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ORIGINAL ARTICLE

Branching Pattern Of External Carotid Artery In Human Cadavers

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ABSTRACT

Background: The rich vascularity of most parts of the head and neck is mainly maintained by the external carotid artery through its branches. Like other great vessels of the neck, the external carotid artery and its branches have numerous variations. These variations pose a dangerous situation during various neck surgeries.

Aim: To study the branching pattern of external carotid artery in human cadavers.

Methods: The present cross-sectional study was undertaken to assess the branching pattern of the external carotid artery in 37 formalin-preserved head and neck specimens by detailed dissection method.

Results: The level of termination of the common carotid and the origin of the branches of the external carotid arteries were found to be variable significantly. The anterior branches of the external carotid arose separately only in 56.76% of the cases and in the remaining, they shared common trunks between themselves. In 35.14% of the cases, the superior thyroid artery was found to arise from the common carotid. The posterior branches were found to share common trunks between themselves in 27% of the cases. The point of origin of the branches from the external carotid artery was also found to be variable. The trunk between the occipital and the ascending pharyngeal arteries was the commonest, the next common to it was the linguofacial trunk and the least common was the thyrolingual trunk.

Conclusion: It can be concluded that these vessels show great variability and hence, a better anatomical knowledge about the vessels and their variations is essential in head and neck surgeries and also during the interpretation of angiograms by the radiologist.

Key words: variations; thyrolingual trunk; linguofacial trunk; neck surgeries.

Key messages:

- The rich vascularity of most parts of the head and neck is mainly maintained by the external carotid artery through its branches. Like other great vessels of the neck, the external carotid artery and its branches have numerous variations. These variations pose a dangerous situation during various neck surgeries.
- The level of termination of the common carotid and the origin of the branches of the external carotid arteries were found to be variable significantly.
- These vessels show great variability and hence, a better anatomical knowledge about the vessels and their variations is essential in head and neck surgeries and also during the interpretation of angiograms by the radiologist

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Introduction

The word *carotid* is derived from the Greek word 'Kapwrides', meaning *to stupefy* or *throttle*; *kapos* also means *heavy sleep,* says Skinner[1]. Rufus noted that the compression of the carotid arteries in man produced deep sleep and aphonia, as also quoted by Persson[2].

The rich vascularity of most parts of the head and neck (except brain and eye) is mainly maintained by the external carotid artery through its branches[3]. The external carotid artery has numerous important anastomoses with the internal carotid artery and the vertebrobasilar system, thus ensuring blood circulation in case of disturbed cerebral blood flow[4]. Like other great vessels of the neck, the external carotid artery and its branches have numerous variations and their exploration is more than interesting for a better anatomical knowledge of the neck. These variations pose a dangerous situation during:

- Surgeries like – thyroidectomy, laryngectomy, faciomaxillary surgeries, tonsillectomy, glossectomy and other neck surgeries.
- Ligating external carotid artery or its branches in cases of severe epistaxis.
- The elevation of various cutaneous and myocutaneous flaps for plastic and reconstructive surgeries of the head, neck and face, which depend on the external carotid artery for their blood supply; as quoted by Strauch[5].
- Preoperative selective arterial angiograms to map out the vascularity and the true extent of the tumours of the head, neck and face; as told by Richter[6].
- Selective arterial embolization to reduce the vascularity of the tumours of the head, neck and face.; and
- Selective intra arterial chemotherapy; as studied by Shintani[7].

In spite of its surgical importance, there are not many studies on the branching pattern of the external carotid artery as a whole, more so in India. Most of the literatures available are case reports. The present study was undertaken to know the anatomy of the external carotid artery and its branching pattern and the possible variations.

Material and Methods

This cross sectional study was done by procuring 37 adult head and neck specimens from the Department of Anatomy, out of which 25 were males and 12 were females. Ethical clearance was obtained from the institution. A 5% formalin solution was used as a preservative for these specimens.

The meticulous dissection of the external carotid artery was carried out in the carotid triangle and the infratemporal fossa, clearly delineating its origin and all the branches. The course and relations of the artery were noted. Its level of origin and the point of origin of its branches were also noted by making the measurements using digital calipers.

Results

The level of origin of the external carotid artery was found at the superior border of the thyroid cartilage in 56.76% (21/37) of the cases and it was found at a higher level (10-25mm above the superior border of the thyroid cartilage) in 16.22%(6/37) of the cases. In 27.02% (10/37) of the cases, the origin of the external carotid artery was found at a lower level (10-22 mm below the superior border of the thyroid cartilage).

Superior Thyroid Artery

The superior thyroid artery was found to arise from the anteromedial surface of the external carotid artery as the first branch in 64.86%(24/37) of the cases [Table/Fig.1, d] and in 35.14% (13/37) of the cases, it was found to arise from the common carotid artery [Table/Fig.2, d].

The superior thyroid artery arose most frequently as a separate branch from the external carotid artery and in only one case; it shared a common trunk with the lingual artery, i.e., the thyrolingual trunk (2.7%). When the superior thyroid artery arose from the external carotid artery, its point of origin was almost at the point of origin of the external carotid artery in 75%(18/24) of the cases and in 25%(6/24) of the cases, the superior thyroid artery was found to arise 5-16 mm above the point of origin of the external carotid artery.

[Table/Fig 1]. Normal branching pattern of external carotid artery

Lingual Artery

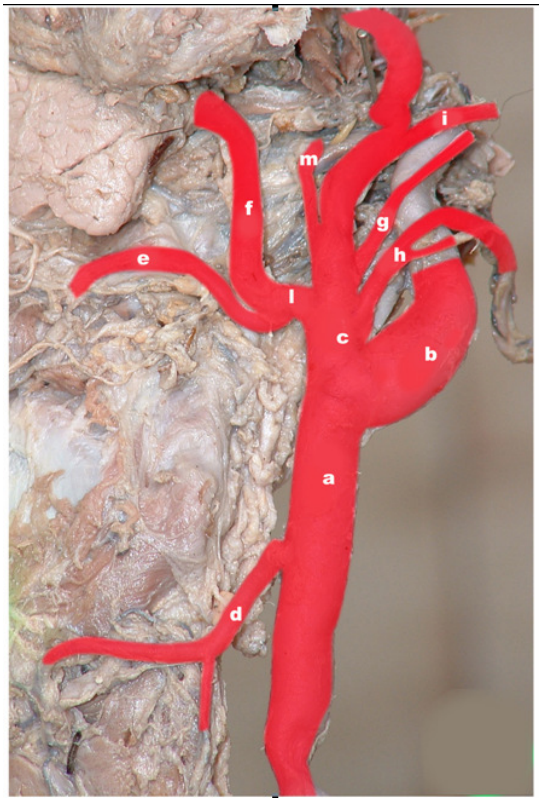
The lingual artery was found to arise from the anteromedial surface of the external carotid artery as a separate branch in 78.38 % (29/37) of the cases [Table/Fig.1, e]. It was found to share a common trunk in 7 cases with the facial artery, i.e., the linguofacial trunk (18.92%) [Table/Fig.2,l], but in one case (2.70%), there was athyrolingual trunk. The commonest point of origin of the lingual artery was found to be between 4-10mm above the origin of the external carotid artery in 48.65 %(18/37) of the cases.

Facial Artery

The facial artery was found to arise from the anteromedial surface of the external carotid artery as a separate branch in 81.08 %(30/37) of the cases [Table/Fig.1, f] and it shared a common trunk with the lingual artery in 18.92% (7/37) of the cases [Table/Fig.2, l]. The commonest point of origin of the facial artery was found between 11-20 mm above the origin of the external carotid artery in 48.65 %(18/37) of the cases.

These three branches of the external carotid artery, i.e., superior thyroid, lingual and facial, were found to arise as separate branches in 56.76% of the cases and in 44.24% of the cases, they shared common trunks between them. The linguofacial trunk was more common than the thyrolingual trunk.

[Table/Fig 2]. Abnormal branching pattern of external carotid artery



Ascending Pharyngeal Artery

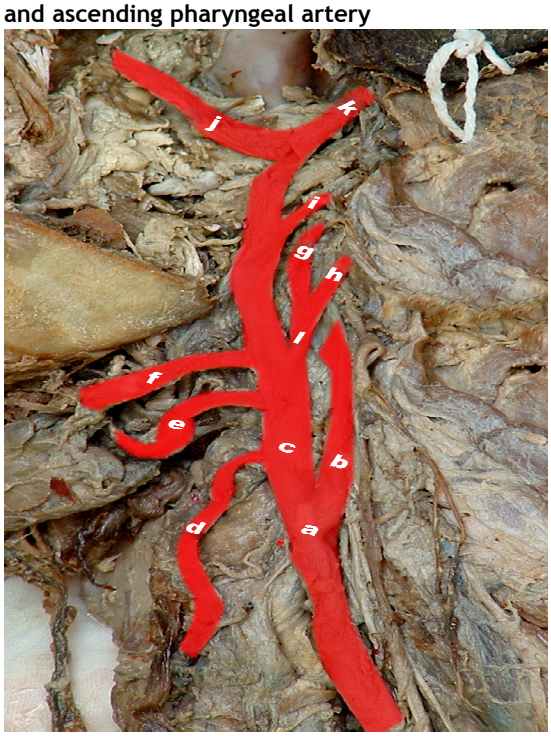
The ascending pharyngeal artery was found to arise from the external carotid artery as a separate branch in 75.68% (28/37) of the cases [Table/Fig.1, g] and it was found to share a common trunk with the occipital artery in 24.32%(9/37) of the cases. The commonest point of origin of the ascending pharyngeal was between 11-20 mm above the point of origin of the external carotid artery in 56.75 %(21/37) of the cases.

Occipital Artery

The occipital artery was found to arise from the posterior surface of the external carotid artery as a separate branch in 72.97% (27/37) of the cases [Table/Fig.1, h] and it shared a common trunk with the ascending pharyngeal artery in 24.33%(9/37) of the cases [Table/Fig 3, l]. In one case, it shared a common trunk with the posterior auricular artery (2.70%).The commonest point of origin of the occipital artery was between 11-20 mm above the origin

of the external carotid artery in 48.65%(18/37) of the cases.

[Table/Fig 3]. Common trunk of occipital artery and ascending pharyngeal artery



Legends to figures:

a - Common Carotid Artery
b - Internal Carotid Artery
c - External Carotid Artery
d - Superior Thyroid Artery
e - Lingual Artery
f - Facial Artery
g - Ascending Pharyngeal Artery
h - Occipital Artery
i - Posterior Auricular Artery
j - Maxillary Artery
k - Superficial Temporal Artery
l - Common Trunk
m - Accessory Branch

Posterior Auricular Artery

The posterior auricular artery was found to arise from the posterior surface of the external carotid artery as a separate branch in all the cases [Table/Fig.1, i], except in one case, wherein it shared a common trunk with the occipital artery. The site of origin of the posterior auricular artery was between 31-40 mm above the origin of the external carotid artery in 45.94 %(17/37) of the cases.

These three branches, i.e., the ascending pharyngeal artery, the occipital artery and the posterior auricular artery were found to arise separately from the external carotid artery in 73% of the cases and in 27% of the cases, they shared common trunks between them. The commonest trunk was shared between the occipital artery and the ascending pharyngeal artery.

Terminal Branches

The termination of the external carotid artery into the maxillary [Table/Fig.1, j] and the superficial temporal arteries [Table/Fig.1, k] was seen in all the cases except one, where it terminated into the posterior auricular, the superficial temporal and the maxillary arteries. The level of termination was found at the neck of the mandible in 67.57% of the cases and in 32.43% of the cases, it was found below the level of neck of the mandible. The average distance of the termination of the external carotid artery from the origin was 60 mm.

Accessory branches

The superior laryngeal artery in two cases, the artery to the sternocleidomastoid muscle in two cases and the artery to the tonsil in one case [Table/Fig.2, m], were found to arise directly from the external carotid artery.

Discussion

The origin of the external carotid artery was found to be variable in a significant number of cases. In the studies of Lucev et al [8], it was found to be at the normal level, i.e., at the superior border of the thyroid cartilage in 50% of the cases and at a higher level in 37.50% of the cases. Bergman et al [9] also stated that the higher origin is common.

The anterior branches of the external carotid were found to share common trunks between them very frequently. The thyrolingual trunk was found in 3.50% of the cases by Shintani[7], in 2% of the cases by Gailloud[10] and Md. Banna[11] and in the present study, it was found to be 2.70%. The linguofacial trunk, on the other hand, was found in 14% of the cases by Lappas[12], in 31% of the cases by Shintani[7], in 20% of the cases by Lucev[8] and it was found in 18.92% of the cases in the present study. [Table/Fig 4].

[Table/Fig 4]. Comparison of the prevalence of thyrolingual and linguofacial trunks in different studies.

Trunk	Prevalence (in %)	Quoting Author
Thyrolingual trunk	3.50% 2% 2% 2.70%	Shintani [7] Gailloud [10] Md. Banna[11] Present study
Linguofacial trunk	14% 31% 20% 18.92%	Lappas [12] Shintani [7] Lucev [8] Present study

The superior thyroid artery was found to arise from the external carotid artery in 68% of the cases by Md. Banna [11], in 30% of the cases by Lucev [8] and in 64.86% of the cases in the present study. In a significant number of cases, the superior thyroid artery was found to arise from the common carotid – in 47.50% of the cases by Lucev[8], in 16% of the cases by Hollinshead [13], in 10% of the cases by Md. Banna[11] and in 35.14% of the cases in the present study [Table/Fig 5].

[Table/Fig 5]. Site of Origin of Superior Thyroid Artery.

Site	Prevalence (in %)	Quoting Author
External Carotid Artery	68% 30% 64.86%	Md. Banna[11] Lucev [8] Present study
Common Carotid Artery	47.50% 16% 10% 35.14%	Lucev [8] Hollinshead[13] Md. Banna[11] Present study

The medial branch of the ascending pharyngeal artery was found to arise as a separate branch in 91.9% of the cases in a study by Luzsa [14]. Lappas [12] observed that it arose as a separate branch in 76.50% of the cases. It was found to arise from the internal carotid artery in 6% of the cases, as quoted in Bergman [9]. The occipital artery was found to arise as a separate branch from the external carotid in 83% of the cases and was found to share a common trunk with the posterior auricular artery in 13.50% of the cases, according to D A Lappas [12].The study by Luzsa [14] revealed that 13.9% of the cases had a common trunk with the posterior auricular artery and that 0.6% cases had a common trunk with the superficial temporal artery. Lappas [12] found that in 10.50% of the cases, the superior laryngeal artery arose directly from the external carotid.

This present study showed differences in the branching pattern as compared to the available literature so far, which may be due to racial differences. This implies that these vessels show great variability. Developmentally, the variations result from the persistence of the channels that normally disappear or from the disappearance of the normally persisting vessels.

Conclusion

It can thus be concluded that these vessels show great variability and a better anatomical knowledge about these vessels and their variations would be of help during head and neck surgeries and also during the interpretation of angiograms by the radiologist.

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References

[1] Skinner HA. The origin of medical terms. 2nd ed. Baltimore: The Williams and Wilkins Company, 1961; 300.
[2] Persson AV. Surgical clinics of North America. In: History of carotid surgery. Philadelphia: W.B. Saunders Company; 1986, 66 (2): p 225.
[3] Williams PL. Gray's Anatomy. 38th ed. London: ELBS with Churchill Livingstone, 1995; 1515-21.
[4] Osborn AG. Diagnostic cerebral angiography. 2nd ed. Philadelphia: Lippincott Williams and Wilkins, 1999; 31-55.
[5] Strauch B, Vasconez LO, Hall Findlay EJ. Grabb's Encyclopedia of flaps. 2nd ed. Vol (1) Head and Neck. Philadelphia: Lippincott-Raven, 1998989-997.
[6] Richter HP, Walter S. Preoperative embolization of intracranial meningiomas. Neurology 1983; 13 (3): 261-8.
[7] Shintani S, Terakado N, Alcalde RE, Tomizawa K, Nakayama S, Ueyama Y et al. An anatomical study of the arteries for intraarterial chemotherapy of Head and Neck Cancer. International Journal of Clinical Oncology 1999; 4: 327-30.
[8] Lucev N, Bobinac D, Maric I, Drescik I. Variations of the great arteries in the carotid triangle. Journal of Otolaryngology Head and Neck Surgery 2000; 122:590-591.
[9] Bergman RA, Afifi AK, Miyauchi R. Compendium of human anatomic variation, Text atlas and World literature. Baltimore: Urban & Schwarzenberg; 1988; 64-66.

[10] Gailloud P, Khan HG, Nathalie K, Rufenacht DA, Fasel JHD. The supra isthmic anastomatic arch. AJR 1998; 170: 497-8.
[11] Banna M, Lasjaunias P. The arteries of lingual thyroid; angiographic findings and anatomic variations. AJNR1990; 11: 730-2.
[12] Lappas DA, Kamberos SP, Gisakis IG, Takis CH, Lykaki G. Anatomic study of the variations in the origin of the branches of the external carotid artery. Beta Medical Arts 2002: 81.
[13] Hollinshead WH. Anatomy for surgeons. Vol.1 Head and Neck. Hoeber Harper International, Philadelphia, 1966;564-576
[14] Luzsa G. X-ray anatomy of vascular system. London: Butterworth and Co. Ltd., 1974; 120-125.