ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

Assessment of Anatomical Variations in the Branches of External Carotid Artery

Dr.Shipra Gupta[1], Dr.Aparna Dixit[2]

[1,2]Assistant professor, Sarawati Medial College,Unnao, Uttar Pradesh, India

Correspondingauthor:
Dr.Aparna Dixit
Assistant professor, Sarawati Medial college, Unnao, Uttar Pradesh, India
Email: aparna221207@gmail.com

ABSTRACT

Background: The external carotid artery (ECA) and its branches serve as the major vascular channels of the head and neck region. The present study was conducted to assess anatomical variations in the branches of external carotid artery.

Materials & Methods: 60 neck-halves of embalmed cadavers were taken and variation in ECA was determined.

Results: Average length of the external carotid artery from its origin by bifurcation of the common carotid artery to itstermination is 8.2 cm on the right side and 8.0 cm on the left side.Common variation was thyrolingual trunk in 6, direct origin of STA from CCA in 10, linguofacial trunk in 25, occipito-auricular trunk in 4, thyrolinguofacial trunk in 5, accessory branches of ECA in 3, SLA direct branch of ECA in 2, terminal trifurcation of ECA in 4 and sternocleidomastoid branch from CCA in 1 cadaver. The difference was significant ($P< 0.05$).

Conclusion: External carotid artery shows variations in its branching. A thorough knowledge is must to avoid intra-operative secondary haemorrhage and post-operative complications.

Key words:external carotid artery, embalmed cadavers, secondary haemorrhage

Introduction

The external carotid artery (ECA) and its branches serve as the major vascular channels of the head and neck region.[1] The ECA arises in the carotid triangle from the common carotid artery (CCA) along with the internal carotid artery (ICA).[2] The ECA is the main feeding vessel to the tissues of the head and neck region through its 8 branches, namely the superior thyroid artery (STA), ascending pharyngeal artery (APA), lingual artery (LA), facial artery (FA), occipital artery, posterior auricular artery (PAA), superficial temporal artery, and maxillary artery.[3] In addition, the ECAs also play an important role in providing collateral blood supply to the brain through the many connections between the branches of the ECA and cranial branches of the ICA and vertebral arteries.[4]

A detailed knowledge blood vessels and nerves in this head, neck and face regions is very helpful in various therapeutic and diagnostic procedures such as surgical resection of head, neck, face and oral cancers, radical neck dissection, plastic and reconstructive surgeries related to this vital region.[5] Cerebrovascular strokes due to atherosclerosis, haemorrhage or embolism require radiological investigation like carotid angiogram, surgical procedures like carotid endarterectomy also require a thorough knowledge of anatomy of external carotid artery and its branches.[6] Anomalous branching pattern of the carotid arteries and variations in the relative position of internal and external carotid arteries can also damage cranial nerves related to them.[7] The present study was conducted to assess anatomical variations in the branches of external carotid artery.

ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

Materials & methods

The present study was conducted among 60 neck-halves of 30 embalmed cadavers irrespective of age and sex in the dissection hall of the Anatomy Department. After skin incisions, sternocleidomastoid muscle was cut in the middle and reflected supero-laterally. The anterior belly of digastric and the infrahyoid muscles were cut and reflected. The submandibular gland was pushed aside. The ansacervicalis loop which was seen is sacrificed. The contents of carotid triangle were exposed by opening the carotid sheath. The external carotid artery was traced upwards. Its course was noted and all its branches were dissected and exposed. The parotid gland was dissected and removed in piece meal to expose the terminal branches of the external carotid artery namely superficial temporal artery and maxillary artery. When all the branches and course of the external carotid artery were visible, variations noted down. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

Results

The mean results and standard deviation (SD) of length of various branches of external carotid arteries of both sides is summarized in Table 1.Average length of the external carotid artery from its origin by bifurcation of the common carotid artery to its termination is 8.2 cm on the right side and 8.0 cm on the left side.

Table 1: Variations in the length of branches of ECA in cm.

Nameofbranchesofexternalcarot-idartery	**Noof specimen**	**Rightside**		**Left side**	
		Meanlength	SD	Meanlength	SD
SuperiorThyroidArtery	30	0.25	0.01	0.25	0.01
LingualArtery	30	2.2	0.04	2.0	0.04
FacialArtery	30	3.2	0.04	2.6	0.05
AscendingPharyngealArtery	30	0.5	0.05	0.5	0.06
OccipitalArtery	30	3.0	0.06	2.6	0.04
PosteriorAuricularArtery	30	4.5	0.05	4.2	0.1
SuperficialTemporal Artery	30	8.2	0.04	8.0	0.08
MaxillaryArtery	30	8.2	0.04	8.0	0.08

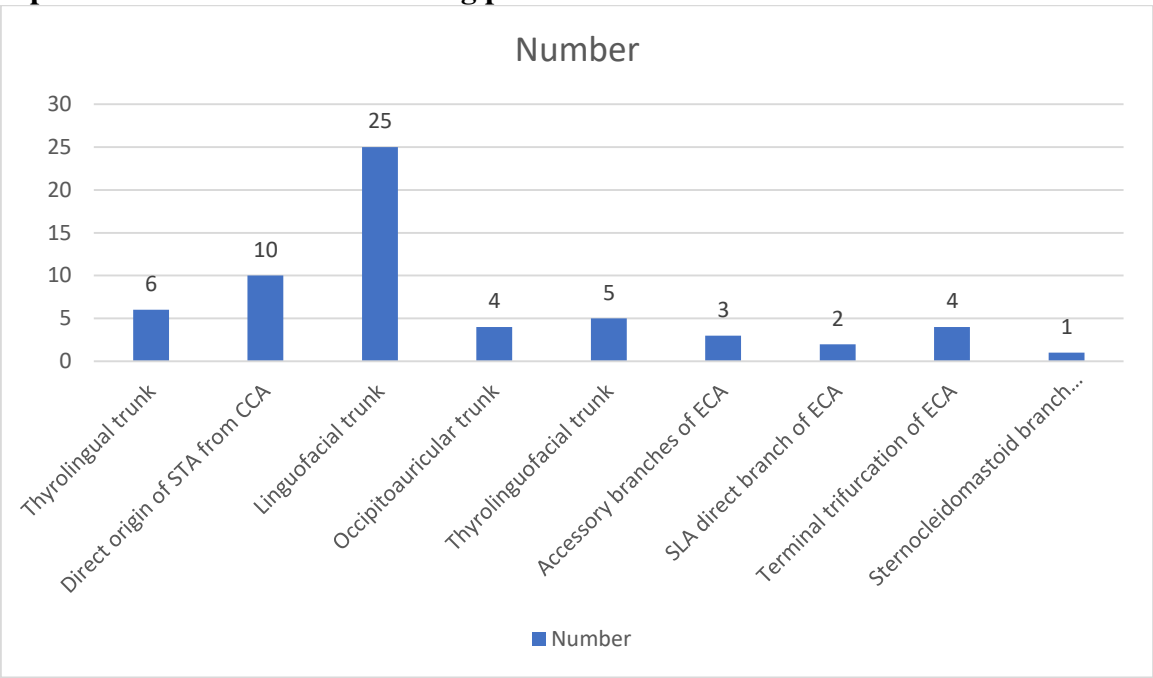
Table II Variations in the branching pattern of ECA

Variations	**Number**	**P value**
Thyrolingual trunk	6	0.01
Direct origin of STA from CCA	10	
Linguofacial trunk	25	
Occipitoauricular trunk	4	
Thyrolinguofacial trunk	5	
Accessory branches of ECA	3	
SLA direct branch of ECA	2	
Terminal trifurcation of ECA	4	
Sternocleidomastoid branch from CCA	1	

ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

Table II, graph II shows that common variation was thyrolingual trunk in 6, direct origin of STA from CCA in 10, linguofacial trunk in 25, occipitoauricular trunk in 4, thyrolinguofacial trunk in 5, accessory branches of ECA in 3, SLA direct branch of ECA in 2, terminal trifurcation of ECA in 4 and sternocleidomastoid branch from CCA in 1 cadaver. The difference was significant (P< 0.05).

Graph IIVariations in the branching pattern of ECA



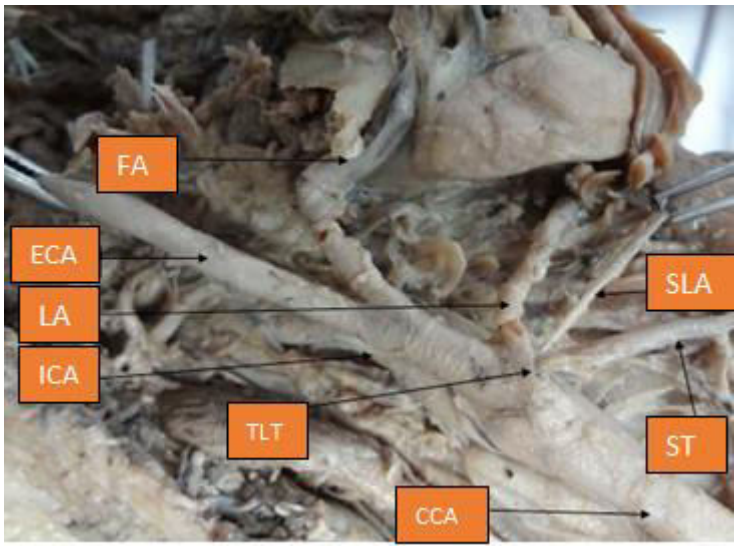


Figure: Showing external carotid artery having thyro-lingual trunk (TLT).

Discussion

Injuries to the carotid arteries in cases of neck trauma is the cause of inaccessible exsanguinating haemorrhage, requiring emergency surgical intervention.[8]Pseudoaneurysms occurring consequent to blunt carotid injury commonly affect branches of the ECA than the main ECA itself.[9] The clinical significance of the ECA and its branches is further reinforced by their application in a wide range of radiological and surgical procedures such as intra-arterial infusion chemotherapy, carotid stenting and endarterectomy as well as various head

ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

and neck surgeries.[10]The present study was conducted to assess anatomical variations in the branches of external carotid artery.

In present study, 60 neck-halves of 30 embalmed cadavers irrespective of age and sex in the dissection hall of the Anatomy Department were selected. Ovhalet al[11] studied variations in the course, relations and branching pattern of external carotid artery. In this study, 60 cadavers embalmed with 10% formalin were used, and thus 120 neck-halves were studied. Of these cadavers 52 were male and 8 were female. Linguofacial trunk was observed to be the commonest variation i.e. in 17 cases (28.33%) on the right side and in 18 cases (30%) on the left side. Thyrolinguofacial trunk was encountered in one case (1.67%) on the left side. Accessory branches of ECA such as branches to the parotid gland, submandibular gland, infrahyoid region and pharyngeal muscular branches were found in 6 cases (10%) on the right side and in 5 cases (8.33%) on the left side.

We found that common variation was thyrolingual trunk in 6, direct origin of STA from CCA in 10, linguofacial trunk in 25, occipitoauricular trunk in 4, thyrolinguofacial trunk in 5, accessory branches of ECA in 3, SLA direct branch of ECA in 2, terminal trifurcation of ECA in 4 and sternocleidomastoid branch from CCA in 1 cadaver. Devdaset al[12]assessed the variant anatomy of external carotid artery. The external carotid artery and its branches were dissected bilaterally in 40 formalin embalmed cadavers. The external carotid artery was traced from its origin to termination and variations in the branching pattern as well as the level of the carotid bifurcation were observed and analysed. A higher carotid bifurcation was observed in 25% cases. The linguofacial trunk was the commonest variation noted in the branching pattern seen in 20% cases. A single case of unilateral thyrolinguofacial trunk was also observed. The external carotid artery gave rise to accessory branches in 7.5% cases namely the superior laryngeal, accessory ascending pharyngeal and masseteric branches. A slender branch to the internal jugular vein was also observed in one case. These findings may provide further insight into the understanding of the vascular anatomy of the carotid triangle to the curious student, the discerning radiologist and the vigilant surgeon to avert complications and help improve overall treatment outcome.

Soubhagya R. Nayak, Ashwin Krishnamurthy et al[13] documented the variable patterns of SLA in their dissection study. According to them, the origin and morphology of SLA is important during partial laryngectomy and reconstruction surgery of the larynx. They also found duplication of SLA in one case. They said that, in case of duplication of the SLA, both the arteries should be ligated to minimize bleeding. According to them, as SLA is the principal artery to the larynx, variations of SLA should be considered by the clinicians in intra-arterial chemotherapy for laryngeal cancers.

According to Al-Rafiahet al[14], the commonest position of high carotid bifurcation was at the level of the hyoid bone in 25% and 36.85% cases respectively which correlates with our study. Lower levels of bifurcation have also been reported by the same authors with varying frequencies. Carotid bifurcations as low as intrathoracic bifurcations have also been reported in available literature.

Bergman et al[15] states that the APA may be occasionally doubled or tripled. In the present study, an accessory APA with higher level of origin was observed in one case. Sanjeev et al[16] observed accessory branches arising from the ECA in 13.5% cases as compared to 7.5% cases in the present study. When present, accessory branches of the ECA are often found to be the SLA as has been observed by the same authors previously.

Conclusion

Authors found that external carotid artery shows variations in its branching. A thorough knowledge is must to avoid intra-operative secondary haemorrhage and post-operative complications.

ISSN:0975-3583,0976-2833 VOL12,ISSUE05,2021

References

1. A. HimaBindu and B.NarsingaRao. Aberrant Patterns of Branching of External Carotid Artery. International Journal of Basic and Applied Medical Sciences. 2012;2(2):170-173.
2. Thwin S.S., Soe M.M., Myint M., Than M., Lwin S. Variations of the origin and branches of the external carotid artery in a human cadaver. Singapore Medical Journal 2010;51(2):40-42.
3. Koneko K, Akita M, Murato E, Imai M, Sowa K, Unilateral anomalous left common carotid artery: A case report. Annals of Anatomy.1996;178:477-480.
4. Chitra R. Trifurcation of the right common carotid artery. Indian Journal of Plastic Surgery.2008;41:85-8.
5. Vinaitha D., SubaAnandhi K., Sharmila Saran R., Lakshmi Ramanathan, ArunaSubramaniam. High Bifurcation of the Common Carotid Artery and Looping of the External Carotid Artery – a Case Report. Journal of Clinical and Diagnostic Research. 2012;6(3):462-464.
6. Natsis K, Raikos A, Foundos I, Noussios G, Lazaridis N, Njau SN. Superior thyroid artery origin in Caucasian Greeks: A new classification proposal and review of the literature. Clinical Anatomy. 2011;24(6):699-705.
7. Ozgur Z, Govsa F, Ozgur T. Assessment of origin characteristics of the front branches of the external carotid artery. Journal of Craniofacial Surgery.2008;19:1159–1166.
8. Anil A, Turgut HB, Peker T, Pelin C. Variation of the branches of external carotid artery. Gazi Medical Journal. 2000;11:81-83.
9. Marques S. R., Itezerote A. M, Saviolo Moreira R., De Angelis M. A., Prates, J.C. Anatomical variations of the occipital artery: relate of two cases. Rev. Chilean Anatomy. 2002;20(2):193-196.
10. Rao Mohandas K.G., RaoAsutosh S. Unusual Origin of the Arteries in the Carotid Triangle of the Neck: A Case Report and Literature Review. The Open Anatomy Journal, 2009;1:24-27.
11. Ovhal AG, Ansari MM, Rajgopal L, Ovhal AG. A cross sectional study of variations in the external carotid artery in cadavers. Indian Journal of Clinical Anatomy and Physiology. 2016 Jul;3(3):282-6.
12. Devadas D, Pillay M, Sukumaran TT. A cadaveric study on variations in branching pattern of external carotid artery. Anatomy & cell biology. 2018 Dec 1;51(4):225-31.
13. Soubhagya R. Nayak, Ashwin Krishnamurthy, Latha V. Prabhu, Bhagath Kumar Potu et al. Variable Origin of the Superior Laryngeal Artery and Its Clinical Significance. Al Ameen J Med Sci.2011;4(1):69-74.
14. Al-Rafiah A, EL-Haggagy AA, Aal IH, Zaki AI. Anatomical study of the carotid bifurcation and origin variations of the ascending pharyngeal and superior thyroid arteries. Folia Morphol (Warsz) 2011;70:47–55.
15. Bergman RA, Afifi AK, Miyauchi R. Illustrated encyclopedia of human anatomic variation. Ascending pharyngeal artery [Internet] Anatomy Atlases; c1995-2018.
16. Sanjeev IK, Anita H, Ashwini M, Mahesh U, Rairam GB. Branching pattern of external carotid artery in human cadavers. J ClinDiagn Res. 2010;4:3128–3133.