



Caso Clínico

The Non-Recurrent Laryngeal Nerve: Can we Predict this Pitfall in Thyroid Surgery?



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A B S T R A C T

The non-recurrent laryngeal nerve is a rare anatomical variation that poses a major risk for iatrogenic injury during thyroid surgery. This has been described on the right side in association with the presence of an *arteria lusoria*.

We report two cases of non-recurrent laryngeal nerves, with emphasis on the role of pre-operative cervical ultrasound in predicting this variation. On both cases, cervical ultrasound was consistent with the presence of an *arteria lusoria*, which raised a strong suspicion that a non-recurrent laryngeal nerve could be found during surgery. This was confirmed during both surgical procedures, which had no interurrences.

Although it should never replace a thorough surgical dissection, we believe that this is a simple and non-invasive method which is a valuable tool to improve pre-operative diagnosis and to plan the surgical strategy and therefore to prevent the complications that may result from an unexpected anatomical variant during thyroid surgery.

Nervo Laríngeo Não Recorrente: Podemos Prever esta Variação Anatômica na Cirurgia da Tiróide?

R E S U M O

O nervo laríngeo não recorrente corresponde a uma variação anatómica rara e que constitui um risco importante de iatrogenia durante a cirurgia tiroideia. Esta tem vindo a ser descrita associadamente à presença de uma *arteria lusoria*.

Descrevemos dois casos de doentes com nervo laríngeo não recorrente, destacando o papel da ecografia cervical pré-operatória na predição de um trajeto não recorrente do nervo laríngeo inferior. A ecografia revelou a presença de uma *arteria lusoria* em ambos os casos, fazendo prever a existência de um nervo laríngeo não recorrente. Esta suspeição foi confirmada intra-operatoriamente nos dois procedimentos, que decorreram sem intercorrências.

Ainda que não deva substituir uma disseção cirúrgica meticulosa, consideramos que este meio complementar de diagnóstico constitui uma ferramenta valiosa para planear a abordagem cirúrgica e, desta forma, prevenir as complicações que podem resultar da presença de uma variação anatómica inesperada durante a cirurgia tiroideia.

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Introduction

The recurrent laryngeal nerve is a branch of the vagus nerve. On the right side, it recurs beneath the subclavian artery before ascending in the tracheoesophageal groove and on the left side it surrounds inferiorly the aortic arch (or the *ligamentum arteriosum*). Its muscular branches innervate all intrinsic laryngeal muscles except the cricothyroid muscle. Its posterior branches also provide innervation for the oesophagus and the cricopharyngeus muscle.^{1,2}

The non-recurrent laryngeal nerve (NRLN) is a rare anatomical variation that poses a major risk for iatrogenic injury during thyroid surgery.³ It has been estimated that a previously undetected NRLN is associated with a nearly six-fold increased risk in intraoperative nerve injuries, leading to significant morbidity in the post-operative period.⁴

In this paper, we report two cases of NRLN, with emphasis on the pre-operative studies that can help the surgeon predict the presence of this rare anatomical variant.

Case Reports

Case 1

We report the case of a 67 year-old woman, with personal history of multiple sclerosis, who was referred to Endocrine Surgery Consultation for multinodular thyroid disease.

The patient denied any compressive symptoms such as dyspnea, dysphagia and hoarseness. Her physical examination and thyroid function analysis were normal.

Cervical ultrasound showed a hypoechoic nodule with 16 x 12 x 17 mm on the right lobe, and a hypoechoic nodule with 15 x 12 x 15 mm on the left. It was also documented on the ultrasound an absence of the brachiocephalic trunk, with the right subclavian artery emerging directly from the left side of the aortic arch and coursing to the right from behind the trachea and oesophagus (Fig. 1).

An ultrasound guided fine needle aspiration was performed for both nodules, with a bilateral result of suspicious for malignancy (Bethesda V). Therefore, a total thyroidectomy was proposed.

During surgery, the right lobe was rotated medially, exposing the right tracheoesophageal groove. However, as it could be

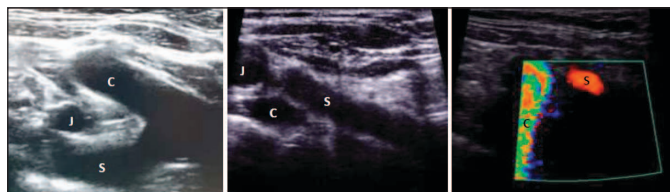


Figure 1. On the left: right common carotid artery (C) and right subclavian artery (S) originating from the brachiocephalic trunk (BCT). On the middle and on the right: (C) originating from the BCT and (S) emerging separately. (J) – internal jugular vein.

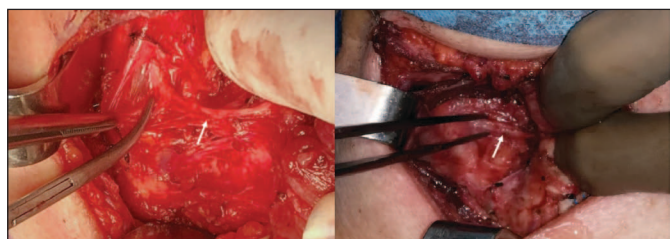


Figure 2. Non-recurrent laryngeal nerve (arrow) running directly to the cricothyroid junction. On the left: patient 1; on the right: patient 2.

expected from the findings on pre-operative ultrasound, the recurrent laryngeal nerve could not be identified at this level. A careful dissection showed that the nerve, after its origin from the vagus nerve, was running medially, directly to the cricothyroid junction (Fig. 2).

The postoperative period was uneventful, and the patient was discharged on the day after surgery. The pathological study of the operative specimen confirmed the result of a multifocal, follicular variant papillary carcinoma (pT1b pN0 pR0).

Case 2

Our second case concerns a 69 year-old woman, who was referred to Endocrine Surgery Consultation for multinodular thyroid disease. On her physical examination, there was a palpable nodule on the isthmus, with approximately 2 cm of diameter, mobile and painless. On her pre-operative cervical ultrasound it was also visible a right subclavian artery coursing from the left to the right side from behind the trachea, instead of emerging from the brachiocephalic trunk.

Ultrasound guided fine needle aspiration was performed, with the result of papillary thyroid carcinoma.

The patient underwent a total thyroidectomy and the presence of a NRLN was confirmed on the right side, which was concordant with the finding of an *arteria lusoria* on cervical ultrasound (Fig. 2).

There were no postoperative complications and the patient was discharged on the day after surgery. The pathological study of the operative specimen confirmed the presence of a multifocal papillary carcinoma (pT1b (m)).

Discussion

The NRLN is a rare anatomical variation that represents an important pitfall for the endocrine surgeon.^{3,5-7} This has been frequently described in association with the presence of an *arteria lusoria* – a right subclavian artery which develops from the aortic arch, next to the left subclavian artery^{3,4,8} (Fig. 3).

When the heart descends during embryogenesis, the recurrent laryngeal nerve is displaced downward in the mediastinum, recurring around the sixth primitive aortic arch. With its regression, the nerve migrates upward, recurring around the fourth aortic arch, from which the subclavian artery is usually originated.^{5,7,9}

When a change occurs in the complex remodelling process of the branchial arch system, with an abnormal involution of the right fourth pharyngeal arch, the inferior laryngeal nerve becomes free to run directly from the cervical vagus to the cricothyroid junction¹⁰⁻¹² (Fig. 4).

From an anatomical point of view, there are three possible variants of NRLN according to its trajectory. In type 1, it presents a close relationship with the superior thyroid vessels. In type 2a, it runs parallel and then above the trunk of the inferior thyroid artery. In type 2b, it runs parallel and then below, or between, the branches of the inferior thyroid artery. In the presence of the first type, a possible iatrogenic lesion may occur during ligation of the superior thyroid pedicle. With the two latter types, the nerve's trajectory may simulate the one of the inferior thyroid artery, and therefore be incidentally ligated.^{5,13,14}

An iatrogenic lesion of the recurrent laryngeal nerve is related to significant morbidity. A unilateral lesion may lead to a partial or complete paresis of the vocal cord, with consequent hoarseness. A bilateral lesion may result in bilateral paralysis of the vocal cords,

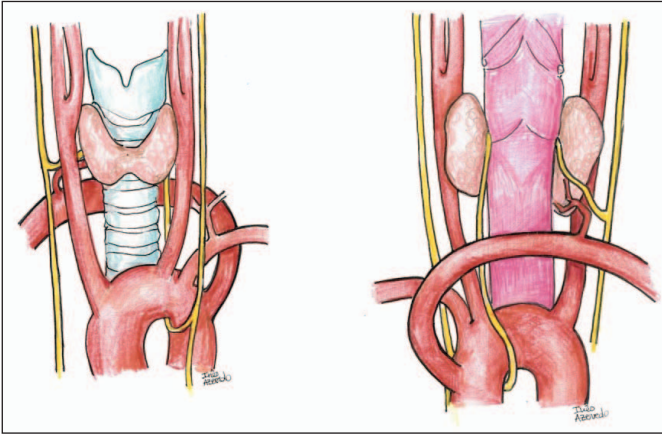


Figure 3. On the left: anterior view, with the right subclavian artery originating as the leftmost branch of the aortic arch; on the right: posterior view, with the right subclavian artery coursing behind the oesophagus.

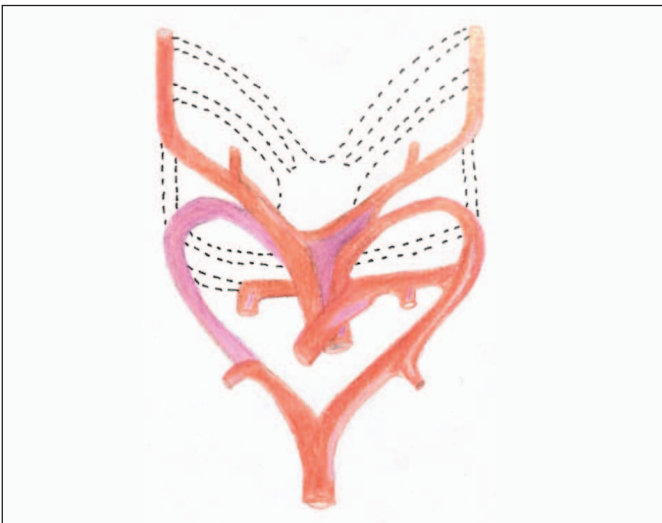


Figure 4. The right 4th pharyngeal arch artery and the cranial part of the right dorsal aorta have involuted (light pink segment). The parts of the dorsal aorta and pharyngeal arch arteries that normally disappear are represented with broken lines.

with eventual need for an emergent tracheostomy due to airway obstruction. As it also provides branches to the oesophagus and cricopharyngeus muscle, the patients may also present with dysphagia after surgery.^{1,13}

On cervical ultrasound, it is possible to identify the right common carotid artery and right subclavian artery originating from the bifurcation of the brachiocephalic trunk (“Y sign”). The absence of this sign should raise the suspicion of a right subclavian artery originating directly from the aortic arch, as its leftmost branch, and coursing to the right side from behind the oesophagus. Therefore, a careful pre-operative cervical ultrasound can be of enormous value to the surgeon, alerting for the possibility of finding a NRLN during surgery.¹⁵

As far as we are concerned, there are very few reports in the literature concerning the utility of ultrasound in predicting the presence of a NRLN.¹⁴⁻¹⁶

Since 2013, our group performed 799 pre-operative ultrasounds. During surgery, we have found three cases of NRLN, which were all previously predicted by the ultrasound images. We have not come across any other cases of NRLN apart from

these three since 2013, and considering that this is an uncommon finding during surgery, we have found to be extremely useful to have a pre-operative study of the cervical vessels, either by CT or cervical ultrasound.³ This last method, although it is operator dependent, it is a safe and accessible tool to assess for the possible presence of an *arteria lusoria*.

The pre-operative suspicion of finding a NRLN should alert the surgeon to perform an even more careful dissection, regarding that the recurrent laryngeal nerve will not be visible in its regular paratracheal course and that it must be identified near the cricothyroid joint.⁵

Conclusion

It is our opinion that having an Endocrine Surgeon with expertise in performing cervical ultrasound within the Endocrine Surgical Unit most often proves to be extremely helpful.

Although it should never replace a systematic and meticulous surgical dissection, we believe that pre-operative ultrasound is a simple and non-invasive method which may be a valuable and cost-effective tool to plan the surgical strategy and to prevent complications that may result from an unexpected anatomical variant during thyroid surgery.

Contributorship statement / Declaração de contribuição:

JS: responsible for the paper’s conception and manuscript drafting.

RP, AR, SG, HC, VR, RE and LC: contributed to the collection and interpretation of the data.

All authors: reviewed and approved the final version of the manuscript.

JS: responsável pela elaboração e redação do artigo.

RP, AR, SG, HC, VR, RE e LC: contribuíram para a aquisição e interpretação dos dados.

Todos os autores: reviram e aprovaram a versão final do artigo.

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References / Referências

1. FurtaSm Rouviere H, Delmas A, Delmas V. Anatomia humana descriptiva, topografica y funcional. Tomo 1. Cabeza y cuello. 11a ed.. Barcelona: Zagier & Urruty Pubns; 2005.
2. Fundakowski CE, Hales NW, Agrawal N, Barczyński M, Camacho PM, Hartl DM, et al. Surgical management of the recurrent laryngeal nerve in thyroidectomy: American Head and Neck Society Consensus Statement. *Head Neck*. 2018;40:663–75. doi: 10.1002/hed.24928.
3. Guerreiro S, Lamas M, Candeias H, Eusébio R, Rocha V. The non-recurrent laryngeal nerve: An anatomical “trap.” *Rev Port Endocrinol Diabetes e Metab*. 2014;9:84–7. doi: 10.1016/j.rpedm.2014.05.001.
4. Henry BM, Sanna S, Graves MJ, Vikse J, Sanna B, Tomaszewska IM, et al. The non-recurrent laryngeal nerve: a meta-analysis and clinical considerations. *PeerJ*. 2017;5:e3012. doi: 10.7717/peerj.3012. 5. Le QV, Ngo DQ, Ngo QX. Non-recurrent laryngeal nerve in thyroid surgery: A report of case series in Vietnam and literature review. *Int J Surg Case Rep*. 2018;50:56–9. doi: 10.1016/j.ijscr.2018.07.017.
6. Toniato A, Mazzarotto R, Piotto A, Bernante P, Pagetta C, Pelizzo MR. Identification of the nonrecurrent laryngeal nerve during thyroid surgery: 20-year experience. *World J Surg*. 2004;28:659–61. doi: 10.1007/s00268-004-7197-7.
7. Forde R, Williams E. The non-recurrent laryngeal nerve – a rare phenomenon which requires vigilance. *West Indian Med J*. 2015;64:303–4. doi: 10.7727/wimj.2014.223.
8. Leite TF de O, Pires LS, Cisne R, Babinski MA, Chagas CA. Clinical discussion of the arteria lusoria: a case report. *J Vasc Bras*. 2017;16:339–42. doi: 10.1590/1677-5449.007617.
9. Yarza IS, Viteri-Ramírez G, Etxano J, Roblero PS, Ferreira M, Alemañ GB. Arco aórtico derecho, divertículo de Kommerell y arteria subclavia izquierda aberrante. *An Sist Sanitario Navarra*. 2011;34:295–300.
10. Myers PO, Fasel JHD, Kalangos A, Gailloud P. Arteria lusoria: developmental anatomy, clinical, radiological and surgical aspects. *Ann Cardiol Angeiol*. 2010;59:147–54. doi: 10.1016/j.ancard.2009.07.008.
11. Carlson BM. *Human Embryology and Developmental Biology: With STUDENT CONSULT Online Access*, 4e. 4th ed. Philadelphia: Mosby; 2008.
12. Moore KL, Persaud TV, Torchia MG. *The Developing Human: Clinically Oriented Embryology*. Amsterdam: Saunders/Elsevier; 2008.
13. Varaldo E, Ansaldo GL, Mascherini M, Cafiero F, Minuto MN. Neurological complications in thyroid surgery: a surgical point of view on laryngeal nerves. *Front Endocrinol*. 2014;5. doi: 10.3389/fendo.2014.00108.
14. Morais M, Capela Costa J, Matos-Lima L, Costa-Maia J. Nonrecurrent laryngeal nerve and associated anatomical variations: the art of prediction. *Eur Thyroid J*. 2015;4. doi: 10.1159/000438751.
15. Citton M, Viel G, Iacobone M. Neck ultrasonography for detection of non-recurrent laryngeal nerve. *Gland Surg*. 2016;5:583–90. doi: 10.21037/gs.2016.11.07. 16. 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*. 2008;393:633–8. doi: 10.1007/s00423-008-0372-9.