

The Nonrecurrent Laryngeal Nerve in Thyroid Surgery

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ABSTRACT

A nonrecurrent laryngeal nerve is a rare anomaly and estimated to be present in 0.25 to 0.99% of patients.¹ The identification and preservation of the recurrent laryngeal nerve is an essential part of thyroid surgery. It is now well-known that the recurrent laryngeal nerve is not only a single nerve but also a complex branching network of innervation. Thyroid surgery demands a precise understanding of the anatomical intimacy between the gland and surrounding structures, including the parathyroid glands and neurovascular tissue. The morbidity associated with thyroid surgery, in the short-term, generally relates to hematoma collection and hypocalcemia. Long-term morbidity is more commonly seen with dysphonia and vocal cord dysfunction due to superior laryngeal nerve damage and its role in explosive sound formation, the recurrent laryngeal nerve, its tortuous anatomical course, and its role in laryngeal musculature innervation.

We review the literature on this subject and report three cases of the rare nonrecurrent anomaly, firstly a 75-year-old lady with a large retrosternal goiter. During her initial work-up which included a CT scan of the thorax, an 'arteria lusoria' was identified in the retrosophageal plane. Intraoperatively, a right-sided nonrecurrent inferior laryngeal nerve (NRILN) was identified. The second case is of a 63-year-old lady with a right-sided type 1 nonrecurrent laryngeal nerve which we identified and photographed when medially retracting the gland off the central compartment and ligament of Berry. The third case is that of a 45-year-old lady with a right-sided thyroid nodule and a right-sided NRILN identified intraoperatively.

Keywords: Thyroid, Nonrecurrent inferior laryngeal nerve, Anatomical anomaly, Vagus.

INTRODUCTION

A 75-year-old female presented with retrosternal goiter. The patient had multiple imaging studies, including a CT scan of her neck and thorax. On the computed tomography (CT) thorax an 'arteria lusoria' can be clearly visualized where the right sided subclavian artery originates from the arch of the aorta. This is indicative of a further anatomical anomaly in relation to the recurrent laryngeal nerve. Her surgery included a total thyroidectomy. A right-sided nonrecurrent inferior laryngeal nerve was appreciated and preserved entirely during the neck exploration (Figs 1 and 2). The recurrent laryngeal nerve normally bisects an angle between the inferior thyroid artery and the trachea as it ascends the tracheoesophageal gutter. It is

interesting to see this example of a type 2 nonrecurrent laryngeal nerve, wrapping itself around the inferior thyroid artery before reaching the larynx (Fig. 3).

The second case is that of a 63-year-old lady who underwent a total thyroidectomy for a left-sided solid nodule at 3.6 cm with cellular atypia on fine needle aspiration. The thyroid on preoperative ultrasonography was noted to have multinodularity. She had no radiation history and had several family members previously operated on for thyroid cancer. Her procedure was standard with a transcervical open approach with dissection through platysma and the linea alba, and identification and exposure of the thyroid lobes. The right-sided vascular pedicle was firstly identified and ligated in systematic fashion. Medial

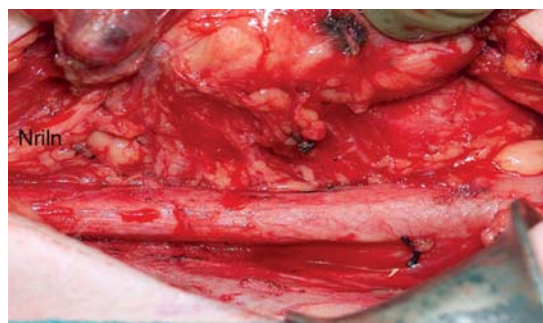


Fig. 1: The carotid artery exposed and the NRILN preserved during the dissection



Fig. 2: CT thorax reveals an 'Arteria Lusoria' traveling retroesophageal which is appreciated in 80% of these anomalies

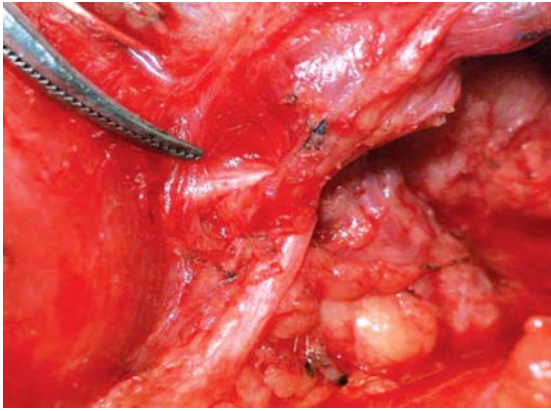


Fig. 3: Type 2 nonrecurrent inferior laryngeal nerve (NRILN) traversing across from the vagus to the larynx looping around the inferior thyroid artery

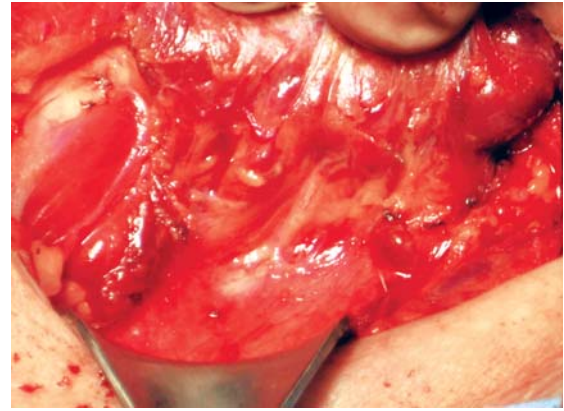


Fig. 4: This image is a right thyroid lobe being medially retracted with a type 1 nonrecurrent laryngeal nerve identified in the middle of the picture travelling from the cervical vagus nerve before turning medially into the cricothyroid joint

retraction of the gland and release of fascial attachments was undertaken. The recurrent laryngeal nerve was not identified within the tracheoesophageal gutter and was instead found travelling from a superolateral position before turning medially into the cricothyroid joint. The nerve was traced to the vagus nerve confirming its nonrecurrence. We classified this as a type 1 NRILN. The third case is that of a 45-year-old lady who also underwent standard transcervical open approach for a right-sided thyroid nodule. No previous CT scanning of the chest was performed. A NRILN was identified entering the larynx and was traced back to its origin—the vagus nerve.

DISCUSSION

The first report of a NRILN in the literature is by Steadman in 1823. The danger associated with this anomaly was realized in the early 1920s. Since then, intermittent cases have been identified. The recurrent laryngeal nerve is the nerve of the sixth branchial arch and is associated with the sixth arch arteries. The ventral branches of these arteries form the pulmonary arteries. The dorsal branches of the sixth arch arteries and the fifth arch arteries do not form representative structures leaving the recurrent laryngeal nerve to navigate the fourth arch arteries. The fourth arch arteries on the right become the right subclavian artery and on the left the aortic arch. This explains the varying course of this nerve.² The fourth arch artery on the right occasionally disappears; and the right subclavian artery originates from the aortic arch. The subclavian then travels behind the esophagus in 80% of cases, between the esophagus and trachea in 15% of cases and in 5% of cases in front of the trachea. This is known as *arteria lusoria*.³⁻⁶

There have been two types of recurrent laryngeal nerves identified. The first or high type arises perpendicularly from the vagus joining the cricothyroid joint transversally after a brief route. The second or low type originates from the vagus nerve at varying locations and has a longer course within the tracheoesophageal groove. True nonrecurrent laryngeal nerves are associated with the *arteria lusoria*, and are right sided,³ however, these have been identified without vascular anomalies.¹ Upon identification of a nonrecurrent nerve, one

should trace its origins to confirm if this is truly from the vagus nerve (Fig. 4). Another anatomical possibility is a branch from the sympathetic trunk as part of the sympathetic-recurrent laryngeal anastomotic branches as described from the reporting on 1,253 recurrent laryngeal nerves.⁷

CONCLUSIONS

A nonrecurrent laryngeal nerve is a rare anatomical anomaly which does not warrant preoperative radiological investigation on its own right but is a variant to be cognizant of as a thyroid surgeon. If the patient had a previous CT scan of the chest it is important to review the imaging. A simple and effective method of identification is preoperative ultrasonography which also has proven reliability in diagnosis.⁸

Nonrecurrence is related to the absence of the brachiocephalic trunk and aberrant (mainly retroesophageal) course of the right subclavian artery. The senior author has identified approximately seven cases of the NRILN in his career. We estimated incidence of less than 1%, however, these anomalies also have implications for other head and neck procedures and vascular surgery.

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