Collateral Circulation via the Ascending Pharyngeal Artery Arising from the Internal Carotid Artery

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AJNR Am J Neuroradiol 2006, 27 (2) 246
http://www.ajnr.org/content/27/2/246.2

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I read with interest the article by Chan et al.[1] They stated that there was a rare *congenital* anastomosis between the vertebral artery (VA) and internal carotid artery (ICA) with an absence of communication between the common carotid and cervical ICA. I, however, diagnose that there was an *acquired* occlusion of the ICA at its origin with a development of collateral circulation from the VA to the ICA via the ascending pharyngeal artery.

I am very interested in the diagnosis of the cerebral arterial variations.[2] It is well known that the ascending pharyngeal artery sometimes arises from the proximal ICA.[3] In the patient reported by Chan et al, the ascending pharyngeal artery was well visualized, but opacification of the ICA was faint and delayed. This suggests that there was not a direct anastomosis between the VA and ICA.

In patients with congenital absence of the ICA, the common carotid artery and the proximal external carotid artery are usually the same size. In the patient reported by Chan et al, the common carotid artery was definitely larger than the proximal external carotid artery. This fact suggests that there was an acquired occlusion of the ICA at its origin.

References

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3. Teal JS, Rumbaugh CL, Segall HD, et al. **Anomalous branches of the internal carotid artery.** *Radiology* 1973;106:567–73

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Reply:

We thank Dr Akira Uchino for his interest in our report and his thoughtful and reasoned letter. We have again examined our imaging findings and concluded that Dr Uchino's observations are probably correct:

1. Complete occlusion of the internal carotid artery at its origin. The location of internal carotid artery origin matches well with the site of common carotid artery on angiography.

2. There is no direct communication between vertebral artery and internal carotid artery. These vessels are connected by small collaterals, which likely arise from the ascending pharyngeal artery. This is in keeping with the slow flow in the internal carotid artery.

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Segmental Agenesis of the Internal Carotid Artery Distal to the Posterior Communicating Artery Leading to the Definition of a New Embryologic Segment

We read with interest Gailloud et al's "Segmental Agenesis of the Internal Carotid Artery Distal to the Posterior Communicating Artery Leading to the Definition of a New Embryologic Segment."[1] In the article, the authors describe a case of segmental agenesis of the internal carotid artery (ICA) distal to the origin of the posterior communicating artery (PcomA) that was well documented by angiography and surgical inspection secondary to an associated anterior cerebral artery aneurysm.

The ICA is constituted by a number of successive embryologically distinct segments, each of them located between embryonic arteries or their remnants. Each of these segments can be absent, representing as a focal agenesis. In the ICA developmental anatomy proposed by Lasjaunias and Santoyo-Vazquez,[2] the ICA ends with the bifurcation into a rostral branch (from which in adult life the ICA distal to the PcomA, the anterior choroidal [AchoA], the anterior cerebral [ACA], and the middle cerebral artery [MCA] are derived) and a caudal branch from which the PcomA, parts of the basilar artery (BA), and the posterior cerebral artery (PCA) are derived in later life. This concept is challenged by the authors taking their case of a segmental agenesis of the ICA distal to the PComA into account. They regard the caudal division of the ICA no longer as a terminal branch of the ICA but instead argue that the PcomA is simply another embryonic vessel bridging the anterior and posterior circulation, being the most cranial of the carotid-basilar anastomoses. From this perspective, a new segment (the eighth segment) of the ICA distal to the PComA has to be defined that ends with the bifurcation into MCA and ACA.

We, on the other hand, argue that the ICA terminates with the bifurcation into a caudal and rostral branch and that, therefore, no eighth segment of the ICA can be present as such. What, on first sight seems to be just a problem of nomenclature (ie, why can't we simply call the "rostral branch of the ICA" the "eighth segment of the ICA") is, when phylogeny and embryology are taken into account, a misnomer that creates a misunderstanding.

The MCA is a recent phylogenetic acquisition and must be considered as a collateral branch of the ACA.[3] The ACA and AchoA are phylogenetically old vessels, forerunners of which are present in fish. The MCA appears as late as in reptiles, though not as a single trunk but instead as a series of small anastomosed vessels arising from the olfactory artery as the forerunner of the ACA. It continues to evolve in mammals and primates to finally become the single stem that we know. In most species, the caudal branch supplies the posterior fossa.

When considering the embryology of the human ICA development, further contradictions against the hypothesis that the ICA ends with the bifurcation into MCA and ACA can be found. The embryonic period is characterized by the shaping of the rostral extremity of the neural tube and, with it, the simultaneous shaping of the arterial tree. At the end of the fifth week (the prechoroidal stage), the ICA ends with a rostral and a caudal division. The caudal branch reaches the cephalic end of the ipsilateral ventral neural artery to constitute the PcomA, the so-called P1 segment and the upper half of the BA. This leads to a regression of pre-existing transient carotid-basilar anastomoses—ie, the trigeminal and hypoglossal arteries.[4] The caudal division, therefore, supplies the diencephalon, the mes-, and metencephalon. The rostral division, on the other hand, may be called the telencephalic branch. It subdivides further into the ACA and AchoA that both encircle the neck of the telencephalic vessel and anastomose with each other to form a ring. Lateral branches of the AchoA will later become the telencephalic portion of the PCA (ie, the so-called P2, P3, and P4 segments). Similarly, lateral branches of the pericerebral network of the hemispheres supplied by the ACA will become, at the end of the choroidal stage (ie, during the seventh and eighth week) the future MCA. Because the MCA, therefore, has to be regarded from a morphogenetic point of view as a branch of the ACA, there cannot be a bifurcation of the ICA into MCA and ACA, because, if it was a bifurcation, both vessels should appear at the same time in phylogeny and embryology.