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Case Report

Basilar vascular system supplied by only right proatlantal intersegmentary artery type 1 with aneurysm and left internal carotid occlusion: a case report and review from the literature

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ABSTRACT

Persistence of proatlantal artery (PA) is a rare condition. More than 40 cases were described in the literature. Aneurysm may involve the PA itself in approximately 2% of cases, most arising from the internal carotid artery (ICA) side of PA. This case was particular because the PA showed a saccular aneurysm on the posterior wall, probably due to atherosclerosis disease and other alterations: plaque ulcerative of ICA, occlusion of left ICA, and aberrant right VA.

Introduction

In the vascular anomalies of the skull base are included anomalies of the circle of Willis, carotid–basilar and carotid–vertebral (VA) anastomoses. Various methods of imaging are available for their detection such as computed tomography angiography, magnetic resonance angiography, and digital subtraction angiography [1,2]. Different studies reported the incidence of primitive carotid–basilar anastomoses as between 0.1% and 1%, and their findings is usually uncommon [3].These anastomoses are physiological system during the embryogenesis and the failure of their involution contribute to vascular anomalies in the adults [4]. The anastomotic channel between the carotid and VA basilar system are: trygeminal, otic, hypoglossal, intersegmentary proatlantis, and intersegmentalis cervicalis arteries [5,6]. More than 40 cases were described for the persistence of proatlantal artery (PA) [1,7].

Case report

Came to our attention, at interventional radiology of our hospital, a man of 65-year old, who had coronaries artery

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disease, vertigo, balance disorders, and a long history of transient ischemic attacks; he was already examined by color Doppler (CD) ultrasonography in another institute with a finding of left internal carotid artery (ICA) occlusion and stenosis of the contralateral ICA. When he came in our institute, we first decided to repeat the CD examination: it confirmed the occlusion of ICA and showed a VA hypoplasy on the left side, on the right side was described an atheromatous plaque of the ICA defining a stenosis of less than 50%, non-hemodynamically significant, and was detected a vascular trunk with an atheromatous plaque inside that originated from the posterior wall of the ICA with a flow similar to it. The course of this artery was not clear, and it was hypothesized to be an anomaly of the origin of the VA from the ICA (Fig. 1). For further diagnostic assessment and to exclude other vascular anomalies, the patient performed computed tomography angiography of the neck and skull base. It confirmed the atheromatous plaque of the right ICA, showing a little ulceration too, and the unusual vessel that originated anteromedially from the right ICA. This vessel had also a saccular aneurysm on the posterior wall that was not visible at CD examination (Fig. 2). Coronal and sagittal reconstruction showed that a muscular branch originated from it. The right VA was not visible. On the left side, the IC was occluded with an upward rehabitation, and the VA was hypoplastic terminating directly in the left posterior cerebellar artery. No others abnormalities of intracranial circulation were found.

For his coronary artery disease, during the coronary angiography, the patient also performed a digital subtraction angiography of the epiaortic vessels that confirmed the diagnosis of PA type 1: the anomalous vessel rising from the right internal carotid at the level of C3 (Fig. 3A) curved dorsally at the level of C1 in the occipitoatlantal space, and then, it entered the skull through the foramen magnum (Fig. 3B); here, it proceeded horizontally and dorsally until it joined the basilar system (Fig. 3C).

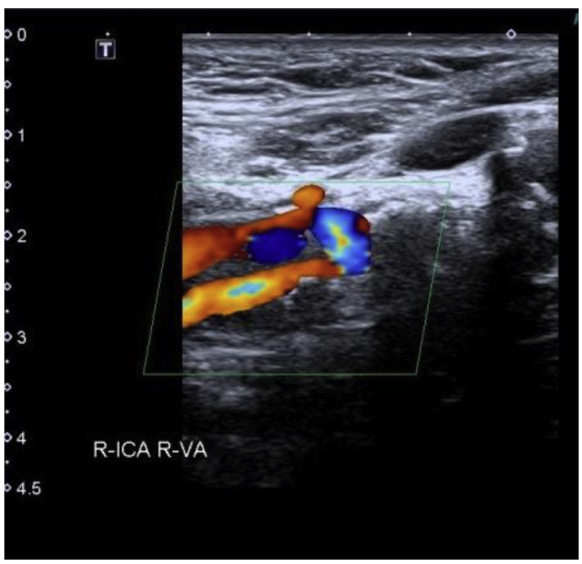

Fig. 1 – CD examination of PA that was initially hypothesized to be an anomaly of the origin of VA from the ICA.

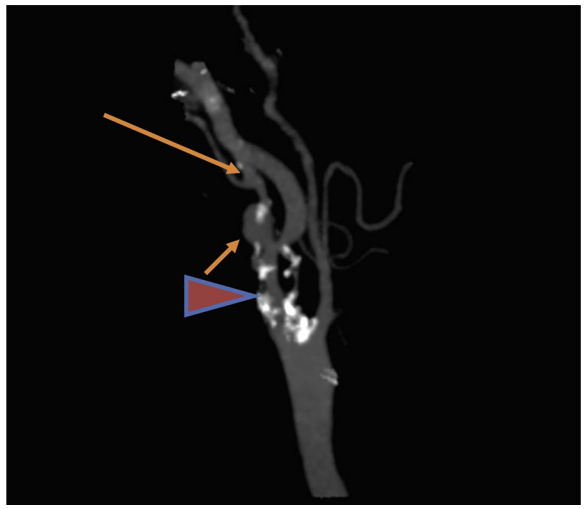

Fig. 2 – Sagittal reconstruction without contrast enhancement of computed tomography angiography of the right carotid. The fibrocalcific plaque was evident at the level of ICA (red arrowhead). The saccular aneurysm (short orange arrow) of the unusual vessel (long orange arrow) was visible on its posterior wall. Also a muscular branch originated from it.

The right endoarterectomy and the treatment of the aneurysm of the PA were hypothesized, but the patient refused it when informed about the risk.

Discussion

Embriology and PA description

The first anatomic description of PA was made by Gottshau in 1885, and the carotid basilar and VA anastomoses were authoritatively demonstrated by Congdon (1922) and Paget (1948). These anastomoses originated at the 4-mm embryo stage at development. In this stage, the ICAs extend from the paired dorsal aortae and anastomose with the longitudinal neural arteries at 3 major sites: the trigeminal ganglion, the otic vescicle, and the rootlets of the hypoglossal nerve. These longitudinal arteries are also connected to VA system by cervical intersegmental arteries, and the PA is the most caudal of these arteries. It became the dominant anastomose in the embryo at 5- to 6-mm stage (28-30 days). Two groups classification of PA are described: type I arising from the internal and type II from the external carotid artery. The PA type 1 corresponds to Paget's PA and accounts for the 57% of cases, the type II to the first cervical intersegmental artery and represents the 38% of cases. There is another variant, the most uncommon, in which the PA originates from common artery bifurcation [7]. The PA originated anteriorly and medially from the ICA at the level of C2-C4 vertebra. It ascends medially along the anterior aspect of the VA bodies up to the suboccipital area, where it curves dorsally toward the atlant, and then enters the skull through the foramen magnum. When PA is large, the VA is usually hypoplasic, and the ipsilateral may