

Identification of Non-Recurrent Laryngeal Nerve - A Case Report

Dr. Jyotirmoy Phookan¹, Dr. Sohini Chakrabarti²

¹(Associate Professor, Department of Otorhinolaryngology, Gauhati Medical College and Hospital, India)

²(Post Graduate Trainee, Department of Otorhinolaryngology, Gauhati Medical College and Hospital, India)

Abstract: The recurrent laryngeal nerves is present on both sides of the trachea, and at the point of entrance to the larynx they are located just lateral to the Berry ligament. They have important anatomic variations. Very rarely, the inferior laryngeal nerve exits the vagus nerve in the cervical region and enters the larynx with a short and straight course from its origin. This anomaly is called "non-recurrent laryngeal nerve". Injury to the recurrent laryngeal nerve is a serious complication in thyroid and parathyroid surgery. Identification and preservation of recurrent laryngeal nerve (Inferior laryngeal nerve) is one of the most important step during Thyroid surgery. Very rarely, Thyroid surgeons may encounter a Non recurrent laryngeal nerve. A preoperative clinical suspicion, in case of an aberrant subclavian artery or situs inversus and a systematic meticulous dissection will help in the identification and preservation of a non recurrent laryngeal nerve In this case report, we present a non-recurrent laryngeal nerve abnormality in a patient who underwent total thyroidectomy for multi-nodular goitre. A non-recurrent laryngeal nerve was identified on the right side during exploration.

Keywords - non-recurrent laryngeal nerve, arteria lusoria, retroesophageal right subclavian artery, aberrant right subclavian artery, neuromonitoring

Date of Submission: 14-02-2018

Date of acceptance: 01-03-2018

I. Introduction

The recurrent laryngeal nerves innervate the intrinsic laryngeal musculature, except the cricothyroid muscle. In addition, the nerves also provide sensory innervation to the glottic larynx. The recurrent laryngeal nerves branch from the vagus low in the neck and descend into the superior mediastinum. On the left side the nerve loops around the ligamentum arteriosum at the level of the aortic arch and ascends in a more medial position toward the cricothyroid membrane. On the right side the nerve loops around the subclavian artery and ascends in a lateral to medial direction toward the tracheoesophageal groove. When the nerve is non-recurrent [1], more commonly on the right side it traversing medially in a loop directly from the vagus nerve. This anomaly is associated with a retroesophageal right subclavian artery.

For being an essential structure to laryngeal function and for its close relation with thyroid gland, the identification and preservation of the recurrent laryngeal nerve are important steps on thyroidectomy and parathyroidectomy. Its injury and then vocal cord palsy is one of the complications of these surgeries, causing dysphonia and even respiratory deficiency soon after surgery, when injury is bilateral. Videolaryngostroboscopy exams can be used after surgery in order to evaluate mobility of vocal folds, confirming the integrity of the nerve structure.

II. Case Report

A 52 year old female presented with a gradually progressive swelling on anterior aspect of neck of 30 year duration.



Figure 1: Preoperative image of the patient



Figure 2: Pre-operative CT scan showing extent of mass. Right lobe more than left lobe of thyroid gland

She complained of pain in the swelling with skin ulceration for past 10 days.

On clinical examination, there was a 15x10 cm firm swelling involving both lobes of the thyroid gland (right > left). No significant lymph nodes were palpable. There was ulceration with discharge from the skin over the swelling. Indirect laryngoscopic examination showed bilateral mobile vocal cords.

She was evaluated and Fine Needle Aspiration Cytology was suggestive of multi-nodular goitre.

CT evaluation showed — heterogenous enhancing mass involving both lobes of thyroid gland, right > left, encasing the internal carotid artery and internal jugular vein but with no retrosternal extension. An aberrant right subclavian artery going posterior to the oesophagus arising directly from the arch of aorta was seen in the imaging. Thus the first suspicion of a non recurrent laryngeal nerve on the right side was raised. Total Thyroidectomy with central compartment clearance and a right side selective neck dissection was done. Right recurrent laryngeal nerve was not found in its usual site. Instead a non recurrent laryngeal nerve arising directly from the vagus was visualized on the right side. It was identified and preserved. Left recurrent laryngeal nerve was present in tracheoesophageal groove and was preserved. The tumour was seen encasing the internal carotid artery and internal jugular vein on right side. Extensive and careful dissection was carried out to remove all the tumour mass whilst saving the major vessels and the right non recurrent laryngeal nerve. Post operation, the specimen of total thyroidectomy measured 1.25 kg.

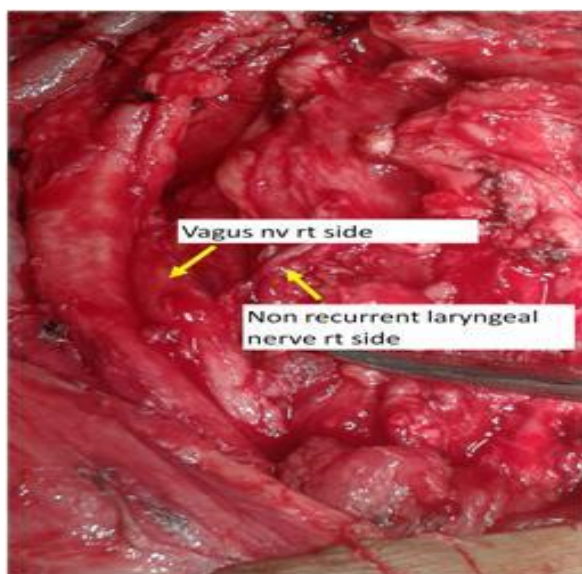


Figure 3: Intraoperative photograph of the Vagus and the Non Recurrent Laryngeal Nerve

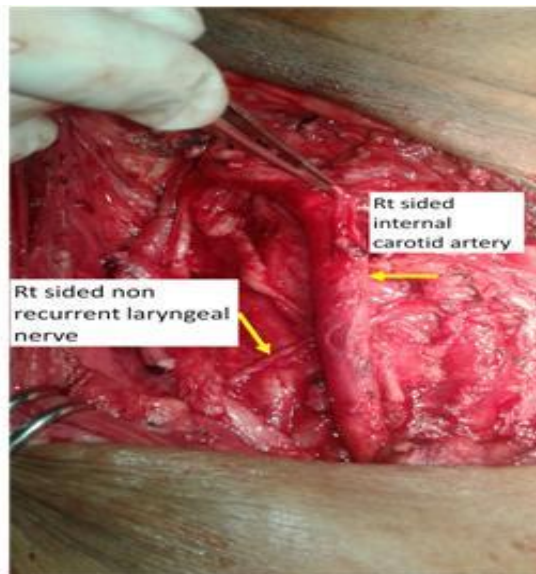


Figure 4: Intraoperative photograph of the Non Recurrent Laryngeal Nerve and the Internal Carotid Artery



Figure 5: Specimen of total thyroidectomy (weight - 1.25 kg)

III. Discussion

The incidence of this anomaly ranges from 0.3% to 1.6% for the right NRLN and it is approximately 0.04% for the left side [2]. Only during situs inversus we can see a non-recurrent inferior left laryngeal nerve, what explains a lower number of cases to this side [3].

In 1823, Stedman reported Non recurrent laryngeal nerve on right side while he was doing cadaveric dissection at Royal Academy, Copenhagen. The surgical importance of NRLN was pointed out by Pemberton and Benner in 1932. First case was aberrant right subclavian artery by Hunwald in 1785. Bayford reported first retroesophageal right subclavian artery in a patient with dysphagia in 1974 [4].

The aberrant origin of right subclavian artery from arch of Aorta gives rise to right sided non recurrent laryngeal nerve. The right and left RLN supply the sixth branchial arch in the embryological stage of life. As the embryo elongates and heart descends, the distal part of sixth arch disappears on right side and the RLN ascends up and winds around the right subclavian artery on its upward course towards larynx. But on left side, the sixth arch remains as Ductus arteriosus until birth and as ligamentum arteriosum later. So the left RLN winds around the ligamentum arteriosum and hence it is more longer than right RLN [4]. If the right fourth aortic arch is absent, the right RLN is free to move upward, originating directly from the vagus nerve at a cervical level and entering the larynx transversely giving rise to the NRLN. That is why the NRLN is almost always observed on the right side as left-side cases require the coexistence of a right aortic arch associated with dextrocardia, a left subclavian artery with a lusoria course, and the absence of an arterial ligament on the left side. The right subclavian artery is often formed from the distal portion of the right dorsal aorta and the seventh intersegmental artery, and originates just below the left subclavian artery to reach the right axillary area in most NRLN cases [5]. The presence of this aberrant right subclavian artery was first named arteria lusoria by Stedman [6].

When right subclavian artery arises from the arch of Aorta as fourth branch, it passes either between trachea and oesophagus or posterior to the oesophagus. In such cases, the right inferior laryngeal nerve passes directly downward and medially from the vagal trunk to the larynx at the level of thyroid gland. Three types of NRLN have been described:

- **TYPE I:** NRLN arises from the Vagus and runs together with the superior thyroid vessels
- **TYPE IIA:** NRLN follows a transverse path parallel to and over the trunk of inferior thyroid artery
- **TYPE IIB:** NRLN follows a transverse path parallel to and under the trunk or between the branches of inferior thyroid artery [7, 8]

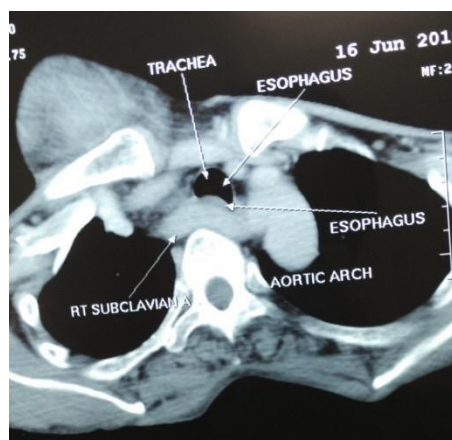


Figure 6: CT Scan showing aberrant retroesophageal subclavian artery on right side

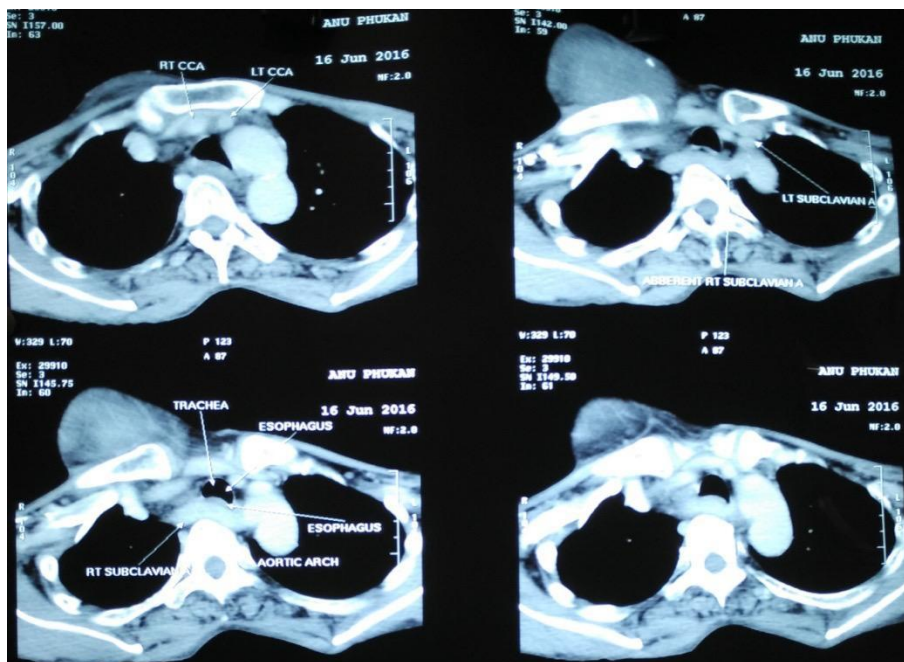


Figure 7: CT Scan showing distinct origin of right common carotid and left common carotid arteries from aortic arch and aberrant right subclavian artery

The main challenge to surgeons is the preoperative and intraoperative diagnosis of the non recurrent laryngeal nerve. Various methods have been described to make a preoperative diagnosis, but each examination has its own limitation

Detection of an anomalous nerve usually occurs during surgery and incidentally.

According to Sparta et al. only the systematic identification of the inferior laryngeal nerve assures surgeons of the absence of injury. Thus, we understand the need of an anatomic knowledge and possible variations to perform surgeries with a lower risk of injuries to this structure [9].

Liu et al., suggested that any transverse bond should not be cut between vascular and laryngeal except middle thyroid vein, unless the recurrent laryngeal nerve is identified [10].

The diagnosis of this anatomical variation is rarely performed before surgery and only a CT from thorax showing a retro-oesophageal subclavian artery (arteria lusoria) and the absence of the brachiocephalic artery can be seen directly and establish a diagnosis of NRLN [11].

A CT Scan is done in case of thyroid swelling in two conditions — (a) there is suspicion of retrosternal extension (including retroesophageal and retrotracheal) (b) if there is suspicion of tracheal invasion.

Ultrasonography is a noninvasive, rapid and inexpensive method to evaluate thyroid diseases preoperatively. Preoperative ultrasonography can correctly identify nonrecurrent laryngeal nerve, allowing earlier nerve identification and prevention of injuries. [12]

USG thyroid and US guided fnac is an accepted protocol for all thyroid swelling evaluation.

Hence a comment from the radiologist regarding the bifurcation of the right subclavian and common carotid artery that is ‘Y’ sign on USG is indicated to be normal and its absence warns the surgeon of the possibility of encountering the non recurrent laryngeal nerve on the right side.

Angiography is one of the most effective and directive methods to diagnose vascular anomalies, but it is inappropriate to use before thyroid cancer surgery because the dye for angiography contains a lot of iodine, which may affect the postoperative radioactive iodine treatment. [13]

Newly developed techniques such as CT angiography (CTA) are needed for identification of the NRLN, Preoperative CTA is much safer and less time-consuming than catheter angiography. Also, CTA is a cost-effective three-dimensional imaging modality for identifying aberrant subclavian arteries associated with NRLNs. [14]

Intraoperative visual identification has been the gold standard for securing the laryngeal nerves during thyroid surgery. However, an anatomically intact nerve identified by gross visualization does not confirm a functional nerve. Consequently, electrophysiologic intraoperative nerve monitoring (IONM) of the nerves was introduced by Shedd and Durham in 1965 as a novel technique which lowers the risk of RLN injury compared to the traditional visual identification. [15]

Neuromonitoring can detect anatomical variation in the courses of the nerves which are at higher risk of injury if not detected. The technique of intraoperative neuromonitoring in thyroid surgery is safe and reliable

in excluding postoperative recurrent laryngeal nerve palsy; it has high accuracy, specificity, sensitivity and negative predictive value. Neuromonitoring is useful to identify the recurrent laryngeal nerve and it can be a useful adjunctive technique for reassuring surgeons of the functional integrity of the nerve but it does not decrease the incidence of injuries compared with visualization alone. Its application can be particularly recommended for high-risk thyroidectomies. [16]

Considering that CT is expensive, requires an X-ray, and achieves less information than ultrasound (US) concerning thyroid nodules, applying US and IONM is more reasonable. [17]

In this case, we observed, during surgery, a Type II A non-recurrent inferior laryngeal nerve to the right during a total thyroidectomy. Despite difficulties like a huge tumor load, and substantial blood loss, the nerve was correctly identified and preserved.

Conclusion

The presence of non-recurrent variant of inferior laryngeal nerve is a major risk during surgical procedures in the neck region which should be prevented to be damaged. The best way to avoid this damage to the nerve is to identify the nerve with a systematic diligent dissection based on usual anatomical landmarks and awareness about the possibility of their existence. The best way of identification of the non recurrent is to have the preoperative mindset of the non recurrent laryngeal nerve and then to save it.

References

- [1] Fahri Yetişir, Alper Bilal Özkardeş, Halit Ziya Dündar, Bozkurt Birkan, Ahmet Burak Çiftci, and Mehmet Kılıç, Non-recurrent laryngeal nerve. *Turkish Journal of Surgery*, 30(2), 2014; 112-114 [[PMC](#)]
- [2] Toniato A, Merante Boschin I, Paetta C, Casalide E, Pelizzo M, A “Pilot light” of the right non-recurrent laryngeal nerve, *Acta Otorhinolaryngologica Italica*, 30(2), 2010, 107-109 [[PMC](#)]
- [3] Henry JF1, Audiffret J, Denizot A, Plan M, The nonrecurrent inferior laryngeal nerve: review of 33 cases, including two on the left side, *Surgery*, 104(6), 1988 Dec, 977-84 [[PubMed](#)]
- [4] Santhosh Kumar N*, Shaji Thomas, Sharath K. Krishnan, N. Senthil Kumar, Non Recurrent Laryngeal Nerve - A Case Report, *Indian Journal of Medical Research and Pharmaceutical Sciences I(6)*, 2014 Nov, ISSN: 2349 – 5340 [<http://www.ijmprs.com/>]
- [5] Li X1, Wang Z, Lu X, Li J, Huang Y, Huang J, Long X, Non-recurrent laryngeal nerve related to thyroid surgery: a report of 5 cases and literature review, *Med Sci Monit*. 16(6), 2010 Jun, CS71-5 [[PubMed](#)]
- [6] Stedman GW, A singular distribution of the nerves and arteries of the neck and the top of the thorax, *Edinb Med Surg J*, 19, 1823, 564-5
- [7] Uludag M, Isgor A, Yetkin G, Citgez B, Anatomic variations of the non-recurrent inferior laryngeal nerve, *BMJ Case Reports*, 2009, pii: bcr10.2008.1107 [[PMC](#)]
- [8] Guerreiro, Sofia, et al, The non-recurrent laryngeal nerve: An anatomical “trap”. *Revista Portuguesa de Endocrinologia, Diabetes e Metabolismo*, 9(1), 2014 Jan-Jun, 84-87 [[ScienceDirect](#)]
- [9] Sparta C, Cossu ML, Fais E, Palermo M, Cossu F, Ruggiu M, Noya G, Non-recurrent inferior laryngeal nerve: anatomy, frequency and surgical considerations, *Minerva Chir*, 59(6), 2004, 555-61 [[PubMed](#)]
- [10] Liu LX1, Wu LF, Xue DB, Meng XZ, Zhang WH, Jiang HC, The importance of nonrecurrent laryngeal nerve in thyroid surgery, *Zhonghua Wai Ke Za Zhi*, 44(13), 2006 Jul, 904-6 [Article in Chinese] [[PubMed](#)]
- [11] Hermans R, Dewandel P, Debryne F, Delaere PR, Arteria lusoria identified on preoperative CT and nonrecurrent inferior laryngeal nerve during thyroidectomy: A retrospective study, *Head Neck*, 25, 2003, 113–117 [[PubMed](#)]
- [12] Iacobone M, Viel G, Zanella S, Bottussi M, Frego M, Favia G, The usefulness of preoperative ultrasonographic identification of nonrecurrent inferior laryngeal nerve in neck surgery, *Langenbecks Arch Surg*, 393(5), 2008 Sep, 633-8 [[PubMed](#)]
- [13] Epstein DA, DeBord JR, Abnormalities associated with aberrant right subclavian arteries a case report, *Vasc Endovascular Surg*, 36, 2002, 297–303 [[PubMed](#)]
- [14] Choi HS1, Shin DH, Kim KR, Park YA, Preoperative three-dimensional CT angiography to distinguish between an aberrant subclavian artery and a double aortic arch in thyroid surgery: Report of 2 cases, *Auris Nasus Larynx*, 38(1), 2011 Feb, 127-32 [[PubMed](#)]
- [15] Deniwar, Ahmed, Emad Kandil, and Gregory Randolph, Electrophysiological Neural Monitoring of the Laryngeal Nerves in Thyroid Surgery: Review of the Current Literature, *Gland Surgery* 4(5), 2015 Oct, 368–375 [[Link](#)]
- [16] Calò PG1, Pisano G, Medas F, Tatti A, Pittau MR, Demontis R, Favoriti P, Nicolosi A, Intraoperative recurrent laryngeal nerve monitoring in thyroid surgery: is it really useful? *Clin Ter*, 164(3), 2013 May-Jun, 193-8 [[PubMed](#)]
- [17] Gao, Er-li et al, Increased Prediction of Right Nonrecurrent Laryngeal Nerve in Thyroid Surgery Using Preoperative Computed Tomography with Intraoperative Neuromonitoring Identification, *World Journal of Surgical Oncology*, 12, 2014, 262 [[PMC](#)]

Dr. Jyotirmoy Phookan "Identification of Non-Recurrent Laryngeal Nerve - A Case Report".
“IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), Volume 17, Issue 2 (2018), PP 80-84.