### *Statement of ethical approval*

No ethical approval required for publishing this case report.

### *Statement of informed consent*

The patient has given informed consent to include personal details for publication purposes.

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