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Original Research Paper

Anatomy

EXTERNAL CAROTID ARTERY ITS VARIATIONS IN BRANCHING PATTERN A STUDY IN HUMAN CADVERS AND FOETUS.

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ABSTRACT

The present study is undertaken to know the anatomy of external carotid artery and its branching pattern and possible variations in it by a detailed dissection method. To study the variations in pattern of branching. A detailed study on 37 bissected halves of adult head and neck procured from Department of Anatomy and 3 Dead foetuses collected from Department of OBG, General Hospital. 5% formalin solution – used as preservative for specimens.

KEYWORDS :

INTRODUCTION

The word "carotid" is derived from the Greek word Kapwrides meaning 'to stupefy' or 'throttle'; kapos also means 'heavy sleep'.[1]most of head and neck is mainly maintained by external carotid artery through its branches. Supplies to important structures like thyroid gland, salivary glands tongue, paranasal sinuses, pharynx mandible, larynx, tonsils etc. The external carotid artery has numerous important anastomoses with internal carotid artery and vertebrobasilar system ensuring circulation in case of disturbed cerebral blood flow.[2]

The great vessels of the neck, and its branches have numerous variations has a better anatomical knowledge of the neck.[4] These variations pose a dangerous situation during neck Surgeries ,Ligating external carotid artery or its branches , arterial angiograms ,Selective intra arterial chemotherapy.[7]

DEVELOPMENT OF EXTERNAL CAROTID ARTERY

Associated with regression of 1st and 2nd aortic arches, a new vessel – the external carotid artery sprouts headwards from the embryonic 3rd aortic arch and extends along the ventral wall of the pharynx. Each embryonic hyoidostapedial artery (HSA) passes through the developing stapes and then divides into three branches. The embryonic hyoidostepedial artery thus consists of three parts.A main trunk derived from the hyoid artery, A maxillofacial division with an infraorbital branch and a mandibular branch and a supra orbital division. It is usually annexed by the external carotid artery trunk. The supraorbital division forms the intracranial segment of middle meningeal artery.

ANATOMY OF EXTERNAL CAROTID ARTERY

External carotid artery begins lateral to the thyroid cartilage's upper border, level with disc between C_3 and C_4. A little curved and with a gentle spiral, it first ascends slightly forwards and then inclines backwards and a little laterally, to pass midway between mastoid tip and mandibular angle, where in the substance of parotid gland behind the mandible's neck, it divides into its terminal branches. Its total length is 7 – 8 cms At mandibular level the styloid process and its attached structures intervene between the vessels, the internal carotid being deep and external carotid superficial to styloid. At higher level the internal carotid artery is separated from external carotid artery by styloid process, styloglossus, stylopharyngeus muscle, glossopharyngeal nerve, pharyngeal branch of vagus nerve and parotid gland.

DISCUSSION

In the present study forty two (37 adult and 5 foetal) specimens are studied for the branching pattern of the external carotid artery. The findings of previous workers on the subject have been compared with present study . In the adult, the level of origin of external carotid artery is found at the superior border of thyroid cartilage only in 56.76% of cases (21 specimens). This level of origin was found in 58% of cases in study of Ilic, in 50% of cases in study of Lucev N et al and in 65% of cases in study of Espalieu et al[4]

In the present study the origin of external carotid is found at higher level (10-25 mm above the superior border of thyroid cartilage) in 16.22% of cases (6 specimens). Higher level of origin was found in 37.5% of cases by Lucev N et al, in 31% of cases by Ilic and in 20% of cases by Von Poisel and Golth.[4]

Table-1:Origin and Relations of ECA

Point of origin of ECA	Normal	Above	Below
	21 (56.76%)	6 (16.22%)	10 (27.02%)
Relation of ECA with ICA	Anterior	Anteromedial	Anterolateral
	23 (62.16%)	13 (35.13%)	1 (2.7%)
Relation with styhyoid & post belly of digastrics	Deep to Muscle		Superficial
	37		-

Lucev N et al found the anterior position in 47.5% of cases, Krampoticnemanic in 21% of cases[4], Trigaux J et al in 34.5% of cases.[24] The anteromedial position was found in 48.5% of cases by Trigaux J et al[24], in 30% of cases by Lucev N et al.[4] Lateral position of external carotid artery was found in 12.3% of cases by Teal J et al[14] in 2% of cases by Trigaux J et al,[24] in 10% of cases by Lucev N et al.[4]

The external carotid artery passes deep to the posterior belly of digastric and stylohyoid muscles in all the 37 specimens of the present study. Study of Singer R on 34 cadavers there was 10% of incidence of external carotid's superficial course.[10] Pisk has reported 2 cases of similar superficial course of external carotid artery.[11] In S. Shintani's study the thyrolingual trunk was found in 3.5% of cases[7] and in 2% of cases by Gailoud P et al[33] and Mohamed Banna et al.[25]

The lingual artery is found to arise from anteromedial surface of the external carotid artery as a separate branch in 78.38% of cases (29 specimens) of the present study. It is found to share a common trunk most often with the facial artery i.e. linguofacial trunk in 18.92% of cases Incidence of linguofacial trunk was found to be 20% by Quain[32], 31% by S. Shintani[7], 20% by Lucev N et al[4]and 14% by DA Lappas[39].

In the present study the occipital artery is found to arise from the posterior surface of the external carotid artery as a separate branch in 27 cases (72.97%) and it shares a common trunk with ascending pharyngeal artery in 9 cases (24.33%). In one case it shares a common trunk with posterior auricular artery (2.70%) .It is found that the site of origin of occipital artery is between 11-20 mm from the origin of external carotid artery in 18 cases (48.65%) and between 1-10 mm in 9 cases

(24.34%), between 21-30 mm in 7 cases (18.92%) and between 31-40 mm in 3 cases (8.11%) .,Study of Luzsa finds that in 85.5% of cases it arises separately, in 13.9% of cases as a trunk with occipital artery and in 0.6% of cases as a trunk with superficial temporal artery.[8]

THE DETALIED STUDUY ON CARDEVERS AND DEAD FETUS

Sp. No.	Sex	Side	Origin of ECA	STA	Termination			Accessory branches		Relation with
					Level	MA	SPTA		ICA	SH-M/ PBD-M
2	M	R	N	+	15, 70	+	+	+ SCM	A	D
3	M	R	N	+, CCA, 9	N, 50	+	+	-	Am	D
4	M	L	N	+, CCA, 9	N, 57	+	+	+ SL	A	D
5	M	R	10	+, CCA, 4	15, 57	+	+	-	A	D
6	M	L	N	+, CCA, 5	15, 57	+	+	-	A	D
7	F	R	N	+, CCA, 2	N, 52	+	+	-	A	D
8	F	L	N	+, CCA, 4	N, 52	+	+	-	A	D
9	M	L	N	+, CCA, 3	N, 66	+	+	-	Am	D
10	M	R	20	STA +LA, 5	N, 50	+	+	-	A	D
11	M	R	N	+	N, 55	+	+	-	A	D
12	M	L	24	+ CCA 9	N, 60	+	+	-	A	D
13	F	L	N	+	N, 65	+	+	-	A	D
14	F	R	N	+	15, 53	+	+	-	A	D
15	M	R	20	+ .17	N, 75	+	+	-	A	D
16	M	L	15	+ .16	N, 70	+	+	-	A	D
17	M	L	N	+	N, 57	+	+	-	Am	D
18	M	R	N	+	N, 60	+	+	-	Am	D
19	M	L	10	+ CCA 29	N, 60	+	+	+ TA	A	D
20	F	L	15	+	15, 50	+	+	-	Am	D
21	M	R	N	+ .4	N, 55	+	+	-	Am	D
22	M	L	N	+ CCA 8	N, 52	+	+	-	Am	D
23	F	R	N	+	N, 60	+	+	-	A	D
24	M	R	17	+	15, 55	+	+	-	Am	D
25	F	L	N	+ CCA 6	N, 63	+	+	-	A	D
26	M	L	10	+ CCA 5	N, 60	+	+	+ SL	A	D
27	M	L	13	+	10, 71	+	+	-	Am	D
28	M	L	8	+	10, 52	+	+	-	A	D
29	M	R	N	+	N, 58	+	+	-	A	D
30	F	R	N	+	N, 60	+	+	-	Am	D
31	F	L	15	+	N, 58	+	+	+ SCM	Am	D
32	M	L	10	+	10, 58	+	+	-	A	D
33	M	R	25	+ CCA 6	10, 45	+	+	-	Al	D
34	M	R	22	+ .11	N, 73	+	+	-	A	D
35	M	L	13	+ .5	N, 70	+	+	-	Am	D
36	M	L	N	+	20, 70	+	+	-	Am	D
37	M	R	N	+	30, 60	+	+	-	A	D
F-1	M	R	10	+	N, 20	+	+	+ SL	A	D
F-2	M	L	10	+	N, 20	+	+	-	A	D
F-3	F	R	N	+	N, 15	+	+	-	A	D
F-4	F	L	N	+, CCA	N, 15	+	+	-	A	D
F-5	M	L	N	+	N, 15	+	+	-	A	D

REVIEW OF LITERATURE

Singer R (1949) studied 34 cadavers for the relation of external carotid artery with posterior belly of digastric and stylohyoid muscle..[10] Hollinshead H (1966) where in 2 cases the stem of the external carotid artery gave rise to internal maxillary and superficial temporal vessels and passed superficial to the stylohyoid and posterior belly of digastric. There is also a mention about the study of carotid bifurcation by Quain in 295 individuals. In 31 cases, there was abnormally low bifurcation and in 5 of them the bifurcation was at the level of cricoid cartilage.[11] Newton T, Duane M, Usaf Y (1968) in angiographic study have reported origin of occipital artery from internal carotid artery 2 cm distal to its origin in 2 cases.[12] Handa J, Matsuda M, Handa H (1972) have reported a rare anomaly of external carotid artery, where it arose at normal level but its position was lateral instead of medial to internal carotid artery,Luzsa G (1974) studied the carotid arterial system by angiographic method. They say that the bifurcation of common carotid at lower level is more frequent than higher level and the difference between the two sides may exceptionally exceed width of a rib. Robert L and Gerald B (1978) have reported a case in which there was no common carotid artery on both sides. Here the internal and external carotid arteries arose separately from arch of aorta directly.They have also quoted the study of Kozielec and Jozwa (1977) on 110 human foetuses in which the incidence of linguofacial trunk was 43% and in 42% the facial artery did not reach medial orbital angle, ending as a superior (20%) or inferior (22%) labial artery. Their results show that the carotid bifurcation was normal only in 50% of cases; in 25% cases at level of inferior border of hyoid bone; in 12.5% cases at level of superior border of hyoid bone; and in 12.5% cases at level of inferior border of thyroid cartilage.In 30% cases the external carotid was anteromedial to internal carotid artery; in 47.5% cases anterior; in 10% cases medial; and in another 10% cases lateral; in only one case the external carotid was anterolateral. and in 8 cases there was linguofacial trunk.Facial artery arose from the anterolateral aspect of the external carotid in carotid triangle above the lingual artery 8 – 50 mm from bifurcation.[4]

SUMMARY

A comprehensive study of the branching pattern of external carotid artery was carried out in the Department of Anatomy,

37 adult bissected halves of head and neck were obtained from the embalmed cadavers in the Department of Anatomy, 3 foetuses were collected from General Hospital, . Detailed dissection method was followed to study the branching pattern of external carotid artery. The origin of external carotid artery and its branches were noted and also any variations in it.

The origin of external carotid artery is found at the superior border of thyroid cartilage in 56.76% of cases. At its origin the external carotid artery is found more often (62.16%) anterior to the internal carotid artery than anteromedial. In all the cases the external carotid artery is found passing deep to the muscular strap formed by stylohyoid and posterior belly of digastric muscles.

The superior thyroid artery most frequently (64.86%) arises as a separate branch from the anteromedial surface of external carotid artery. In 35.14% cases the superior thyroid artery is found arising from common carotid artery,The facial artery most often (81.08%) arises as a separate branch from the external carotid artery. Its commonest point of origin is between 11-20 mm above the origin of external carotid artery. Ascending pharyngeal artery, the most slender branch is found to arise from medial surface of the external carotid artery as a separate branch in 75.65% of cases. Its commonest point of origin is between 11-20 mm from the point of origin of external carotid artery.Posterior auricular artery is found to arise from the posterior surface of external carotid artery as a separate branch in almost all cases except one. Its commonest site of origin is between 31-40 mm from the origin of external carotid artery.The external carotid artery is found terminating into superficial temporal and maxillary arteries at the level of neck of mandible in all the cases.

CONCLUSION

The present study on branching pattern of external carotid artery shows that the origin of the external carotid artery is variable in almost half of the cases studied and its course in all the cases is deep to the muscular strap formed by stylohyoid and posterior belly of digastric.Its branches arise separately in only half of the cases and in remaining cases they form various trunks between them. When they arise as separate branches their point of origin is also variable. Superior thyroid artery arises from the common carotid artery in many cases. Some branches share common trunks.

This present study shows some differences with respect to the same results from the available literature. That means the vessels show great variability.Better anatomical knowledge about the vessels and their variations is essential in avoiding iatrogenic injuries by surgeon and also during interpretation of angiograms by radiologist.Exact embryology of the branches of the external carotid artery is not clear. The variations result from the persistence of channels that normally disappear or from the disappearance of normally persisting vessels. Further study on the embryos in this direction is essential.

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