Basilar-middle meningeal artery anastomoses associated with a cerebral aneurysm

Case report

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Unique radiographic and autopsy findings are described in a patient with bilateral basilar artery-middle meningeal artery (BA-MMA) anastomoses associated with a ruptured aneurysm of the anterior communicating artery. The literature, anatomy, and embryology of BA-MMA anastomosis is reviewed.

KEY WORDS • basilar artery • cerebral aneurysm • carotid artery • cerebral arteries • meningeal artery • vascular anastomosis

The incidence of anatomical variations of the circle of Willis and/or persistent carotid-basilar anastomoses (primitive trigeminal and hypoglossal) is greater in patients with cerebral aneurysms than in the normal population. Vascular anomalies are more commonly associated with aneurysms of the anterior communicating artery (ACoA) complex than with aneurysms at other sites. The present report was prompted by the discovery of an aneurysm of the ACoA complex which was associated with several variations of the circle of Willis, and with previously unreported bilateral basilar artery-middle meningeal artery (BA-MMA) anastomoses.

Case Report

This 50-year-old hypertensive man was transferred to Montefiore Hospital in coma. Three days before admission he complained of headache and dizziness, and could not be aroused the following day. On admission to a local hospital, he was stuporous, and had a stiff neck and a left hemiparesis. The cerebrospinal fluid (CSF) was bloody.

Examination. Computerized tomography (CT) showed ventriculomegaly and a hematoma in the region of the ACoA extending into the right frontal lobe and tracking into the ventricular system.

Angiography via femoral catheterization on the 4th hospital day demonstrated a large aneurysm of the ACoA complex filling only from the left carotid artery. The right \( A_1 \) segment of the anterior cerebral artery was hypoplastic, and both \( A_2 \) segments were separated in the interhemispheric fissure. Segmental arterial vasospasm was present. There was early bifurcation of the right middle cerebral artery and hypoplasia of the right posterior communicating artery and right posterior cerebral artery. Two prominent branches of the basilar artery arose between the superior cerebellar (SCA) and anterior inferior cerebellar arteries, approximately 9 mm proximal to the former. Both vessels followed a similar pattern. They passed laterally and inferiorly, and reached the lateral aspect of their respective trigeminal ganglia, at which point the vessels increased in caliber and coursed forward along the floor of the middle cranial fossae. The vessels continued upward and laterally, following the greater sphenoid wing, and finally assumed the normal position of branches of the meningeal arteries (Fig. 1). The common carotid injections failed to opacify the MMA or its distal branches on either side. The remainder of the external carotid circulation was normal.

On the 8th hospital day, CT showed further enlargement of the ventricular system and partial resolution
of the right frontal hematoma. Serial spinal taps showed persistently elevated CSF pressure and gradual clearing of blood products.

**Operation.** Left craniotomy and clipping of the ACoA aneurysm was performed on the 18th hospital day. The patient awoke promptly after surgery, but his condition deteriorated suddenly 24 hours later. There was no evidence of recurrent bleeding on CT scanning. He died on the 2nd postoperative day.

**Postmortem Examination.** A complete autopsy was performed. Unfortunately, the bilateral BA-MMA anastomoses were not recognized at autopsy and were interrupted, leaving a 2-cm stump on the right and a 2.5-cm stump on the left. Both vessels took origin from the basilar artery at right angles, 9 mm proximal to the SCA. The caliber of these segments was constant (Fig. 2). Examination of the circle of Willis confirmed the angiographic findings (Fig. 3). There was hypoplasia of the proximal segment of the right anterior cerebral artery, the right posterior communicating artery, and the right posterior cerebral artery. There was early bifurcation of the right middle cerebral artery. The aneurysm of the ACoA was clipped.

**Discussion**

The incidence of variations of the circle of Willis in association with aneurysms has been reported to vary
Basilar-middle meningeal artery anastomoses

Fig. 2. Base of fixed brain. The anastomotic vessels (curved arrows) originate from the basilar artery between the superior cerebellar arteries (open arrows) and anterior inferior cerebellar arteries (closed arrows).

from 33% to 79%. Aneurysms have also been reported in association with the more common carotid-basilar anastomoses: persistent trigeminal and hypoglossal arteries.

The angiographic appearance of unilateral BA-MMA anastomosis has been described in five patients. The anomalous anastomotic vessel always originated from the basilar artery several millimeters proximal to the SCA. Altmann described an abnormal vessel in a 7-month-old fetus, termed the "acoustico-facial artery," which arose from the basilar artery between the anterior and posterior inferior cerebellar arteries. A branch of the acoustico-facial artery passed through the superior wall of the internal auditory canal and continued in the normal distribution of the MMA.

The association of BA-MMA anastomosis with a cerebral aneurysm has not been reported previously. Djindjian and Merland reported a dural arteriovenous malformation in association with BA-MMA anastomosis.

The development of BA-MMA anastomosis was discussed by Seeger and Hemmer. They thought that either an anastomosis developed between a prominent lateral pontine branch, such as the trigeminal artery of Stephens and Stilwell, and trigeminal branches from the MMA, or the primitive trigeminal artery anastomosed with the MMA. The more common anomalous origins of the MMA are the ophthalmic artery via a lacrimal branch and the petrosal portion of the internal carotid artery via a persistent stapedial artery.

The ipsilateral foramen spinosum was absent radiographically in one of Seeger and Hemmer's cases and in the autopsy study by Altmann. The appearance of the foramina spinosa in the current case was not noted. Certainly an absent foramen spinosum suggests the absence of a normal MMA. Opacification of the MMA during angiography via an anomalous connection does not imply that the MMA will fail to opacify via a common carotid or selective external carotid artery study.

References


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