

A Study of Variations in the Origin and Branching Pattern of Lingual Artery: Cadaveric StudyAtul Chandrashekhar Raut^{1*}, Muthuchitra Pandian², Dhairyshilrao Y Shinde³¹Assistant Professor, Department of Anatomy, Rajiv Gandhi Medical College, Kalwa, Thane, Maharashtra.²Associate Professor, Department of Anatomy, Dr. N.Y. Tasgaonkar Institute of Medical Sciences, Diskal, Karjat, Maharashtra.³Assistant Professor, Department of Anatomy, Dr. N.Y. Tasgaonkar Institute of Medical Sciences, Diskal, Karjat, Maharashtra

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Abstract:**Background:** The lingual artery is a branch of external carotid artery (ECA), which is one of the major arteries that supplies blood to the head and neck. The presence of variations in the Lingual artery, its origin, course, relations and its branching pattern can become a matter of great concern to the Surgeons, Radiologists, ENT surgeons, Oncologists & Dentists**Aim and Objectives:** to gain knowledge about the course, relations and variations in branching pattern of Lingual artery from its origin in the carotid triangle of the neck to its termination in the tongue.**Materials and Method:** This study was under observational study, by using conventional dissection method, in which 50, embalmed human adult cadavers specimens allotted for routine dissection to the first year MBBS students at our Institute were included in the study, for the duration of one year after following inclusion and exclusion criteria and approved by institutional ethical committee.**Observation and Results:** The branching pattern of origin of lingual artery varied from separate branches to common trunks with superior thyroid artery, facial artery and combined both. The lingual artery originated as separate branch from ECA in 40 specimens (right 22 and left 20) In 3 specimens (right 1 and left 2), they were arising as common thyrolingual trunk, and in 7 specimens (right 5 and left 2), they originated as linguofacial trunk, in common with facial artery.**Conclusion:** variations in the development and branching pattern of the lingual artery are not rare and should be evaluated before any diagnostic or therapeutic interventional procedures are planned in head and neck, oral and dental surgeries.**Keywords:** Lingual Artery, Thyrolingual Trunk, Linguofacial Trunk.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

The lingual artery is a branch of external carotid artery (ECA), which is one of the major arteries that supplies blood to the head and neck. Specifically, the lingual artery arises from the external carotid artery just above the level of the superior thyroid artery. It travels a short distance and then splits into several branches, which supply blood to various structures in the tongue and floor of the mouth. The lingual artery plays a crucial role in providing oxygenated blood to the tongue, which is essential for its function in speech, taste sensation, and swallowing. It also contributes to the blood supply of the floor of the mouth, the sublingual gland, and nearby muscles and tissues. In medical and dental procedure, knowledge of the lingual artery's location and course is important to avoid accidental damage during surgery, particularly in oral and maxillofacial

surgeries, as injury to this artery can lead to significant bleeding.

The Lingual artery is the second branch of ECA arising from ventral aspect, just opposite to the tip of greater cornu of hyoid bone in the carotid triangle. It first runs obliquely upwards and medially to the greater cornu of the hyoid bone afterwards it curves downward and forward, forming a loop which is crossed by the hypoglossal nerve, and passes medially to the digastric and stylohyoid muscle. Further it proceeds horizontally forward, behind the hyoglossus muscle, and finally ascending almost perpendicular to the tongue, turns forward on its lower surface as far as the tip, under the name of the deep lingual artery[1]. Its branches are dorsal lingual artery which supplies the base and body of the

tongue, suprahyoid artery supplies the suprahyoid muscles, sublingual artery supplies the mylohyoid muscle, sublingual salivary gland, and mucous membranes of the floor of the mouth and deep lingual artery which is a terminal branch supplies the apex of the tongue. Lingual artery is divided into three parts by hyoglossus muscle [2].

Surgeons should be able to differentiate between the facial and lingual arteries to ensure exact arterial ligation during faciomaxillary surgery, base of tongue and radical neck dissection. The knowledge of possible variations in Lingual artery is important

during head and neck surgeries such as extra oral ligation of Lingual artery, carotid endarterectomy, catheter insertion of common carotid artery, plastic and reconstructive surgeries of neck, face and lip, selective arterial blocking to reduce the blood supply of tumours of head, neck, face and lip, and also during the interpretation of angiograms and imaging by the interventional radiologists [3]. The presence of variations in the Lingual artery, its origin, course, relations and its branching pattern can become a matter of great concern to the Surgeons, Radiologists, ENT surgeons, Oncologists & Dentists [4].

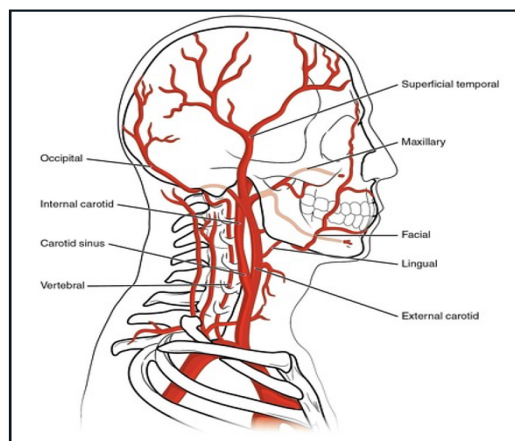


Figure 1: External Carotid Artery and its Branches

Hence the Anatomical study of the Lingual artery in humans gain much importance and thus we have undertaken this study to gain knowledge about the course, relations and variations in branching pattern of Lingual artery from its origin in the carotid triangle of the neck to its termination in the tongue.

Materials and Method

This study was under observational study, by using conventional dissection method, in which 50, embalmed human adult cadavers specimens allotted for routine dissection to the first-year MBBS students at our Institute were included in the study, for the duration of one year after following inclusion and exclusion criteria and approved by institutional ethical committee.

Inclusion Criteria: The cadavers belonging to different age groups and both the sexes available from the department of anatomy, of our institute were included in the study. The hemi sectioned head and neck specimens which were allotted to students of previous year were also included.

Exclusion Criteria

- The specimens which were damaged during embalming, done through carotid artery was excluded.

- Any injuries in the region of neck which have injured the external carotid artery were excluded.
- Anomalous tortuosity, dilatations, aneurysms or atheromatous / occlusive disease and any other gross abnormalities in the specimens were excluded.
- Those cadavers with visible (naked eye) tumours of head and neck and underwent any head and neck surgeries will be excluded.

Method

Locate the external carotid artery In the neck region. Make a midline incision along the anterior surface of the neck. Extending from the chin down to sternum. Carefully dissected away the overlying soft tissues, including muscles and fascia, to expose the carotid artery. Identified the external carotid artery, which was found just anterior and slightly lateral to the internal carotid artery. Traced the external carotid artery upwards until locate the branch point of lingual artery. Once it was identified the lingual artery's branch point, gently isolated it from the surrounding tissues using blunt dissection and fine instrument, as probes and forceps. Carefully dissected the lingual artery also its course, traced it toward its destination in the tongue and floor of the mouth. Noted down the lingual artery's branches, such as dorsal lingual artery and deep lingual artery,

as well as any anastomoses with other nearby arteries.

Statistical Analysis: Collected data were entered in the Microsoft excel 2016, for further statistical analysis. Categorical data was expressed in terms

frequency and proportion. Statistics was expressed in descriptive statistics.

Observation and Results

Present study of the origin and branching pattern of lingual artery from ECA among 50 specimens reveals the following results.

Table 1 : Origin of Lingual Artery in Relation to Greater cornu of Hyoid Bone

Origin of Lingual Artery	Frequency	Percentage
Greater cornu of hyoid bone	40	80
Above the level of greater cornu of hyoid	6	12
Below the level of greater cornu of hyoid	4	8

Table 2 : Pattern of origin of Lingual Artery from External Carotid Artery

Pattern of Origin of Lingual Artery	Right	Left	Total
Separate branch from ECA	22	18	40
Thyrolingual trunk	1	2	3
Linguofacial trunk	5	2	7
Thyrolinguofacial trunk	0	0	0

The branching pattern of origin of lingual artery varied from separate branches to common trunks with superior thyroid artery, facial artery and combined both. The lingual artery originated as separate branch from ECA in 40 specimens (right 22 and left 20) In 3 specimens (right 1 and left 2), they were arising as common thyrolingual trunk, and in 7 specimens (right 5 and left 2), they originated as linguofacial trunk, in common with facial artery.

Table 3 : Distance of origin of Lingual Artery from carotid bifurcation

Distance of LA from origin to Carotid Bifurcation	Right(mm)	Left(mm)	Total (n=50)
Mean	12.7	12.1	12.4
Minimum	7	6	6
Maximum	22	19	22

The distance of origin of lingual artery from carotid bifurcation of common carotid artery is measured. In present study the maximum distance of origin of lingual artery to carotid bifurcation is 22 mm on right side, 19 mm on left side and 22 mm on both sides .the minimum distance is 7 mm on right side, 6 mm on left side and 6mm on both sides and the mean distance is 12.7±3.1 mm on right side and 12.1±3.5 mm on left side and 12.4 mm on both sides with standard deviation ±3.3mm.

Table 4 : Length of Lingual artery from origin to the termination.

Length of Lingual Artery	Right(mm)	Left(mm)	Total (n=50)
Mean	97	98.5	97.5
Minimum	91	92	91
Maximum	105	115	115

Table 5 : Distribution of Branches of Lingual Artery

Branches of LA	Frequency	Percentage
Supra Hyoid Artery	50	100
Dorsal Lingual artery	43	86
Sublingual artery	41	82
Deep lingual artery	50	100

Among all 50 specimens of head and neck all the specimens shows the artery arises from the lingual, among 43 specimens dorsal lingual artery, 41 specimens sublingual artery and all 50 specimens of head and neck all the specimens shows the deep lingual artery was a continuation of the lingual artery in this study.

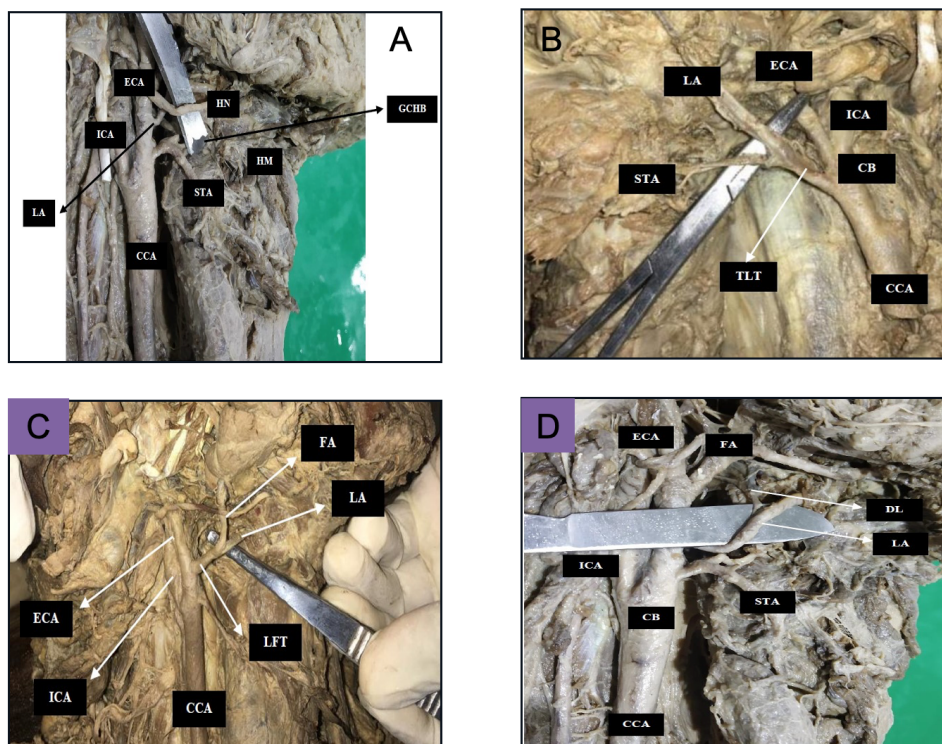


Figure : (A) Lingual artery relation to greater cornu, (B) Thyrolingual Trunk, (C) Linguofacial Trunk, (D) Suprahyoid Artery

Discussion

According to the Sir William Osler “ Variability is the law of Life” As per his quote, variations do occur in the human body. The motive of anatomical studies usually lies in the identification, documentation and correlation of the variations with the developmental reasons and the clinical impacts of them. In the present study, the origin of lingual artery from external carotid artery occurred at the level of greater cornu of hyoid bone in 40 specimens. In 6 specimens, the artery arises above the greater cornu of hyoid bone; in remaining 4 specimens, the artery arises below the greater cornu of hyoid bone. In study conducted by Maria kala et al [3] 2010, of 100 foetuses, it was found that the origin of lingual artery from external carotid artery was occurred at the level of greater cornu of hyoid bone in 189 specimens. In 7 specimens, the artery arises above the greater cornu of hyoid bone; in remaining 4 specimens, the artery arises below the greater cornu of hyoid bone. According to the literature data accessed, the LA has an individual origin from the ECA in most cases, this pattern of origin having the highest prevalence, as follows: Sanjeev IK et al, 2010, showed in their study on Indian population that the LA has an individual origin from the ECA in 78.38% of cases, and the level of origin, also variable, was 4 to 10 mm above the origin of the ECA [5]; according to Anuradha M and Chitra S’ study on Indian population, 2017, the LA individually arises from the ECA in 90% of cases [4].

Ozgun et al [6], 2008 in their study it was found that the mean distance of origin of lingual artery from carotid bifurcation was $13.74 \text{ mm} \pm 5.16 \text{ mm}$ which was slightly higher than that of the present study. Another study by Gong M et al [7] 2012 whose distance was $9.5 \text{ mm} \pm 3.1 \text{ mm}$ which was similar to our study, one more study by Anu radha et al [4], 2017 in their study found that the mean distance was 13 mm which is almost equal to the present study.

Ye J et al [8], in their studies in 2001, found that the length of lingual artery was $92.88 \pm 13.53 \text{ mm}$ which is slightly lower than the present study. But other study by Guan J et al [9], in their studies in 2005, they found that the length of lingual artery was $97.3 \pm 8.3 \text{ mm}$, which is an almost correlate to the present study.

The first branch of lingual artery called as supra hyoid artery, arises just before it passes the posterior border of hyoglossus muscle, supplies supra and infra hyoid regions by anastomosing with infrahyoid artery of superior thyroid artery. Sethi M and kumar D [10], states that the head and neck region of a 40 year old male cadaver an unusual origin of the suprahyoid artery from facial artery was found and also facial and lingual artery arising as a common linguofacial trunk from ECA. In the present study out of 50 specimens dorsal lingual artery was present in 43 specimens (86%), study by Gastova Rassier Isolan et al [11], in their studies, out of 12 cadavers dissected they found that the dorsal lingual artery was small in calibre and was identified in only one cadaver (8.3%). sublingual artery arises from lingual

artery in 82% cases (41 specimens) and remaining 18% of the cases (9 specimens) the sublingual artery was absent, which is slightly lower than the present study. Study by Joseph Gakonyo et al [12], in their studies in 2015, the sublingual artery arises from lingual artery in 73.5% cases and remaining 26.5% of the sublingual artery was absent, which is slightly lower than the present study. In the present study, out of 50 specimens dissected all the specimens' shows presence of deep lingual artery, study conducted by Katsumi Y et al [13], in their studies in 2013, out of 27 human cadavers dissected, 29.6% sublingual artery was absent, in that cases deep lingual artery was absent in 1.8% of specimens, which was almost similar to present study.

Conclusion : From overall observation and after discussion with other studies we can conclude that, it was evident that the variations in the development and branching pattern of the lingual artery are not rare and should be evaluated before any diagnostic or therapeutic interventional procedures are planned in head and neck, oral and dental surgeries.

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