Open Journal of
Clinical & Medical
Case Reports

Volume 12 (2026)
Issue 01

Case Report ISSN: 2379-1039

Two cases of non-recurrent laryngeal nerve diagnosed during thyroid surgery

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Abstract

We report two separate cases of right non-recurrent laryngeal nerve diagnosed intra-operatively during thyroid surgery.

Keywords: Non-recurrent laryngeal nerve; Thyroidectomy; Recurrent laryngeal nerve; Vocal cord palsy.

Abbreviations: RLN: Recurrent Laryngeal Nerve; NRLN: Non-Recurrent Laryngeal Nerve; US: Ultrasound; FNA: Fine Needle Aspiration; LTJ: Laryngotracheal Junction; IONM: Intra-Operative Nerve Monitoring; TI-RADS: Thyroid Imaging Reporting and Data System.

Background

The Recurrent Laryngeal Nerve (RLN) is a branch of the vagus nerve. It carries motor innervation to all intrinsic muscles of the larynx, with the exception of the cricothyroid muscle, which is supplied by the external branch of the superior laryngeal nerve. In addition, the recurrent laryngeal nerve provides sensory innervation to the larynx below the level of the vocal cords [1].

Typically, the recurrent laryngeal nerve descends into the thorax, where it loops around the aortic arch on the left and subclavian artery on the right, before ascending again into the neck to innervate most intrinsic laryngeal muscles and provide sensation below the vocal cords. The Non-Recurrent Laryngeal Nerve (NRLN) is a rare anatomical variant of the recurrent laryngeal nerve that follows an aberrant course without descending into the thorax and is found almost exclusively on the right. This atypical course results from incomplete regression of the fourth pharyngeal arch, leading to an aberrant right subclavian artery that runs posterior to the oesophagus [2]. The prevalence of a right non-recurrent laryngeal nerve is reported to be approximately 1% and its presence poses an increased risk of iatrogenic injury, potentially leading to significant postoperative complications [3]. The right non-recurrent laryngeal nerve was first described by Stedman in 1823 [4].

In this case report, we report two cases of a right non-recurrent laryngeal nerve diagnosed intraoperatively during thyroid surgery.

Case Presentation

The first case is a 46-year-old otherwise healthy lady with a known history of osteopenia and diverticular disease. She initially presented to clinic with right-sided neck swelling, and an Ultra Sound (US) of the neck was arranged. The initial US demonstrated a right thyroid nodule measuring 23×13 mm with overall benign characteristics. As the patient was asymptomatic, a repeat US was recommended after 12 months. On follow-up imaging, a small solid hypoechoic nodule located immediately inferior to the original lesion was identified. This nodule was classified as TI-RADS 5, and a Fine-Needle Aspiration (FNA) was, therefore performed. Cytology was reported as Bethesda category VI, consistent with papillary thyroid carcinoma. Following discussion at the multidisciplinary team meeting, the options of right thyroid lobectomy versus total thyroidectomy were discussed with the patient. She elected to undergo total thyroidectomy, which was performed a few weeks later.

Intraoperatively the right recurrent laryngeal nerve was identified with some difficulty due to its non-recurrent course (Figure 1A). The left recurrent laryngeal nerve followed a normal anatomical course. Postoperatively, the patient had a normal voice, and flexible nasoendoscopy demonstrated bilaterally mobile vocal cords. Her post-operative recovery was uneventful. Histopathological examination revealed a multifocal papillary thyroid carcinoma (12 foci), comprising both conventional and follicular variants, involving both thyroid lobes. The largest tumour measured 19 mm in maximum diameter and demonstrated focal microscopic extrathyroidal extension and angiolymphatic invasion. In view of these high-risk features, the patient was referred for postoperative radioiodine ablation.

The second case involves a 61-year-old lady with a medical history of hypertension, dyslipidemia, and ischemic heart disease who initially presented with a right parotid lump. As part of the diagnostic work-up, she underwent Magnetic Resonance Imaging (MRI) of the parotid gland, which incidentally demonstrated a multinodular goitre. An elective US of the thyroid was subsequently recommended. Ultrasound imaging confirmed the presence of multiple nodules involving both thyroid lobes. At the junction between the left thyroid lobe and the isthmus, a nodule measuring 22×8 mm was identified and classified as TI-RADS 4. A fine-needle aspiration of this lesion was therefore performed. Similar to the first case, cytological analysis was reported as Bethesda category VI, consistent with papillary thyroid carcinoma.

These findings were discussed at a multidisciplinary team meeting and with the patient, and a decision was made to proceed with a total thyroidectomy. Intraoperatively, identification of the right recurrent laryngeal nerve was challenging, and careful dissection revealed a non-recurrent laryngeal nerve (Figure 1B). Postoperatively, the patient had a normal voice, with bilateral vocal cord mobility confirmed of flexible nasoendoscopy. Histopathological examination demonstrated a multifocal papillary thyroid carcinoma (3 foci), tall cell variant, confined to the left thyroid lobe. There was no extrathyroidal extension; however, angiolymphatic invasion was present. In light of these histological features, the patient was referred for postoperative radioiodine ablation.

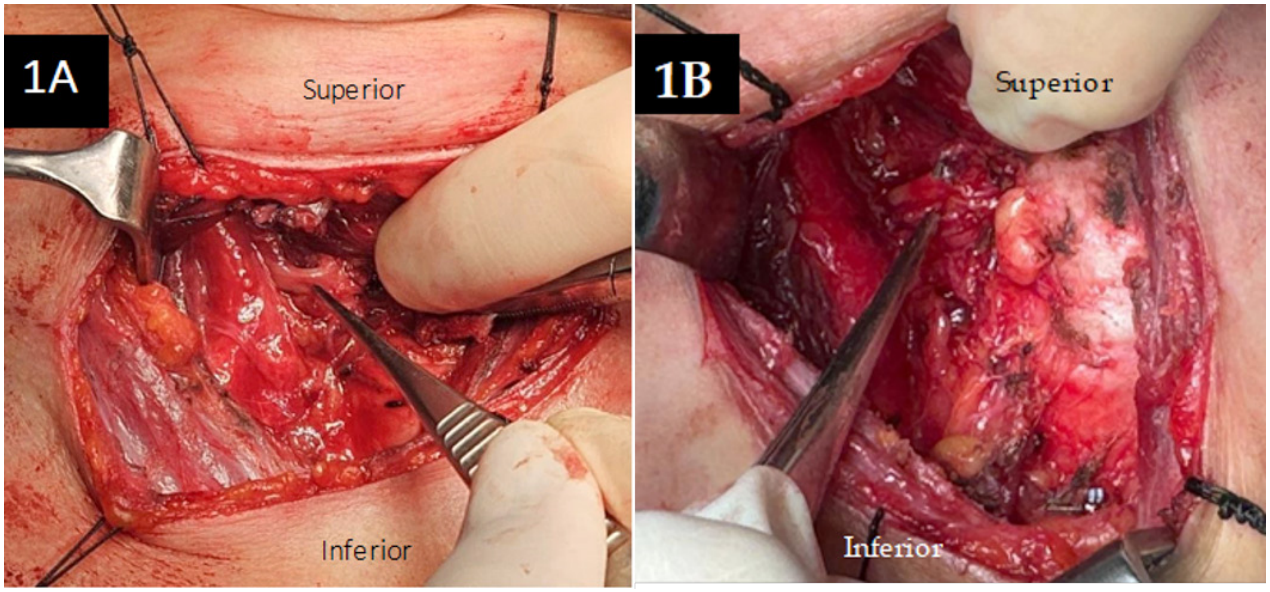

Figure 1: Intraoperative pictures showing the presence of a right non-recurrent laryngeal nerve in both cases presented in this case report. Both NRLNs are marked by a forceps.

Discussion

The presence of a right non-recurrent laryngeal nerve is a rare anatomical variation, with a reported prevalence of approximately 1% in the general population. A large meta-analysis by Henry et al. (2017), which examined 33,571 recurrent laryngeal nerves, reported a prevalence of 0.7%. In this study, a right NRLN was associated with an aberrant right subclavian artery – known as arteria lusoria – in 89.3% of cases. Although an aberrant subclavian artery may produce symptoms such as dysphagia, chronic cough, or unexplained ischemia of the right upper limb, most patients are asymptomatic. Subgroup analysis by Henry et al. (2017) demonstrated that in 58.3% of patients, the NRLN originated above the Laryngotracheal Junction (LTJ), while in the remaining 41.7%, it arose from the vagus below the LTJ. In contrast, the presence of a left non-recurrent laryngeal nerve is exceedingly rare, with a prevalence of 0.04%, and is almost invariably associated with major congenital anomalies suh as situs inversus or right-sided aortic arch [1].

The Avisse Classification describes three distinct anatomical courses of the non-recurrent laryngeal nerve. In type 1, the NRLN emerges directly from the vagus nerve and courses alongside the superior thyroid pedicle vessels. In type 2A, the nerve runs parallel and superficial to the inferior thyroid artery. In type 2B, the NRLN follows a transverse course parallel and deep to the trunk of the inferior thyroid artery or between its branches. Among these variants, type 2A is the most common encountered course of the non-recurrent laryngeal nerve [5,6].

The clinical significance of a non-recurrent laryngeal nerve lies in its increased risk of intraoperative injury, which may result in temporary or permanent vocal cord paralysis. Adequate identification and careful dissection - often combined with intraoperative nerve monitoring in specialised centres – are crucial to minimize this risk. Patients with a preoperatively undiagnosed NRLN have a six-fold higher likelihood of nerve injury compared to those with a normally recurring laryngeal nerve. This risk is particularly pronounced in type 1 variant, where the NRLN originates above the laryngotracheal junction and courses

along the superior thyroid artery [3].

Several imaging modalities, including ultrasonography and Computed Tomography (CT), have been proposed for the preoperative identification of a non-recurrent laryngeal nerve. These techniques do not visualise the nerve directly; rather, they aim to detect vascular anomalies—such as aberrations of the brachiocephalic trunk or the presence of an arteria lusoria—that are associated with the occurrence of an NRLN [7,8]. However, these investigations are not routinely performed, primarily due to their variable accuracy, higher cost, and the low prevalence of NRLN, which occurs in less than 1% of patients.

Intraoperative Nerve Monitoring (IONM) facilitates reliable identification of the recurrent laryngeal nerve and its anatomical variant, the non-recurrent laryngeal nerve. When using IONM, latency thresholds shorter than 3.5 ms following ipsilateral vagus nerve stimulation are indicative of the presence of an NRLN [9]. However, IONM is not universally available, particularly in smaller or resource-limited centres. Locally, IONM was not accessible and therefore was not employed in either of our cases. Consequently, meticulous intraoperative dissection remains the most effective method for identifying both the recurrent and non-recurrent laryngeal nerves and minimizing the risk of nerve injury.

Conclusion

The non-recurrent laryngeal nerve is a rare anatomical variant of the recurrent laryngeal nerve, occurring in less than 1% of the population. Its presence significantly increases the risk of iatrogenic injury during thyroid surgery, potentially resulting in postoperative voice and airway complications. Meticulous surgical dissection, thorough anatomical knowledge, and awareness of this variant are essential to accurately identify the NRLN and minimise the risk of complications.

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Manuscript Information: Received: January 14, 2026; Accepted: February 27, 2026; Published: March 06, 2026

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Citation: Portelli G, Muscat K. Two cases of non-recurrent laryngeal nerve diagnosed during thyroid surgery. Open J Clin Med Case Rep. 2026; 2403.