

Short Communication

BILATERAL ABSENCE OF THE INTERNAL CAROTID ARTERY VERSUS BILATERAL ABSENCE OF THE VERTEBRAL ARTERY

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Abstract. *Despite the rare appearance of the bilateral absence of paired cerebral arteries - internal carotid or vertebral one, the purpose of this paper is the comparison of such cases. Described differences (or similarities) are mostly related to the general data, morphophysiology, and (selected) pathological conditions.*

Key words: *Internal carotid artery, vertebral artery, bilateral absence, comparison*

What is the significance of internal carotid (ICA) or vertebral (VA) arteries in the vascularization of the brain (two thirds in relation to one third), as well as other cranial or vertebral structures has already been very well known. However, what is little known is that there is a possibility of the bilateral absence of ICA or VA. The purpose of this paper is to compare some substantial facts about the general, morphological, and pathological status of these cases.

The comparison of 68 and 31 cases of the bilateral ICA and VA absence, respectively is presented according to the content in the reviews about them [1, 2] and the newly discovered cases of ICAs absence [3–10]; the new cases of the bilateral VA absence (older or more recent date) were not found (Table 1).

The main differences between the cases of the bilateral ICA and VA absences were as follows: Generally, the cases of bilateral ICA absence were more commonly described in the literature than the cases of the bilateral VA absence (G2, Table 1). From an anatomical point of view, the proposed literature types of the bilateral ICA absence according to the absence (or presence) of carotid canals in the petrous part of temporal bone could be disputable due to the presence of ICA vascular source in almost of described cases (G6 and M1, Table 1). The presence of terminal ICA branches in almost all of these cases could prove a hypothesis about possible bilateral obliteration of the 3rd primitive aortic arches (PAAs) and a part of dorsal aortae between the PAA1 and PAA3 in a human embryo, probably with the crown-rump length of 5 to 6 mm, i.e. after a division of

the primitive ICA in the anterior and posterior branches; on another side, the constant presence of the BA with the help of some of the CVBAs leads us to suppose that the longitudinal neural arteries (precursors of the BA) on the hindbrain are decisive for their persistence than the absence of anastomoses of six cervical intersegmental arteries (precursors of future VA) (M4, Table 1).

Although the embryonic precursors of both ICA and VA are different [1, 2], their morphofunctional relationships in the postnatal life are to be expressed; a crucial role of the VBS in a case of bilateral ICA absence or some CVBA (common branch of ICA) in a case of the bilateral VA absence are the arguments for further discussion. Morphologically, there were more common variations of the VA in a case of the bilateral ICA absence, than ICA variations in a case of the bilateral VA absence (M6, Table 1). Regarding the pathology of these cases, it should be underlined that discovered cerebral aneurysms were more associated with the bilateral VA absence thus with the bilateral ICA absence; however, only 2/6 cerebral aneurysms were located on the ICA and persistent primitive hypoglossal artery in the cases of the bilateral VA absence, while all diagnosed cerebral aneurysms were located on the VBS branches in the cases of the bilateral ICA absence (P1, Table 1). The next specificity was that there were more frequent cases of the ICA stenosis associated with the bilateral VA absence than the contrary (P2, Table 1).

Although in almost half of the cases of both groups of abnormalities no accompanying pathology was recorded (N1, Table 1), for the time being these cases cannot be compared.

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Table 1 Comparison of cases of the bilateral absence of internal carotid (ICA) and vertebral (VA) arteries

Comparison		Absence of both ICAs	Absence of both VAs
General data*			
G1	First (available) description	In 1913	In 1970
G2	Number of cases	60 (31 male, 23 female, 6 of unknown gender)**	31
	+ additional cases (gender)	+ 8 (3 male, 3 female, 2 of unknown gender)***	(19 male, 11 female, 1 of unknown gender)**
G3	Age of cases	Newborn–80s	Neonate–80s
G4	Ethnicity predisposition	Expressed doubt	No data
G5	Familiar predisposition	No data	No data
G6	Literature types	Agenesis Aplasia	No data Aplasia
Morphophysiology*			
M1	Presence of common vascular sources	There was bilateral absence of the common carotid a. (CCA) only in one case and unilaterally also in one case.	Both subclavian arteries (SAs) were always presented.
M2	Status of constant vascular osseous canals or grooves	Carotid canals in the petrous part of temporal bones were bilaterally absented in 37/60 (known) cases and unilaterally in 2/60 cases; cited 8 cases did not included. There were no data for the presence of the carotid sulcus on the side of the body of the sphenoid bone.	Bilaterally, the foramen transversarium of the cervical vertebra was always presented; an exception was one cited case for which there were no available data. There were no data for the presence or absence of the groove for the VA on the posterior arch of atlas.
M3	Status of side-branches of (absented) ICA or VA	There were several descriptions of the origin of the ophthalmic or posterior communicating a.	There were several descriptions about the origin of some cerebellar arteries.
M4	Status of terminal branches of (absented) ICA or VA	The anterior cerebral artery was bilaterally described (or showed) in 56/60 (known) cases, except in two cases on the right side, while the middle cerebral artery was described (or showed) in all cases; cited cases did not included.	The basilar artery (BA) was mostly in a continuation of the persistent primitive carotid-vertebrobasilar anastomosis (CVBA)—proatlantal intersegmental (15 times) or hypoglossal artery (11 times). It was a continuation of the occipital a. in 2 cases and the ascending pharyngeal or paired primitive trigeminal arteries each in one case.
M5	Collateral circulation	The anterior cerebral circulation was supplied mostly via the vertebrobasilar system (VBS), while it was supplied via the CVBA(s) in 5 patients or via the branches of the external carotid arteries (ECAs) in 2 patients, although some branches of ECA were the supplements to the CVBA.	Idem
M6	Additional vascular variations of the VA and/or BA or ICA, respectively	Left VA originated from the aorta (2) or the left-sided arterial duct (1); hypoplasia of the right VA (2); duplication of the left VA in the intracranial part (1); tortuosity of VBS arteries (4); leftward deviation of the BA (1); ectasia of the BA (4) or VA (2); bridging fenestration into the BA lumen (1).	Irregular caliber of the ICA (1), tortuous course of the persistent primitive hypoglossal artery (PPHA) (1)).
M7	Association of the bilateral ICA and VA absences	There were only single (published) cases of an association of the segmental aplasia ICA and VA	
Reasons of discovery*			
R1		Unspecified	
Selected pathology*			
P1	Aneurysms	13.33% or 8/60 (known) cases	20% or 6/30 (known) cases
	----- Aneurysmatic VA (or other VBS branches), or ICA (branches)	8 cases (VA (1), left posterior cerebral artery (1), BA (6))	2 cases (ICA (1), PPHA (1))
P2	Additional specific disorders of the VA or ICA	2 cases (VA dissection (1), VA stenosis (1))	9 cases (ICA stenosis)
No explored pathology*			
N1	Σ (un)known cases	28 (10+18 cases)	15 (1+14 cases)

*Summarized data from all cited articles (1–10)

**Data according to the contents in the corresponding review (1 and 2, respectively)

***Data according to the new discovered cases (3–10)

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