

## Right Non-Recurrent Laryngeal Nerve Discovered during Total Thyroidectomy

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## Abstract:

**Introduction:** The non-recurrent laryngeal nerve (NRLN) is an infrequent variant of inferior laryngeal nerve that takes an unusual course. Since this is a rare anatomic variation, operations on these patients carry a great risk of laryngeal nerve injury.

**Case Presentation:** A 25-year-old woman with papillary thyroid carcinoma and cervical lymphadenopathy underwent total thyroidectomy and bilateral neck dissection levels II – VI. It was noted intraoperatively that right inferior laryngeal nerve was a NRLN and right common carotid artery originated directly from the aorta and right brachiocephalic artery was absent. The nerve was preserved and patient underwent an uneventful surgery. She was well in her follow-up visits, her voice was good and both of her vocal cords were mobile on indirect laryngoscopy examination.

**Conclusion:** Although NRLN is a rare anatomic variation, surgeons should always think twice about this finding whenever right recurrent laryngeal nerve cannot be found according to anatomical landmarks intra-operatively.

### Keywords:

Recurrent Laryngeal Nerve, Laryngeal Nerves, Vocal Cord Paralysis

### Introduction:

The non-recurrent laryngeal nerve (NRLN) is an infrequent variant of inferior laryngeal nerve that takes an unusual course. It does not descend into thorax as generally does (1). This anatomical variation was first mentioned by Stedman in 1823 (2). It occurs almost always on the right side and there is a strong association between the anatomic variation and vascular anomalies of the aortic arch (3). The right NRLN is generally

consequence of partial regression of the fourth branchial arch, resulting in an aberrant subclavian artery that runs behind the esophagus which is called *arteria lusoria* (3). As the embryo grows longitudinally, the unusual vascular pattern permits the nerve to migrate into the neck and has a fairly direct course towards the larynx (3). The existence of an NRLN without the coincident vascular anomalies does not have a clear embryological explanation thus far (3). NRLNs on the left side is extremely rare, all of them

are accompanied by other important anatomical variations such as situs inversus (4 - 6).

This case report aimed to draw attention to NRLN as a rare anatomic variation of inferior laryngeal nerve during thyroidectomy surgery.

### Case presentation:

A 25-year-old woman referred to outpatient head and neck oncological surgery clinic of Cancer Institute (a tertiary medical center, Tehran, Iran) with the complaint of anterior cervical mass for long time. On examination, a mass was palpated on anterior of the neck on the left side of trachea 1×1.5 cm. The clinical ultrasonography report showed 2 hypoechoic nodules in the left thyroid lobe 13×15 mm and 9×15 mm in size. There was bilateral suspicious cervical lymphadenopathy. The greatest lymph node size was 11×25 mm on right side and 16×38 mm on the left side. Fine needle aspiration (FNA) biopsy of thyroid nodule result according to Bethesda System for Reporting Thyroid Cytopathology was malignant, papillary thyroid carcinoma. The FNA biopsy of lymph nodes was compatible with papillary thyroid carcinoma.

The patient underwent total thyroidectomy and bilateral neck dissection levels II – VI. The inferior laryngeal nerve was non-recurrent on the right side and was preserved (Figure 1).

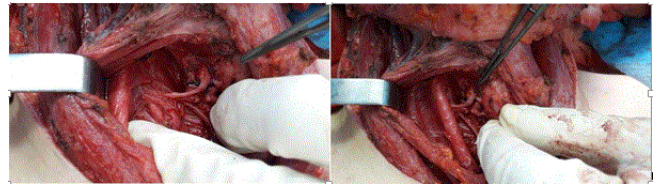


Figure 1. Right lateral view from a patient with non-recurrent laryngeal nerve undergoing total thyroidectomy for papillary thyroid carcinoma

The right common carotid originated directly from the aortic arch passing over the trachea (Figure 2).

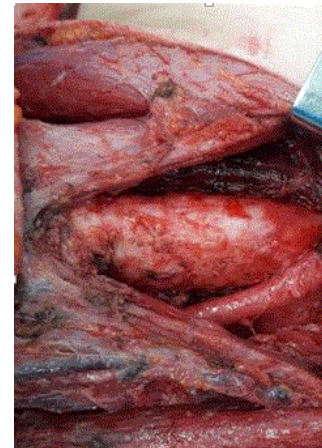


Figure 2. Right common carotid artery originated directly from the aortic arch, passing over the trachea

The patient underwent an uneventful operation and was well during her follow-up visits. Her voice was good. Indirect laryngoscopy examination revealed that both of her vocal cords were mobile. She underwent radioactive iodine (I-131) ablation therapy to complete her treatment.

## Discussion:

All surgeons should try to preserve laryngeal nerves during thyroid surgery to maintain a normal voice postoperatively and this issue should not be taken lightly. A substantial increase in knowledge of laryngeal nerve anatomy and its variation aids surgeons to preserve the laryngeal nerve during the thyroid surgery.

The first case of non-recurrent laryngeal nerve (NRLN) was described in nineteenth century (2). It was shown to be associated with aberrant right subclavian artery, originating from the left side of the aortic arch and passing posterior to the esophagus (2). Nowadays there are several reports and case series of NRLN in the literature. The incidence of NRLN is 0.5–1% on the right side (7-9). The left NRLN is extremely rare and the incidence is 0.04% (4, 5). The most common classification that is used is Avisse's classification; which divides the course of NRLN in two types according to the course of NRLN. In NRLN type 1 the nerve originates near the upper thyroid pole and follows the superior thyroid artery (STA), while in NRLN type 2 makes a small curve downward, and then the nerve runs parallel to the inferior thyroid artery (ITA). Eventually, the nerve runs superiorly to enter into the larynx (10).

The NRLN type 2 was subsequently classified in two different subtypes. In type 2a the nerve passes

over the ITA, while in type 2b, it runs between the branches of the ITA. Type 2a seems to represent the most common type of NRLN (5).

Embryonic development provides a basis of NRLN. The NRLN is widely supposed to be developed from an anomaly of the aortic arches. When the heart descends during embryonic development, the inferior laryngeal nerves wrap around the sixth branchial arches bilaterally. The sixth branchial arch regresses on the right side later on and the inferior laryngeal nerve (ILN) ascends up to the level of the fourth branchial arch that develops into the right subclavian artery. If the fourth branchial arch is not present, the ILN courses more directly towards the larynx, resulting in an NRLN. On the left side there is a faint possibility of NRLN as the sixth branchial arch remains until birth and develops into ductus arteriosus (11). The left NRLN is anatomically feasible only in case of dextrocardia. This also explains the strong association between this anatomic anomaly and the absence of innominate artery and existence of an aberrant right subclavian artery. In 80% of these patients in fact, the right subclavian artery originates in the left part of the aortic arch, passing behind the esophagus on its path towards the right arm. In 15% of them it passes between the trachea and the esophagus and 5% of cases in front of the trachea (12).

Most of the time patients with aberrant right

subclavian artery are asymptomatic, but in 10% of cases it manifests itself with dysphagia due to esophageal extrinsic compression which is called dysphagia lusoria. The gold standard technique in identifying arteria lusoria is computed tomography angiography (CTA). Arteria lusoria may present as an extrinsic compression on the left edge of the posterior esophagus at the third thoracic vertebral level below the aortic arch on the barium esophagogram, which is called “bayonet sign” (11, 13). A pulsation in the posterior wall of esophagus on esophagoscopy can aid in establishing the diagnosis. It is likely to discover this anomaly during carotid surgery, as CTA often enters pre-operative preclinical exams and can easily be noted as an incidental finding. It is not an ordinary practice ordering CTA in thyroid and parathyroid surgeries, unless in case of thyroid or parathyroid cancer or intrathoracic goiters. It is not a cost-effective practice to order CTA to predict an aberrant subclavian artery and NRLN in all thyroid surgeries (11).

Preoperative neck ultrasonography (US) is a simple, non-invasive and cost-effective method to predict NRLN, but its specificity varied between (41-100%) in different studies was not absolute. (14).

Present case had type 1 right NRLN and right common carotid originated directly from the aortic arch which was noted intra-operatively.

A patient with NRLN associated with anomalous vertebral artery was reported. The vertebral artery was originated from the subclavian artery in the same position of the common carotid artery ascended medial to it (15).

### **Conclusion:**

Although NRLN is a rare anatomic variation, surgeons should always think twice about this finding whenever right recurrent laryngeal nerve cannot be found according to anatomical landmarks intra-operatively. Any transverse bond should not be cut between the common carotid artery and larynx except the middle thyroid vein till inferior laryngeal nerve is found.

Preoperative ultrasonography is an excellent replacement for computed tomography (CT) scanning to detect arterial abnormalities associated with NRLN.

### **Authors' Contributions:**

H.S. drafted the manuscript. M.M. and A.S. critically revised the manuscript for important intellectual content.

### **Conflict of Interest Disclosures:**

There are no conflicts of interest in terms of the present manuscript.

### **Ethical approval/Consideration:**

A written informed consent was signed by patient for reporting her case. All the personal information remained anonymous.

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