VIA MEDICA

CASE REPORT

Folia Morphol.
Vol. 83, No. 2, pp. 439–443
DOI: 10.5603/fm.95862

ISSN 0015–5659
eISSN 1644–3284
journals.viamedica.pl

A rare variation in the origin of the lingual artery: thyro-linguo-laryngeal trunk

Elena Bozhikova[1], Stoyan Novakov[2], Nikolay Uzunov[3]

[1]*Mercer University School of Medicine, Department of Biomedical Sciences, Columbus, GA, United States*
[2]*Medical University — Plovdiv, Department of Anatomy, Histology and Embryology, Plovdiv, Bulgaria*
[3]*University Hospital "Medika", Department of Maxillofacial Surgery, Ruse, Bulgaria*

[Received: 2 June 2023; Accepted: 6 October 2023; Early publication date: 16 October 2023]

The anatomy of the external carotid artery and its variations are of ground significance in head and neck surgery. During a dissection of a male cadaver, an undescribed common trunk between superior thyroid, superior laryngeal, and lingual arteries was found. The variations of the anterior cervical branches of the external carotid artery and their clinical implications are discussed. The described unusual branching pattern of the external carotid artery must always be considered in invasive or non-invasive procedures because it may lead to unexpected complications. (Folia Morphol 2024; 83, 2: 439–443)

Keywords: thyro-linguo-laryngeal trunk, vascular variations, external carotid artery, external carotid artery variations, lingual artery, lingual artery variations, thyro-lingual trunk, carotid artery variations, common carotid artery

INTRODUCTION

The common carotid artery (CCA) is the main source of blood supply to the neck and head. On the neck, CCA passes through the carotid triangle and usually bifurcates at the level of the upper border of the thyroid cartilage and the intervertebral disc between C3 and C4 vertebrae [31]. Sometimes, it may divide at the inferior border of the thyroid cartilage or in level of the upper or lower border of the hyoid bone [17, 19]. The CCA gives off two terminal branches — the external carotid artery (ECA) and the internal carotid artery (ICA). ECA supplies neck and head, and the ICA — portions of the brain and head.

The cervical branches of the ECA are distributed into anterior and posterior divisions, except the ascending pharyngeal artery, which originates from the medial (deep) surface of ECA. The anterior division consists of the superior thyroid artery (STA), the lingual artery (LA) and facial artery (FA). The posterior division includes the occipital artery and posterior auricular artery. In the neck, initially the ECA is located medial and anterior to the ICA, superiorly it runs lateral to it [26, 29].

The LA is the second branch of the ECA and through its course, it supplies the adjacent tissues, i.e. the tongue and the floor of the mouth together with the sublingual gland, suprahyoid muscles, the lingual alveolar mucosa. It appears anteromedially from the ECA at the tip of the greater horn of the hyoid bone, between the STA and the FA [5]. The vessel runs medially to the hyoid bone, crosses the hypoglossal nerve (CN XII), and courses deep to the stylohyoid and digastric muscles, passing subsequently between the middle constrictor and the deep surface of the hyoglossus muscle [25] to reach the posterior part of the tongue where it continues as the deep lingual

Address for correspondence: Dr. Elena Bozhikova, DDM, DM, PhD, Mercer University School of Medicine, Department of Biomedical Sciences, Columbus, GA, USA; e-mail: elibozhikova@gmail.com

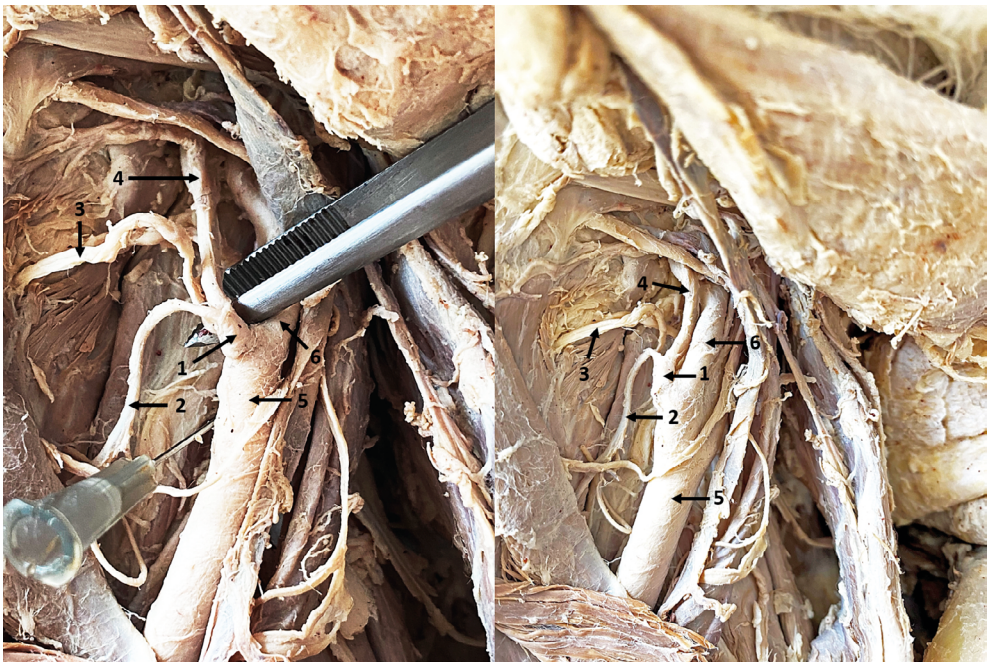

Figure 1. Thyro-linguo-laryngeal trunk — a common trunk between superior thyroid artery, superior laryngeal artery and lingual artery (1 — thyro-linguo-laryngeal trunk; 2 — superior thyroid artery; 3 — superior laryngeal artery; 4 — lingual artery; 5 — common carotid artery; 6 — external carotid artery).

artery to the lingual tip. The major branches of the LA include the suprahyoid artery, the dorsal lingual artery, the sublingual artery, and the deep lingual artery, also known as the ranine artery [27].

Usually, the LA originates as a single branch but in some cases, it can form common trunks: with the STA — thyro-lingual trunk (TLT), with the FA — linguo-facial trunk (LFT), and with the STA and FA — thyro-linguo-facial trunk (TLFT) [4, 31]. The variations of the ECA are of great clinical significance and they must be considered during the preoperative, radiological and ultrasonic assessment [18].

CASE REPORT

A male human cadaver, aged 76 years old, was prone to detailed neck dissection at the Department of Anatomy, Histology and Embryology at the Medical University — Plovdiv, exposing the CCA, ICA and ECA together with the corresponding branches. The dissection of human cadavers at the Anatomy Labs for educational and scientific purposes was approved by the Local Ethic Committee and Medico-Legal Office of the University. The cadaver was preserved in a liquid composed of 96° denatured alcohol, 36% formaldehyde, glycerol, carbol and water for a period of 3 months.

During the direct observation of the CCA, the ECA and its branches, a common trunk between the superior thyroid, lingual and superior laryngeal arteries – thyro-linguo-laryngeal trunk (TLLT), that has not been yet described, was found. The length and diameter of the vessels were measured by an electronic calliper RoHS (manufactured by KWB) with a measurement accuracy up to 0.02 mm and a measurement speed of 1.5 m/s, powered by 1.45 V battery. The measurements were recorded in millimetres.

The trunk was located on the left side of the neck and it arose from the medial aspect of the ECA, 6 mm above the carotid bifurcation. The superior laryngeal artery (SLA) originated directly from the common TLLT and not from the STA. The common trunk trifurcated and gave origin to the STA, SLA and LA (Fig. 1). The length of the TLLT and its diameter as well as the diameters of the STA, SLA, and LA are summarized in Table 1. The course of the three arteries after the trifurcation was typical. The FA appeared 22 mm above the carotid bifurcation without any variations. The branches of the ECA on the right side of the cadaver did not show any variations (Fig. 2).

DISCUSSION

Head and neck surgical procedures require detailed knowledge of the vascular supply and the possible variations. The anatomical variations of the STA and LA may lead to misdiagnosis, difficulties in the exact

Table 1. Dimensions of the thyro-linguo-laryngeal trunk (TLLT) and its branches

Vessel	Diameter [mm]	Length l [mm]
TLLT	3.0	3
STA	1.0	-
SLA	1.0	-
LA	2.5	-

TLLT – thyro-linguo-laryngeal trunk; STA – superior thyroid artery; SLA – superior laryngeal artery; LA – lingual artery

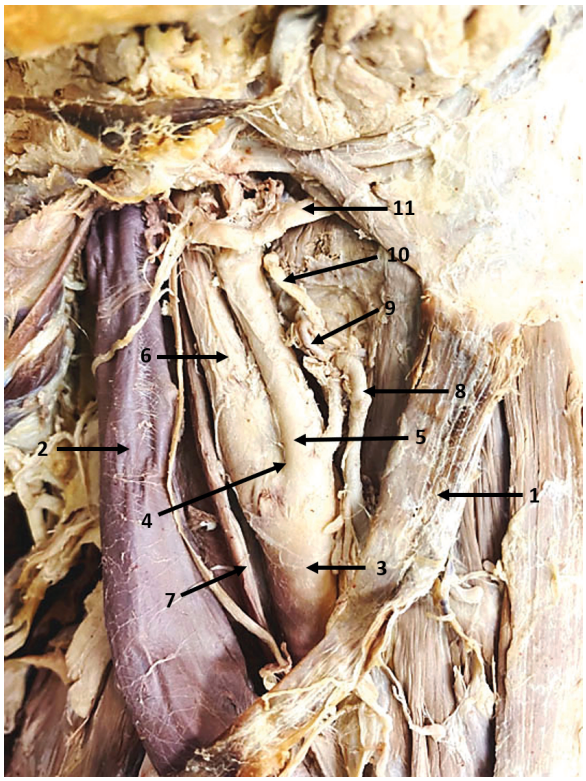

Figure 2. Right side of the same cadaver without any variations (1 — superior belly of omohyoid muscle; 2 — internal jugular vein; 3 — common carotid artery; 4 — carotid bifurcation; 5 — external carotid artery; 6 — internal carotid artery; 7 — vagus nerve; 8 — superior thyroid artery; 9 — superior laryngeal artery; 10 — superior laryngeal nerve; 11 — hypoglossal nerve).

identification of the arterial branches, and intra- and postoperative complications as vascular injuries, and profuse haemorrhage during and after many surgical procedures such as thyroidectomy, neck dissection, catheterization of the common and external carotid arteries, glossectomy, etc. These variations are also important for establishing the proper diagnosis in radiology and for preventing of fatal errors in cases when the branches are mistaken with each other [17].

Deviations in blood supply are usually asymptomatic. Different diseases and pathologies may reveal the clinically silent abnormalities and variations of the vascular network and cause a manifestation of complaints and symptoms. In most cases, they can be visualized during angiographic examinations or surgical treatment [8, 31].

The variations of the branches of the ECA are well known. As a rule, they arise separately but, in some individuals, common trunks may be formed.

Lucev et al. [17] showed that the STA may arise from the CCA (47.5%), ECA (30%) or the carotid bifurcation (22.5%). Sanjeev et al. [24] found that the LA is a separate branch of the ECA in 78.38% of the cases. Its position varies between 4–10 mm above the carotid bifurcation. Other authors stated that the individual branching pattern of the LA varies between 77% and 90% [6, 9, 19, 21]. The LA may also appear from the CCA [13] or from its bifurcation [17, 31].

The lingual artery forms more often LFT than TLT or TLFT. Zümre et al. [31] found that the prevalence of the LFT is about 20% (10% on the left and 10% on the right side), of the TLT — 2.5% (on the left side), and the TLFT — 2.5% (on the right side).

The LFT is the most common variation with estimated frequency of about 10–20% [1, 4, 19]. Sirbu et al. [28] reported that the occurrence of the LFT varies between 3.29% and 44.7%, average 16.39%. In most cases the variation is unilateral. The high frequency of this variation should always be considered because it may lead to uncontrolled bleeding because of trauma, pathology or surgical interventions [28].

Thyro-lingual and thyro-linguo-facial trunks are rare variations. The TLFT usually occurs in about 2.2% of the cases [28]. Some authors reported it has unilateral appearance [9, 22, 31], while others found it bilaterally [3].

The TLT may arise from the CCA [14, 16, 20, 23], the carotid bifurcation [11, 14], or the ECA [23]. Its prevalence is between 2.5% and 9.5% [14, 19, 21, 31]. Ozgur et al. [21], Zümre et al. [31] and Mata et al. [19] found TLT in 2.5% of the cases. Sanjeev et al. [24] reported TLT frequency of 2.7%, and Patel et al. [22] — of 3%. In most cases, the trunk is located unilaterally, but it can be bilateral [12], as well. TLT may be the cause for damage of the LA during thyroidectomy [28]. TLT can appear at a different distance from the carotid bifurcation. Ergur and Icke [7] reported that it originates 7.6 mm from the carotid bifurcation; Babu [2] found it 2 cm below the bifurcation. Surgery of tongue malignan-

cies demands preservation of its blood supply. In advanced cases treatment may require ligation of the ECA above the origin of the STA. Preoperative visualization of the TLT is of crucial importance in patients undergoing tongue surgery. The ligation of the common trunk may compromise the blood supply to the tongue and/or the thyroid gland; the ligation of the ECA above the common trunk may induce profuse bleeding when tongue surgery is performed [12].

The origin of the SLA is also variable. Vazquez T et al. [30] classified the appearance of the SLA in 4 different types. In type I the SLA arises from the STA (78%), in type II — from the ECA (9%), in type III — from the CCA (5%), in type IV — from the CB (4%). In 2022, Landzhov et al. [15] proposed a new classification of the variations of the SLA. The classification determines the variations of the SLA into 5 types: Type I — variations in the SLA arising from branches of the ECA; type II — variations of the SLA arising from the carotid tree; type III — variations of the SLA arising from a common trunk; type IV — doubled SLA; type V — absent SLA.

We did not observe the familiar variations of the branches of the ECA. However, we discovered a common trunk between STA, SLA and LA — a variation, which is not described in the literature. We chose the name — thyro-linguo-laryngeal trunk — according to the current edition of the Nomina Anatomica, and by adding the name of the SLA to the name of the TLT.

CONCLUSIONS

The variations of the branches of the ECA are well-known but they must be always taken under consideration when radiological examination, surgery and other invasive or non-invasive procedures are performed. Deviations in blood supply predispose to confusion and poor identification of the branches of the ECA in the neck which can be the cause for unexpected complications such as profuse bleeding and impaired blood supply to occur. Preliminary assessment of the anatomy of the neck is the basis for sound treatment planning and prevention of complications.

ARTICLE INFORMATION AND DECLARATIONS

Data availability statement

We confirm that the data supporting the findings of this study are available within the article.

Ethics approval statement

The dissection of human cadavers at the Department of Anatomy, Histology and Embryology for educational and scientific purposes is approved by the Local Ethic Committee and Medico-Legal office of Medical University — Plovdiv, Bulgaria.

Acknowledgments

The authors sincerely thank those who donated their bodies to science so that anatomical research and teaching could be performed. Therefore, these donors and their families deserve our highest respect.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of interest: The authors declare that there is no conflict of interest.

REFERENCES

1. Anil A, Turgut HB, Peker T, et al. Variations of the branches of the external carotid artery. Gazi Med J. 2000; 11(2): 81–83.
2. Babu BP. Anomalous origin of thyrolingual trunk from right common carotid artery: a case report. J Anat Soc India. 2001; 50: 47–48.
3. Baxla M, Kumari C, Kaler S. Bilateral thyrolinguofacial trunk: unusual and rare branching pattern of external carotid artery. Anat Cell Biol. 2018; 51(4): 302–304, doi: 10.5115/acb.2018.51.4.302, indexed in Pubmed: 30637166.
4. Bergman RA, Thompson SA, Afifi AK, Saadeh FA. Compendium of human anatomic variations. Urban & Schwarzenberg, Baltimore 1988.
5. Buffoli B, Verzeletti V, Rezzani R, et al. Unusual branch of the lingual artery supplies the infrahyoid muscles. Anat Sci Int. 2020; 95(1): 153–155, doi: 10.1007/s12565-019-00501-6, indexed in Pubmed: 31444702.
6. Delic J, Savkovis A, Bajtarevic A, et al. Variations of ramification of external carotid artery – common trunks of collateral branches. Period Biol. 2010; 112(1): 117–119.
7. Ergur IK, Icke CA. A case with thyrolingual trunk originating from common carotid artery. ARAJ IK. 2004; 18: 256–259.
8. Gluncic V, Petanjek Z, Marusic A, et al. High bifurcation of common carotid artery, anomalous origin of ascending pharyngeal artery and anomalous branching pattern of external carotid artery. Surg Radiol Anat. 2001; 23(2): 123–125, doi: 10.1007/s00276-001-0123-x, indexed in Pubmed: 11462860.
9. Gupta V, Agarwal R. Anomalous branching pattern of the external carotid artery in cadavers. Int J of Sci Stud. 2014; 2(1): 28–31.
10. Heltzel S, Jelinek L, Jaynes D. Variation in the caudal branches of the external carotid artery: comparison of

sex and side. Med Res Arch. 2015(1), doi: 10.18103/mra.v0i1.21.
11. Jadhav SD, Ambali MP, Patil RJ, et al. Thyrolingual trunk arising from the common carotid bifurcation. Singapore Med J. 2011; 52(12): e265–e266, indexed in Pubmed: 22159950.
12. Janardhan D, Varghese B. Thyrolingual trunk – significance in head and neck surgery. J Otolaryngol ENT Res. 2018; 10(6): 397–398, doi: 10.15406/joentr.2018.10.00389.
13. Kaneko K, Akita M, Murata E, et al. Unilateral anomalous left common carotid artery; a case report. Ann Anat. 1996; 178(5): 477–480, doi: 10.1016/S0940-9602(96)80147-6, indexed in Pubmed: 8931862.
14. Kapre M, Mangalgiri AS, Mahore D. Study of thyro-lingual trunk and its clinical relevance. Indian J Otolaryngol Head Neck Surg. 2013; 65(2): 102–104, doi: 10.1007/s12070-011-0411-7, indexed in Pubmed: 24427547.
15. Landzhov B, Gaydarski L, Angushev I, et al. Variations in the origin of the superior laryngeal artery and their clinical significance: a case report with a proposal for a new classification. Int J Morphol. 2022; 40(3): 595–600, doi: 10.4067/s0717-95022022000300595.
16. Lemaire V, Jacquemin G, Medot M, et al. Thyrolingual trunk arising from the common carotid artery: a case report. Surg Radiol Anat. 2001; 23(2): 135–137, doi: 10.1007/s00276-001-0135-6, indexed in Pubmed: 11462863.
17. Lucev N, Bobinac D, Maric I, et al. Variations of the great arteries in the carotid triangle. Otolaryngol Head Neck Surg. 2000; 122(4): 590–591, doi: 10.1067/mhn.2000.97982, indexed in Pubmed: 10740186.
18. T M, Rai R, Prabhu LV, et al. Anomalous branching pattern of the external carotid artery: a case report. Rom J Morphol Embryol. 2010; 51(3): 593–595, indexed in Pubmed: 20809046.
19. Mata JR, Mata FR, Souza MCR, et al. Arrangement and prevalence of branches in the external carotid artery in humans. Ital J Anat Embryol. 2012; 117(2): 65–74, indexed in Pubmed: 23420995.
20. A rare case report: thyrolingual trunk and the absence of facial artery determined by 3D-CTA. J Turgut Ozal Med Cent. 2013; 20(3): 257–259, doi: 10.7247/jtomc.20.3.13.
21. Ozgur Z, Govsa F, Ozgur T. Assessment of origin characteristics of the front branches of the external carotid artery. J Craniofac Surg. 2008; 19(4): 1159–1166, doi: 10.1097/SCS.0b013e3180690252, indexed in Pubmed: 18650752.
22. Patel JP, Dave RV, Shah RK, et al. et al.. A study of superior thyroid artery in 50 cadavers. Int J Biol Med Res. 2013; 4(1): 2857–2858.
23. Phalgunan V, Baskaran S. Anomalous origin of thyrolingual trunk and its clinical relevance. PARIPEX-Indian J Res. 2020; 9(8): 22–23.
24. Sanjeev IK, Anita H, Ashwini M, et al. Branching pattern of external carotid artery in human cadavers. J Clin Diagn Res. 2010; 4(5): 3128–3133.
25. Sakamoto Y. Gross anatomical observations of attachments of the middle pharyngeal constrictor. Clin Anat. 2014; 27(4): 603–609, doi: 10.1002/ca.22344, indexed in Pubmed: 24343865.
26. Sarachev E, Uzunov N. Clinical and regional anatomy of the maxillo-facial region. IK VAP, Plovdiv 2001: Plovdiv.
27. Seki S, Sumida K, Yamashita K, et al. Gross anatomical classification of the courses of the human lingual artery. Surg Radiol Anat. 2017; 39(2): 195–203, doi: 10.1007/s00276-016-1696-8, indexed in Pubmed: 27189234.
28. Sirbu VD, Poll A, Nimigean VR, et al. Anatomical variations on the origin of the lingual artery and their clinical significance – review from literature. Romanian J Oral Rehabil. 2019; 11(3): 55–63.
29. Standring S. Gray's Anatomy. The Anatomical basis of clinical practice. Elsevier Churchill Livingstone, Edinburg 2016.
30. Vázquez T, Cobiella R, Maranillo E, et al. Anatomical variations of the superior thyroid and superior laryngeal arteries. Head Neck. 2009; 31(8): 1078–1085, doi: 10.1002/hed.21077, indexed in Pubmed: 19340860.
31. Zümre O, Salbacak A, Ciçekcibaşi AE, et al. Investigation of the bifurcation level of the common carotid artery and variations of the branches of the external carotid artery in a common trunk. Am Surg. 2011; 77(2): 151–154.