



## Case Series

# Non-recurrent laryngeal nerve in thyroid surgery: A report of case series in Vietnam and literature review<sup>☆</sup>

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## ABSTRACT

**INTRODUCTION:** 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 one of the main issues in thyroid surgery; thus, thyroid surgeons should have adequate knowledge of all anatomical variations of the RLN. **PRESENTATION OF CASES:** All four patients with the non-recurrent laryngeal nerve on the right side were performed thyroidectomy and discharged without any complications. During the procedure the surgeons found that the right laryngeal nerve was not recurrent and originated directly from the vagus nerve. Moreover, the right subclavian artery of these patients arose directly from the aortic arch.

**DISCUSSION:** NRLN can be easily damaged during surgery and its presence is closely related to subclavian artery anomaly. There are 2 types of NRLN in terms of its origin, nonetheless, in all variations of the NRLN and RLN, the nerve travels to the larynx at the level of cricothyroid joint, close to berry ligament.

**CONCLUSION:** The NRLN is a rare, but clinically relevant structure and is associated to an increased risk in iatrogenic injury. Thorough anatomical knowledge and cautious dissection are essential to identify variants of RLN in order to minimize the risk of injury to the patient. Additionally, in embryological terms, the presence of NRLN is closely related to subclavian artery anomaly.

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## 1. Introduction

The recurrent laryngeal nerve (RLN) arises from the vagus nerve that supplies all intrinsic laryngeal muscles, except for the cricothyroid muscles. In thyroid surgery, RLN identification and preservation are fundamental steps. Non-recurrent laryngeal nerve (NRLN) is known as a rare abnormality with the proportion of 0.3%–0.8% on the right side, and 0.004% (exceptionally rare) on the left side [2].

The NRLN was firstly reported by Steadman in 1823 [3]. Its intra-operative identification and preservation can be a challenge even for the most experienced endocrine surgeons. Thus, the possibility of a preoperative diagnosis reduces the risk of inadvertent damage to the nerve.

## 2. Case presentation

### 2.1. Case 1

We present a case report of a 33-year-old female patient who came to our institute to have her health checked periodically. After an ultrasound test, she was diagnosed with 9 x 8 mm nodule on the right thyroid lobe and 5 x 5 mm nodule on the left lobe. Ultrasound-guided fine-needle aspiration was carried out on both thyroid lobes and the result was papillary carcinoma. Total thyroidectomy was indicated and the patient was operated on 29th May 2017. The postoperative diagnosis was pT1N0M0 thyroid carcinoma.

During surgery, on the right side, after careful dissection, the surgeons found that the right laryngeal nerve was not recurrent and it originated directly from the vagus nerve, near the cricothyroid muscle before turning medially into the cricothyroid joint (Fig. 1). The recovery was uneventful without any complication and the voice was normal. Postoperative pathology confirmed papillary carcinoma on both sides of the thyroid gland.

### 2.2. Case 2

A female patient aged 28 years was admitted to the hospital after she palpated a mass at the base of her neck. Physical examination

<sup>☆</sup> The following case report has been reported in line with the PROCESS criteria [1].

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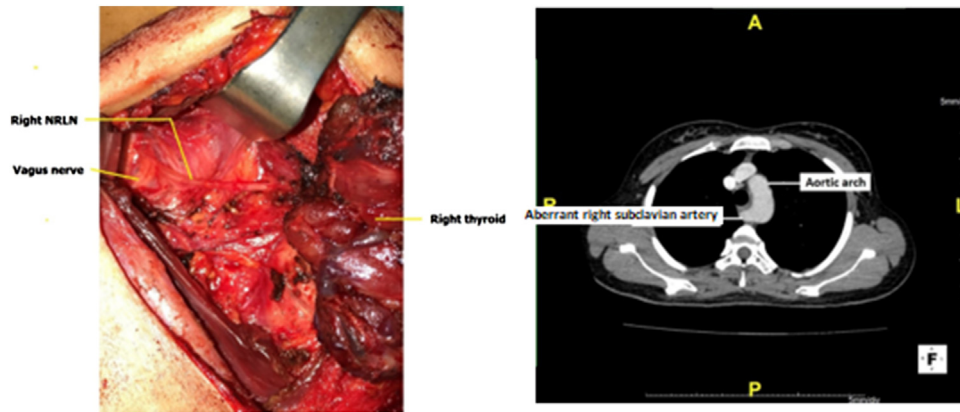


Fig. 1. The first NRLN and aberrant right subclavian artery.

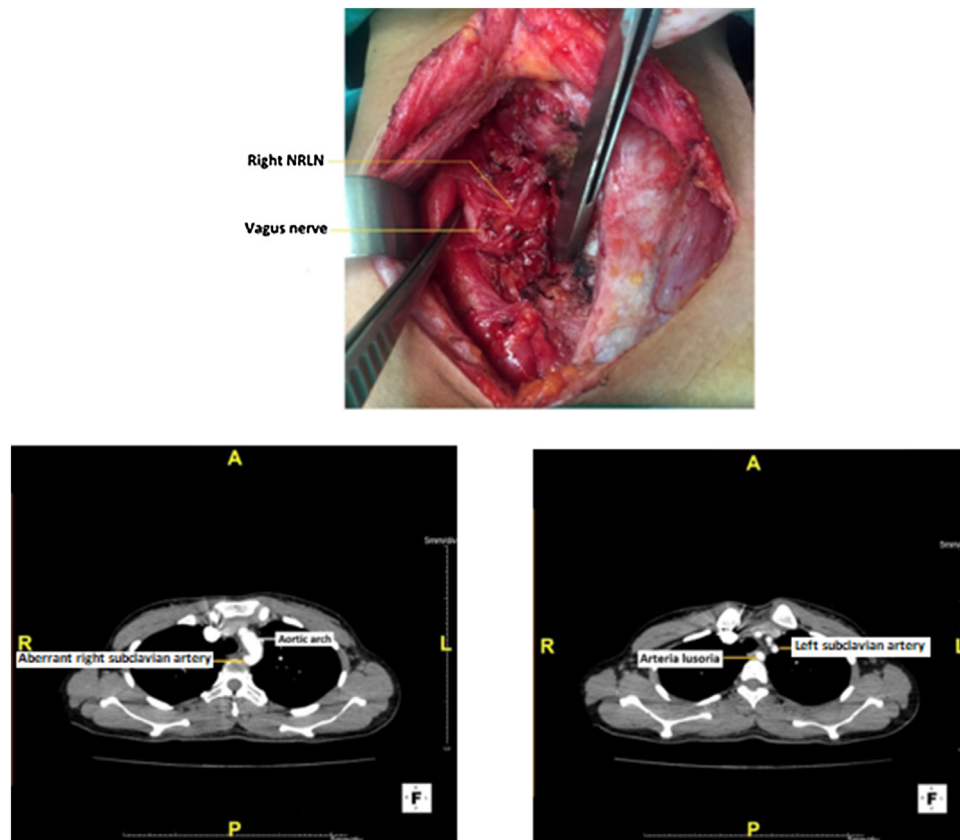


Fig. 2. The second NRLN and aberrant right subclavian artery.

and ultrasound revealed a solid, hypoechoic nodule 12 x 8 mm in size (TIRADS 5). Cytology tests resulted in the identification of a papillary carcinoma. A total thyroidectomy was performed on the 5<sup>th</sup> of February 2018, during which it was observed that the laryngeal nerve, running parallel to the inferior thyroid artery and over its trunk, was a non-recurrent variant. Computed tomography (CT) scan of her chest revealed an aberrant right subclavian artery.

### 2.3. Case 3

A 37-year-old woman came to our institute with papillary thyroid cancer at the stage of T1N1bM0. The surgeons proceeded total thyroidectomy and bilateral lymph node dissection the 26<sup>th</sup> December 2017. During surgery, the laryngeal nerves on both side were found, however, a non-recurrent laryngeal nerve had been observed on the right side. Its position and relation with other com-

ponents were strikingly similar to those in case 2. Thus, the NRLN was classified as type 2a. Upon closer inspection of the patients CT scan of her chest, one can in fact notice the aberrant right subclavian artery. After surgery, our patient had no abnormal change in her voice (Fig. 3).

### 2.4. Case 4

A 60-year-old woman was referred to our department with the diagnosis of multinodular goiter on the right thyroid lobe. Hospital consultation decided that the patient should undergo a thyroidectomy on the 12<sup>th</sup> of January 2018. Intraoperatively, a right NRLN related to the inferior thyroid artery and over its trunk was noted entering the larynx. Furthermore, the patient's axial chest CT scans showed signs of the aberrant right subclavian artery (Fig. 4).

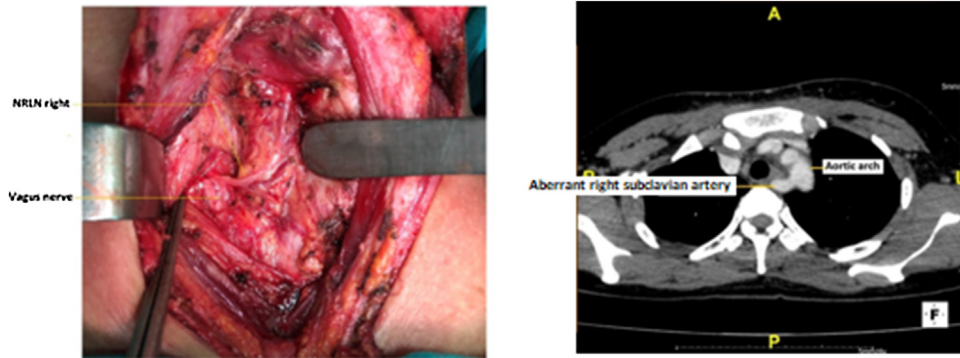


Fig. 3. The third NRLN and aberrant right subclavian artery.

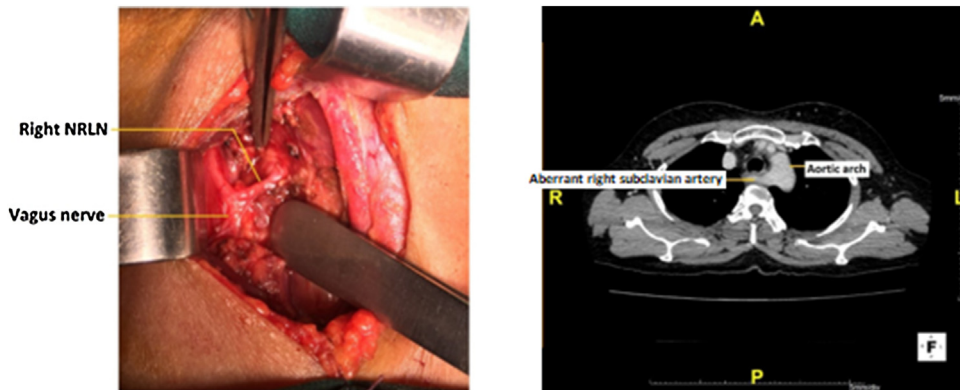


Fig. 4. The last NRLN and aberrant right subclavian artery.

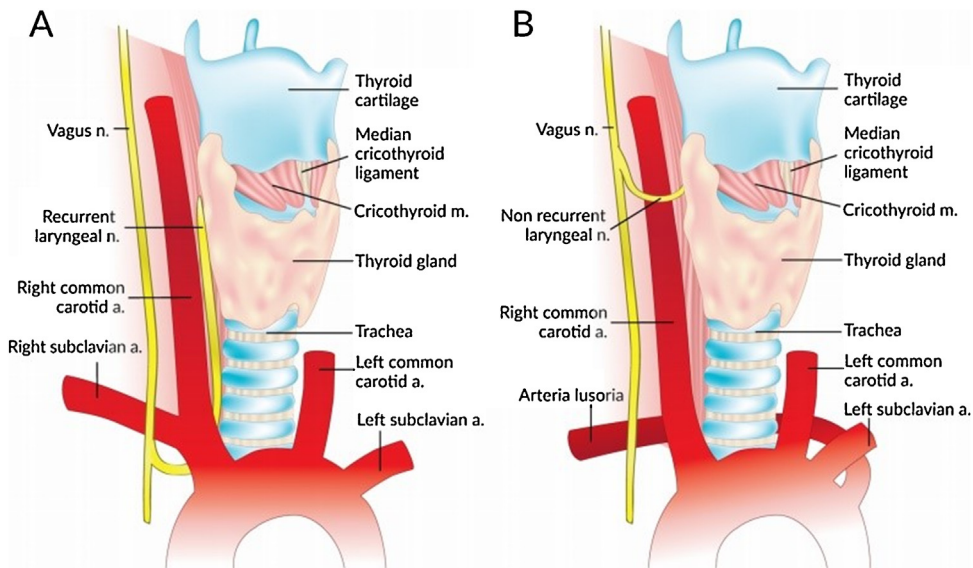


Fig. 5. Normal right recurrent laryngeal nerve (A) and right non-recurrent laryngeal nerve in the presence of an aberrant subclavian artery (B) [3].

### 3. Discussion

In 1823, a case of NRLN was firstly reported in the literature by Steadmen. The proportion of the right NRLN was estimated at 0.3–1%, while it was only reported at 0.004% on the left hand side [4].

In terms of embryology, the presence of NRLN is closely related to subclavian artery anomaly. Normally, the right subclavian 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 embryogenesis, it drags the 6<sup>th</sup> arch structure along. Therefore, when it

comes to the anomaly of the right subclavian artery, the failure in the descending of RLN would occur [5,6]. In 80% of the cases, the right subclavian artery travels behind the esophagus, 15% between the esophagus and trachea, and in 5% of the cases it courses in front of the trachea. This is called arteria lusoria (Fig. 2) [4]. Its prevalence is estimated around 0.5–2% of the population [7,8]. All four patients also had aberrant right subclavian artery on CT chest (Fig. 5).

According to Toniato’s assessment from 31 cases of NRLN (2004), there are 2 types of NRLN, with respect to their origin [7]. 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

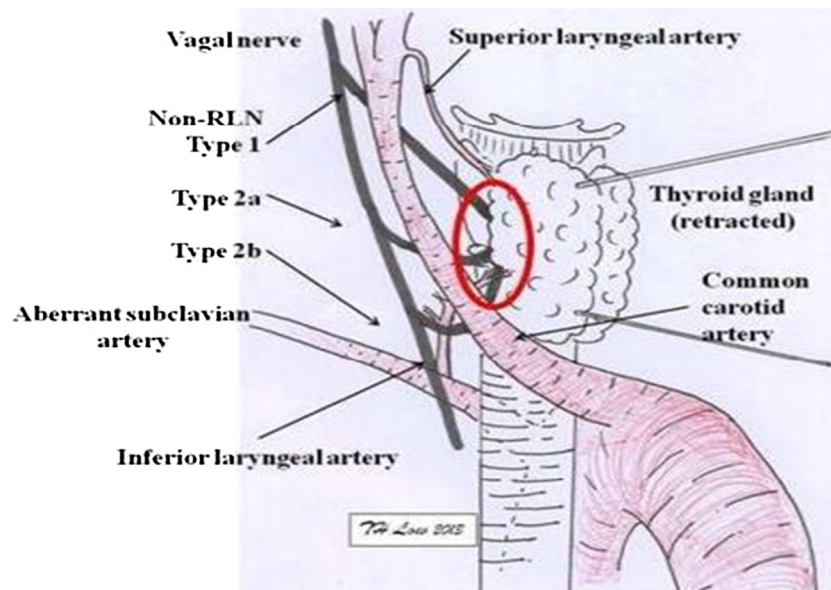


Fig. 6. Types of NRLN [8].

shows that NRLN is parallel and over the trunk of the inferior thyroid artery, meanwhile in type 2b, the NRLN runs parallel to, but either under or between, the branches of the inferior thyroid artery, as shown in Fig. 6. In our study, case 1 can be categorized into type 1 NRLN and cases 2–4 can be categorized as type 2a. 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.

#### 4. Conclusion

Despite the fact that NRLN is rare, its presence increases the risk of intraoperative vocal cord injury. Therefore, surgeons should have complete knowledge of its prevalence, embryogenesis and anatomical variations to minimize nerve injury and improve the rate of operative success.

#### Conflict of interest

None.

#### Funding

None.

#### Ethical approval

The study was approved by our research committee, Vietnam National Cancer Hospital, Hanoi, Vietnam.

#### Consent

The publication of this study has been consented by all relevant patients.

#### Author contribution

Quang V. Le: Surgeon performed all cases.

Duy Q. Ngo: Assisting surgeon operated all cases, wrote manuscript.

Quy X. Ngo: Follow up and post-operative management.

#### Registration of research studies

researchregistry3847.

#### Guarantor

Quang V. Le, M.D.

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