CASE REPORT

The non-recurrent inferior laryngeal nerve: The clinical and surgical implication

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ABSTRACT

Objectives: We report two cases of a non-recurrent right inferior laryngeal nerve; per operative discovery during a thyroidectomy. Through these cases, we highlight the clinical and surgical implications by first analyzing the most appropriate technique.

Results: The frequency of the recurrent non-recurrent nerve was 1.3% with confidence interval between 0.2 and 4.6% in our center. We identified two patients who underwent a thyroidectomy, during which the discovery of the recurrent non-recurrent right nerve was made intraoperatively. The nerve approach was performed by the superior approach in front of a bulky and plunging goiter. The outcome was simple.

Conclusion: The thyroid surgeon must keep in mind the probability of finding this nerve variation. For indirect signs, the superior approach would be the most suitable technique to avoid recurrent morbidity.

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KEYWORDS

Recurrent non-recurrent nerve; thyroid; superior approach

Introduction

The recurrent laryngeal nerve is a cervical branch of the vagus nerve that supplies motor, sensory and parasympathetic nerve fibers to the larynx [1,2]. Non-recurrence of the nerve is a rare anatomical variant [3]. The first case was reported in 1823 by Stedman [4]. This variation is constantly associated with vascular malformations due to an abnormality in the development of the sixth brachial arch [5,6]. One series found a non-recurrent lower right laryngeal nerve at 0.6% in 4921 right cervical dissections and a non-recurrent lower left laryngeal nerve at 0.04% in 4673 left cervical dissections [3,6]. The circumstances of discovery is either:

- By indirect signs. The symptom ‘dysphagia lusoria’ is an impairment of swallowing due to compression from an aberrant right subclavian artery (artéria lusoria). It’s most often associated with the non-recurrent inferior laryngeal nerve [1,2,5].

Preoperative imaging using ultrasound, computed tomography and angiography allows us to find predictive signs of the non-recurrent laryngeal nerve, notably an aberrant right subclavian artery, a right retro-oesophageal or pre-oesophageal artery, a situs inversus [5–7].

- Intraoperative which is the most frequent.

This anatomical variant is a source of operative morbidity. The clinical spectrum depends on the topography of the lesion. Dysphonia is marked in the event of unilateral involvement; the symptomatology becomes noisy in the event of bilateral involvement, a major respiratory distress involving the life prognosis of the patient requiring a tracheotomy [1]. The incidence of an intraoperative lesion of the lower laryngeal nerve is from 0.4 to 7.2% for temporary paralysis and from 0 to 5.2% for permanent paralysis and can reach 12 to 14% in case non-recurrence of the nerve [3,5,8]. The increased incidence of recurrent lesion in the event of non-recurrence of the nerve is the source of many hypotheses according to the analysis of the different series. The various techniques describing recurrent research cannot be asserted on a technique adapted to the search for the recurrent non-recurrent nerve. According to some author, this non-recurrence...
is suspected if the nerve is not visualized according to the classical technique; it is first of all by the inferior approach. According to the various series reported when the indirect signs are present, the approach to the recurrent nerve would be better at the upper level [9].

We report two cases of a non-recurrent right inferior laryngeal nerve; per operative discovery during a thyroidectomy. Through these cases, we highlight the clinical and surgical implications by analyzing the technique that is best suited for the approach of the non-recurrent recurrent nerve in the presence of indirect signs.

**Case report**

The frequency of the recurrent non recurrent nerve was 1.3% with confidence interval between 0.2 and 4.6% in our center.

**Case report 1**

35-year-old patient admitted for bilateral multinodular goiter. No other signs were noted. Total thyroidectomy was performed. The superior approach to the inferior laryngeal nerve was the locating technique. We found that the right lower laryngeal nerve from its point of entry into the larynx was directed directly to the vagus nerve on the right. The non-recurrent laryngeal nerve has been classified as type 1 (Figure 1). The outcome was simple. The pathology examination found an adenoma.

**Case report 2**

36-year-old patient admitted for isolated bilateral multinodular goiter. She underwent a total thyroidectomy with a superior approach to the inferior laryngeal nerve. We found a non-recurrent right lower laryngeal nerve type 1 (Figure 2). We did not notice any difficulty in the recurrent laryngeal nerve search. The nerve was visualized after exposure of the cricopharyngeal muscle. The outcome was simple. The pathology examination found an adenoma.

Surgical technical: A Kocher incision was made extending over 10 cm long, two centimeters from the sternal fork of the superficial cutaneous-musculo-fascial complex. We then proceeded to expose the gland after a median aponeurotomy. After ligation of the vessels of the upper pole of the right lobe the cricopharyngeal muscle was carefully exposed through an avascular zone between the upper pole and the thyroid cartilage. The search for the nerve started with the palpation of the small horn of the thyroid cartilage which allows us to estimate the depth of the recurrent nerve. The dissection was carried out with a forceps from the lower edge of the cricopharyngeal muscle in a triangle whose base is the lower edge of the right cricopharyngeal muscle and the top being the junction of the gland with the trachea, in the ligament of Berry on the lateral face of the trachea. This allowed us to find in our two patients the recurrent nerve which from its point of entry went directly to the vagus nerve. We then dissected the wave to confirm that it was the recurrent non-recurrent nerve.

**Discussion**

The inferior laryngeal nerve is a cervical branch of the vagus nerve that supplies motor, sensory and parasympathetic nerve fibers to the larynx [1,2]. The lower laryngeal nerves are the nerves of the sixth branchial arches. The ventral parts of these arches become the pulmonary arteries, leaving the nerves retained only by the remaining dorsal parts [2,5,6].
These dorsal parts regress, as do the fifth branchial arches, allowing the nerves to reproduce and rise below the fourth arches [2,5]. The fourth right and left arches respectively become the right subclavian artery and the aortic arch; this is considered normal embryological development [2].

In the case of the non-recurrent inferior right laryngeal nerve, the fourth right brachial arch degenerates and is replaced by an aberrant right subclavian artery of the name of ‘Arteria lusoria’ coming from the left aortic arch [2,5,12]. The fourth absent right gill arch allows the nerve to follow a direct path to the larynx. It is agreed that the non-recurrent right lower laryngeal nerve is associated with the Lusorian artery in all cases [2,5,13]. Toniato et al. have described three types of non-recurrent inferior laryngeal nerve according to their specific evolution [10]:

- The non-recurrent type 1 nerve arises directly from the cervical vagus nerve and mates with the vessels of the upper thyroid pedicle.
- The non-recurrent nerve type 2A follows a transverse path parallel to the trunk of the lower thyroid artery and above it.
- A non-recurrent nerve of type 2B follows a transverse path parallel to the trunk or between the branches of the lower thyroid artery.

A meta-analysis on several series of non-recurrent inferior laryngeal nerve diagnosed preoperatively and intraoperatively discovered respectively a rate of 30.7% type 1 in 88 cases against 69.3% type 2 and 19.9% type 1 out of 146 cases against 80.1% type 2 [3]. Our cases concerned type 1.

The non-recurrent inferior laryngeal nerve is suspected when associated indirect signs of a lusorian artery are present. The ‘Dysphagia Lusoria’ is confirmed at endoscopy (visualization of the imprint of the arterial lusoria on the posterior part of the esophagus or between the esophagus and the trachea) [1,2,5,11]. Our two observations did not present any clinical manifestation. Preoperative neck ultrasound imaging can find an aberrant right subclavian artery in the absence of the ‘Y-signs’ of the brachiocephalic artery [4,6,7]. In addition, computed tomography (CT) detects the ‘hook-shaped’ course of the artery under the right keypad (usually retro-esophageal) [4,6,7]. In our case the discovery of the nerve was intraoperative. The preoperative cervical ultrasound performed did not objectify a vascular anomaly and our patients showed no clinical signs. The incidence of an intraoperative lesion of the lower laryngeal nerve is 2 to 7% and can reach 12 to 14% in the event of non-recurrence of the nerve [3,5]. The different approaches of the recurrent nerve during the thyroidectomy take into account the classic landmarks. Identification and ungrouped ligation of the vessels closest to the gland, dissection of the carotid sheath in order to isolate the vagus nerve, monitoring of the nerve with an electrical stimulation of 1 mV of the vagus nerve up to the upper edge of the cartilage thyroid (proximal portion) and at the lower edge of the fourth tracheal ring (distal portion) [5,12]. Despite these multitudes of locating techniques, the authors have reported little for that of the recurrent non-recurrent nerve. Even in the series where indirect signs were detected the classical technique of the lower approach was performed. This approach gives little information about the benchmark on the non-recurrent nerve. The nerve will be exposed to recurrent lesions, stimulation is indicated for certain and the risk will be increased when the indirect signs are absent. In the literature review, Koné et al highlighted the superior approach to remedy the problem of identification in case of recurrent non-recurrent nerve [9]. In terms of landmarks, the nerve is approached at the upper level, a faithful point of entry of the nerve without modification. In our two observations, the superior approach to the lower laryngeal nerve was the locating technique. This approach was indicated in relation to the volume and the plunging nature of the goiter. We did not find any indirect sign that could direct us towards this non-recurrence of the recurrent nerve. Access to the nerve was easy during the superior approach. The nerve was followed from its point of entry into the larynx to the vagus nerve. The two non-recurring nerves were classified as ‘type 1’. This approach is justified in the literature and recognizes several indications. It would be better suited in cases where non-recurrence of the nerve is suspected. In the different anatomical series, the reliability of entry of the recurrent nerve under the small horn is 100% [9]. The limits of our work: Our discovery constitutes a fortuitous discovery intraoperative; however the superior approach of the recurrent nerve has been indicated on the two characteristics of voluminous and plunging goiter. The indication of the upper approach was not previously established due to the absence of indirect signs. The absence of stimulation by nerve monitoring in our context but despite this the superior approach was our reference technique.

**Conclusion**

The non-recurrence of the inferior laryngeal nerve is a rare anatomical variation. The indirect clinical and
imaging signs of the presence of a lower laryngeal nerve may be missing; however the cervical surgeon should keep in mind the probability of finding this nerve variation. The insensitivity of the point of entry of the inferior laryngeal nerve into the larynx makes the superior approach of the latter a reliable technique for locating the nerve, thereby preventing nerve damage with serious consequences.

Informed consent
We have obtained informed consent from all patients.

Disclosure statement
No potential conflict of interest was reported by the author(s).

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