



Variations of ramification of external carotid artery – common trunks of collateral branches

JASMIN DELIĆ¹
ADMEDINA SAVKOVIĆ¹
ALMA BAJTAREVIĆ¹
ELDAR ISAKOVIĆ¹

Department of Anatomy
School of Medicine
University of Tuzla
PZU »Medicom« Zenica

Correspondence:

Jasmin Delić
School of Medicine
University of Tuzla
Univerzitetska 1
75000 Tuzla
E-mail: jasmin.delic@untz.ba

Key words: External carotid artery, anatomy, variations

Summary

This research involved 50 patients processed in PZU, »Medicom« Zenica, by the method of MRI-angiography when performing MR of the neck. The way of ramification of the a. carotis externae, that is described in classical anatomy textbooks, where its branches separate as individual branches, is found in 76,6% to 81%, according to the data from the literature available. These data are confirmed by our researches, where presence of this ramification type was found in 84% of the total number of technically accurate MRI angiograms (91 angiogram). In 16% of cases, the branches of a. carotis externae originate as common trunks, or have unusual place of origin (a. carotis communis). A. thyroidea superior in 1,09% originates as common trunk with a. lingualis, but in three cases (3,33%) it originates as common trunk with a. lingualis.

INTRODUCTION

Development of procedures and techniques of vascular, plastic and reconstructive surgery of the head and neck demands knowledge on variations of vascular system, that appears more frequently than known and described so far. Microsurgical anatomy of cerebral and cerebellar blood vessels in relation to techniques and procedures of revascularization includes extracranial-intracranial bypass of blood vessels, then interpositions of blood vessels and their heterolateral anastomosing, as well. At the time when the procedures of cerebral revascularization are not completely defined, it is important to realize mutual relation of microsurgical techniques to corresponding anatomical structures (1–5). Safe and effective transarterial embolization in the cases of abundant haemorrhage in maxillofacial and nasopharyngeal area demands precise and detailed knowledge on local anatomy (6, 7). Morphological properties of the external carotid artery branches represent a base for planning reconstructive surgery of the head and neck (8–12). Branches of a. carotis externae may originate unusually, they may appear in larger or small number than it is described in classical textbooks of anatomy. When they appear in small number, they originate as common trunks, or as the branches of its individual branches. Sometimes all the branches originate near one another, immediately above bifurcation of the a. carotis externae (13). The a. carotis externa gives individual branches in 76–80% of cases (14, 15). The a. lingualis originates as a separate artery in 77–81% of cases, and as a common trunk with the a. facialis (truncus linguofacialis) it ranges to 20% cases, and in 1% as common trunk with a. thyroidea superior (14,

16, 17). The a. facialis originates as common trunks with a. maxillaris in 20% of cases making the truncus maxillo-facialis (14, 16, 18, 19).

The objective of this research was to examine how common trunks of collateral branches of the a. carotis externae evolve and in what percentage.

EXAMINEES AND METHODS

Prospective research involved 50 consecutive adult patients, both sexes, examined in PZU »Medicom« in the town of Zenica. All the 50 patients were examined by the method of MRI-angiography (non-invasive method with no addition of contrast material) as a part of MR of the neck.

RESULTS

After MRI-angiogram have been analyzed, all the branches of the a. carotis externae could not be identified in 9% out of total number of examinees. To analyze vari-

ation of ramification of the a. carotis externae the rest of 91 MRI angiogram was taken as the full (100%) sample. It was established that the a. carotis externa shows variation of ramification. In 84,61% of cases (77 analyzed MRI-angiograms) of total number of the analyzed, branches of the a. carotis externae originate as individual arterial trunks. A thyroidea superior and a. lingualis in one case (1,09%) originate as common trunk (Figure 1).

A. facialis in 88 cases (96,70%) out of total of analyzed MRI-angiograms originates from the front wall of the a. carotis externae, above the outcome of a. lingualis as an individual artery, and in three cases (3,29%) as common trunk with a. lingualis (Figures 2 and 3).

DISCUSSION

The way of ramification of the a. carotis externae, that is described in classical textbooks of anatomy, where its branches originate as individual trunks, according to the data cited by Frick *et al.*, Shima *et al.*, and Hayashi *et al.*, is present in 76,6% to 81% of cases (14–16). These data are confirmed by our researches, where this type of ramification is present in 84,61% cases of total number of analyzed MRI-angiograms (91 angiograms).

In 11,01% of cases, branches of the a. carotis externae have unusual place of origin (a. carotis communis), i.e. in 4,38% of cases originate as common trunks.

Results of our researches correspond to those presented by Shima *et al.*, and Hayashi *et al.*, Their researches established that a. thyroidea superior originates as an individual branch of the a. carotis externae ranging from 70–95% of cases (15, 16). A. carotis externa gives a. thyroidea superior as an individual branch in 87,90% of the analyzed angiograms. In 1,09% it originates as a common trunk with a. lingualis, what corresponds to the percentage of truncus thyrolingualis presence (1,7–2,5%), that is presented in all the papers of Shima *et al.*, and Zumre *et al.* (15, 20).



Figure 1. A. thyroidea superior and a. lingualis originate as common trunk.



Figure 2. Common trunk of the a. lingualis sinistrae and a. facialis sinistrae.



Figure 3. Common trunk of the a. lingualis dextrae and a. facialis dextrae.

Zumre *et al.*, and Hayashi *et al.* noted the truncus linguofacialis (common trunk of a. lingualis and a. facialis), whose presence ranged from 18–20% in their research material (16, 20). Our results show considerably smaller presence (3,29%) of the truncus linguofacialis, and they are opposite to the results of the authors cited above. The a. facialis in our investigational material appears as an individual branch in 95,71% of total number of examinees, what approximately corresponds to the data (82–87,5%) presented by Zumre *et al.*, and Hayashi *et al.* (16, 20).

CONCLUSION

Some variations of ramifications of the a. carotis externa appear very rarely and are found in small percentages. On the other hand, some variations of the carotid blood vessels are surprisingly frequent, and they are in the focus of surgical anatomy of the head and neck. Embryogenesis of these variations is not completely explained, but anatomical outcomes have great clinical implications. Being familiar with anatomy of blood vessels of the neck is necessary for an accurate explanation of radiological records of these areas, for the precise diagnosis and safe surgical approach to this region. It is especially important, because most of these variations happen asymptotically and that is a great risk factor, so these variations may cause intraoperative damages of blood vessels in the neck region.

REFERENCES

- CORCOFORO P, ROCCA T, NAVARRA G 1997 Morphologic anomalies of extracranial internal carotid artery. *Minerva Cardioangiol* 45(1): 37–41
- VASCONCELOS C, XAVIER J, ALMEIDA-PINTO J, CRUZ R 2001 Vascularization of the skull base—review of the literature and illustrative cases. *Acta Med Port* 14(1): 33–42
- ULKU C H, USTUN M E, BUYKUMUCU M 2004 Radial artery graft for bypass of the maxillary to proximal posterior cerebral artery: an anatomical and technical study. *Otolaryngol* 124(7): 858–862
- HOLODNY A I 2005 Supply of the unilateral circulation of the brain by an occipital artery anastomosis—a case report. *Angiology* 56(1): 93–95
- KAWASHIMA M, RHOTON A L, TANRIOVER N 2005 Mikrosurgical anatomy of cerebral revascularization. Part II: posterior circulation. *J Neurosurg* 102(1): 132–147
- HACCEIN-BEYL, DANIELS D L, ULMER J L 2002 The ascending pharyngeal artery: branches, anastomoses, and clinical significance. *AJNR Am Neuroradiol* 23(7): 1246–1256
- SHANG J B, LI Y H, CHEN Y 2004 Clinical application of transarterial embolization for massive hemorrhage in the nasopharyngeal and maxillofacial regions. *Di Yi Jun Yi Da Xue Xue Bao* 24(2): 210–212
- NDIAYE A, TOURE S, DIOP F M 2004 The superficial temporal artery: anatomical type and clinical application to the flap of the fascia temporal superficial. *Morphologie* 88(282): 155–159
- PINARYA, GOVSA F 2006 Anatomy of the temporal superficial artery and its branches: its Importance for surgery. *Surg Radiol Anat* 28(3): 248–53
- JOSHI A, RAJENDRAPRASED J S, SHETTY K 2005 Reconstruction of intraoral defects using fa-cial artery musculomucosal flap. *Br J Plast Surg* 67(7): 12–15
- HOFERS O, POSCH N A, SMIT X 2005 The facial artery perforator flap for reconstruction of peroral defects. *Plast Reconstr Surg* 115(4): 996–1003
- RONALD A, ADEL K, RYOSUKE M 2005 Illustrated Encyclopedia of Human Anatomic Variations: Opus II: Cardiovascular System: Arteries: Head, Neck and Thorax. John Wiley & Sons, Inc., New-York.
- FRICK H, LEONHARDT H, STARCKL D 1992 Spezielle Anatomie II. Georg Thime Verlag, Stuttgart – New York.
- SHIMA H, VON LEUDINGHHAUSEN M, OHNO K, MICHIKI K 1998 Anatomy of microvascular anastomosis in the neck. *Plast Reconstr Surg* 101(1): 33–41
- HAYASHI N, HORI E, OTHANI Y, KUWAYAMA N, ENDO S 2005 Surgical anatomy of the cervical artery for carotid endarterectomy. *Neurol Med Chir* 45(1): 25–29
- KRMPOTIĆ-NEMANIĆ J 1978 Anatomy, variations and malformations of the vessels of the head and neck region. *Arch Otorhinolaryngol* 219(1): 1–91
- ŠLJIVIĆ B (1996) Anatomija – glava i vrat (XIV ed), Naučna knjiga, Beograd
- PRETTERKLIEBER M L, KRAMMER F B, MAYER R 1991 A bilateral maxillofacial trunk in man: an extraordinary anomaly of the carotid system of arteries. *Acta Anat* 141(3): 206–211
- ZUMRE O, SALBACAK A, CICEKCIBASI A E, TUNCER I, SEKER M 2005 Investigation of the bi-furcation level of the common carotid artery and variations of the branches of the external carotid artery in human fetuses. *Ann Anat* 187(4): 361–369