Aneurysm of a persistent primitive olfactory artery

Case report

TAKEHISA TSUJI, M.D., MASAMITSU ABE, M.D., AND KAZUO TABUCHI, M.D.

Department of Neurosurgery, Saga Medical School, Saga, Japan

A ruptured anterior cerebral artery (ACA) aneurysm is reported in a patient in whom an anomalous ACA arose from the internal carotid artery at the bifurcation. The aberrant artery coursed anteriorly along the ipsilateral olfactory tract and made a hairpin turn posterior to the olfactory bulb, supplying the circulation of the ACA. Persistence of the primitive olfactory artery is suggested as an embryological origin of this vascular anomaly.

KEY WORDS • aneurysm • anterior cerebral artery • primitive olfactory artery • embryology

Aneurysms of the distal anterior cerebral artery (ACA) have frequently been found in association with various anomalies of this vessel, which include an azygous ACA and a connection between the two pericallosal arteries that has been called a “supreme anterior communicating artery.”4 An anomalous branch of the internal carotid artery (ICA), an interoptic course of the ACA, and carotid ACA anastomosis have also been reported in cases involving an aneurysm of the ACA. We have encountered a rare case of a ruptured aneurysm of the distal ACA associated with the anomalous course of the artery. The anomalous vessel is believed to be a persistent primitive olfactory artery. In this report we describe the clinical features of the patient and discuss the possible embryogenesis of the anomaly.

Case Report

This 59-year-old right-handed woman was referred to our hospital on April 16, 1990, 12 hours after the sudden onset of headache, nausea, and vomiting.

Examination. The patient was alert and had a mildly stiff neck, bilateral anosmia, and hyperactive deep tendon reflexes in the right lower extremity. Computerized tomography revealed subarachnoid hemorrhage in the basal cistern. Four-vessel angiography was obtained on the day of...

Fig. 1. Left internal carotid angiograms revealing an aneurysm (thick arrow), with anterior (left), lateral (center), and right anterior oblique views (right). Anomalous anterior cerebral artery (arrowheads) originating from the left internal carotid artery at the bifurcation, running anteroinferiorly and making a hairpin turn posterior to the crista galli. Note the long anterior cerebral artery (fine arrow) and the right recurrent artery of Heubner (double arrows).
admission. A saccular aneurysm was found arising from the anomalous left ACA, which originated from the left ICA at the bifurcation, ran anteroinferiorly, coursing anteromedially distal to the long anterior communicating artery (ACoA) and turning sharply posterior to the crista galli on the midline, supplying the pericallosal artery (Fig. 1). The aneurysm was found at the hairpin curve of the anomalous ACA at which the callosomarginal artery arose.

The recurrent artery of Heubner was identified on the right side but was not found on the left side. No other vascular anomalies were revealed on angiogram. Magnetic resonance (MR) imaging also demonstrated flow voids of the aneurysm and the anomalous ACA in the anterobasal interhemispheric fissure.

Operation. On April 17, a left frontotemporal craniotomy was performed. The anomalous ACA was confirmed to run medially along the left olfactory tract and to turn posterior to the olfactory bulb. The dome of the aneurysm protruded into the right frontal lobe. The left olfactory tract was sacrificed, and the aneurysmal neck located at the bifurcation of the distal ACA and the callosomarginal artery was clipped with a No. 2 Sugita clip.

Postoperative Course. The postoperative course was uneventful and follow-up angiograms revealed successful obliteration of the aneurysm. On May 30, the patient was discharged with no deficit except for left anosmia.

Discussion

This anomalous vessel is described as an anomalous ACA because it supplies the territory usually perfused by the ipsilateral ACA. The characteristics of the vessel include an anomalous course, an association with the long ACoA, and an absence of the recurrent artery of Heubner on the anomalous side (Fig. 2). There are three similar cases in the literature in which the anomalous course of the ACA is identifiable. They were diagnosed on angiograph, and one of them was confirmed during surgery for the associated aneurysm. One report shows the anomaly bilaterally. Although none of these reports demonstrates...
the long ACoA or refers to the recurrent artery of Heubner, the condition should be considered as an entity.

According to Padget, the development of the ACA in the human embryo begins as the formation of a secondary branch of the primitive olfactory artery at 5 weeks gestation, and at 6 weeks, the ACA advances and joins with its counterpart from the opposite side by plexiform anastomoses in the midline region at the future ACoA. At 7 weeks gestation, the ACA extends up between the cerebral hemispheres. The medial striate branches or recurrent artery of Heubner are formed from the primitive olfactory artery or the components of the anastomosis between this artery and its collateral anterior cerebral branch. The graphic reconstruction of sectioned human embryos with 9- to 43-mm crown–rump length (5–8 weeks estimated gestational age) is schematically summarized in Fig. 3.

In the present case, we presume that an error in the development of the left distal ACA and a persistence of the primitive olfactory artery comprise the embryological etiology. Thus, the primitive olfactory artery supplies the anterior cerebral circulation, and the long ACoA is formed as a consequence of the absence of the distal ACA (Fig. 3). The recurrent artery of Heubner, which is a remnant of the primitive olfactory artery, is absent.

The clinical significance of this anomaly is unclear. Two of the four reported cases (including ours) are associated with aneurysms of the distal ACA. This represents too few samples to differentiate between a real and coincidental association. However, the aneurysms might be caused by the alterations of hemodynamics, because they are located at the point of greatest angulation of the anomalous ACA.

References


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