

Right non-recurrent laryngeal nerve associated with anomalous origin of right subclavian artery and bicarotid trunk

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Introduction

Non-recurrent laryngeal nerve is a rare anatomical variation with an incidence in literature of 0.3% to 1.6% on the right side. This variation places the nerve at risk of inadvertent injury during head and neck surgeries. Awareness about this abnormality and meticulous dissection of the nerve in every case is the only way to stay safeguarded. Here we present a case of right non-recurrent laryngeal nerve in a 32 year old female patient who underwent near total thyroidectomy for non-toxic multinodular goitre. During surgery, the right recurrent laryngeal nerve could not be identified in its normal location. Further dissection revealed a non-recurrent laryngeal nerve arising from the vagal trunk. A CT angiogram was done post operatively and showed an anomalous origin of the right subclavian artery as the last branch of the aortic arch and a bicarotid trunk. Every surgeon operating on the neck should be aware of and anticipate this variation of the recurrent laryngeal nerve especially when the nerve cannot be identified in its' normal location.

Case report

A 32 year old female presented with a swelling in front of the neck. Clinical examination found a thyroid swelling with multiple palpable nodules in both lobes which were firm in consistency and had no retrosternal extension. There were no palpable cervical lymph nodes. An USG (Ultra Sonogram) of the neck confirmed this finding. The patient was clinically and biochemically euthyroid. FNAC (Fine Needle Aspiration Cytology) was consistent with a nodular

goitre. On direct laryngoscopy, vocal cord function was normal bilaterally. With the diagnosis of euthyroid multinodular goitre, the patient was posted for near total thyroidectomy.

During thyroidectomy the recurrent laryngeal nerve could not be identified in its usual location. Instead there was a white cord like structure traversing parallel to and between the branches of the inferior thyroid artery. This structure was traced laterally in to the carotid sheath and was found to arise from the right vagal trunk. Medially this structure was found to enter the cricothyroid membrane and hence identified to be the non-recurrent laryngeal nerve (Figure 1). Thyroidectomy was completed and the recurrent laryngeal nerve on the left side had a normal course.

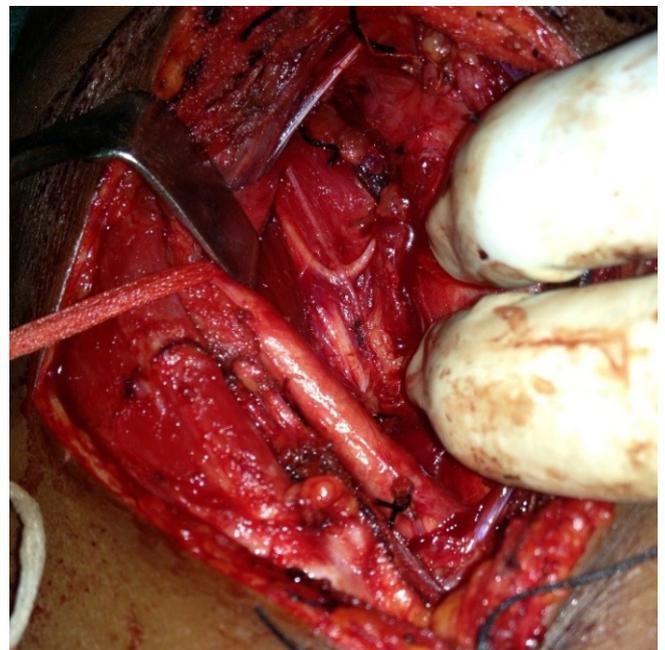


Figure 1. Intraoperative photograph showing the right non-recurrent laryngeal nerve.

The postoperative period of the patient was uneventful and a vocal cord examination showed equal movement on both sides. A CT angiogram done retrospectively revealed an anomalous origin of a right subclavian

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artery as the last branch of the aortic arch. This artery crossed from left to right, posterior to the oesophagus. Moreover the right and left common carotid artery originated from the aortic arch as a common trunk (bicarotid trunk) which was the first branch of the aortic arch (Figure 2). A normal left subclavian artery arose between the bicarotid trunk and the anomalous right subclavian artery. The patient did not have any difficulty in swallowing (dysphagia lusoria) on retrospective questioning.

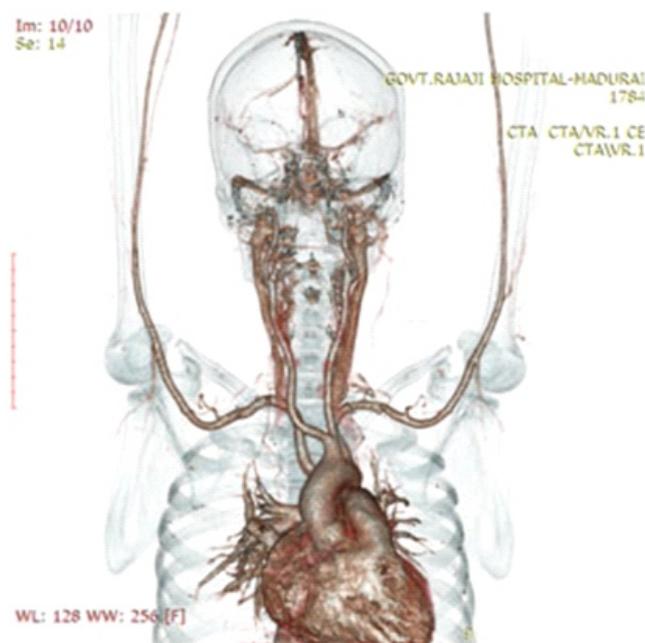


Figure 2. Reconstructed image CT angiogram seen from anterior aspect. Reconstructed image CT angiogram seen from posterior aspect.

Discussion

During embryological development, the series of mesodermal thickenings called the pharyngeal arches develop in between the future mouth (stomatodeum) and the pericardium to form the neck. In the process, the developing heart with the great vessels descent into the thorax. The recurrent laryngeal nerve (RLN) is the nerve of the 6th pharyngeal arch and lies caudal to the artery of this arch. During the descent of the heart, the RLN is dragged downwards into the thorax by the developing great vessels. The nerve thus has to follow a recurrent course into the larynx. On the left side the nerve lies under the ligamentum arteriosum (remnant of the left 6th arch artery). However the distal part of the right 6th arch artery and the 5th arch artery disappears. Hence the nerve comes to lie under the right subclavian artery (4th arch).

In the anomalous origin of the right subclavian artery, the right 4th arch artery fails to develop. Hence the inferior laryngeal nerve (synonymous with RLN normally) is not recurrent on the right side, but passes directly to the larynx without being drawn down as a loop by the subclavian artery. In this condition the anomalous right subclavian artery develops from the distal part of the right dorsal aorta and hence arises from the descending portion of the aortic arch as its last branch. In such cases the anomalous artery usually crosses from the descending aorta on the left to the right side of the body. During this part of its course, the artery usually lies posterior to the oesophagus and may compress it producing dysphagia in 5% cases (dysphagia lusoria as described by David Bayford in 1789).

The recurrent laryngeal nerve on the right side originates from the vagus nerve where it crosses the right subclavian artery and loops around it before ascending in the trachea oesophageal groove, the nerve may branch before it enters the larynx at the cricothyroid membrane. The nerve lies in close proximity to the branches of the inferior thyroid artery and the parathyroids. The superior parathyroid lies dorsal to the nerve and the inferior parathyroid ventrally. The identification of the nerve during thyroidectomy is facilitated by mobilising a prominence on the posterolateral border of the thyroid gland called the tubercle of zuckerhülle. The recurrent laryngeal nerve has mixed motor, sensory and autonomic nerve supply. It supplies all laryngeal muscles except for cricothyroid which is innervated by the external branch of superior laryngeal nerve. It also provides sensory supply to the larynx below the level of the glottis. Unilateral paralysis of the RLN causes the ipsilateral vocal cord to lie in a medial position or just lateral to the midline. A normal, although weakened voice may be present due to compensation by the contralateral cord. If the vocal cord remains paralysed in an abducted position a severely impaired voice and an ineffectual cough may result. Bilateral RLN injury causes complete loss of voice or airway obstruction necessitating emergency tracheostomy.

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Key Point:

- There are two main types of non-recurrent laryngeal nerves described. Type 1 – nerve arises directly from the cervical vagus and runs together with the vessels of the superior thyroid pedicle. Type 2 – it follows a transverse path parallel to the inferior thyroid artery (further subdivided into type 2 A when it turns over the trunk and type 2B when it runs under the trunk or between the branches of the artery).
- The incidence of non-recurrent laryngeal nerve quoted in literature ranges from 0.3 – 1.6 % on the right side and approximately 0.04 % on the left side.
- The anomalous origin of the right subclavian artery appears in the general population with an incidence of 0.1 to 4%. The incidence of aberrant right subclavian artery combined with bicarotid trunk varies from 0 – 2.5%.
- Every surgeon operating on the neck should be aware of and anticipate this variation of the recurrent laryngeal nerve especially when the nerve cannot be identified in the normal location. Visualisation of the recurrent laryngeal nerve in every case is the only way to remain safeguarded and prevent inadvertent injury.