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Accessory Middle Cerebral Artery as a Source of Collateral Blood Flow

The accessory middle cerebral artery arises from the anterior cerebral artery and parallels the middle cerebral artery. The reported prevalence in autopsy and angiographic series has varied from 0.329% to 4%. We report an accessory middle cerebral artery and its effectiveness as a collateral vessel of the middle cerebral artery.

Case Report

A previously healthy 15-month-old girl became pale and lethargic. CT showed subarachnoid hemorrhage. Cerebral angiography showed a 5-mm aneurysm in the M1 segment of the left middle cerebral artery (Fig. 1A). The anterior cerebral artery was not visualized on the left carotid artery angiogram. Both anterior cerebral arteries filled from the right carotid injection. An additional vessel originated near the anterior communicating artery and extended into the left sylvian cistern (Fig. 1B). Intraoperatively, one of the lenticulostriate arteries was detected arising from the aneurysm. The aneurysm was clipped. No intraoperative complications were reported. Postoperatively the patient was neurologically intact. CT performed the day after surgery showed a small lentiform nucleus infarction. An angiogram performed 6 days after surgery showed a clip at the site of the aneurysm. The left middle cerebral artery did not fill from the left carotid artery injection (Fig. 1C). Delayed filling of peripheral middle cerebral artery branches through posterior cerebral artery collaterals was seen. Injection of the right carotid artery showed increased opacification of the left insular vessels via the accessory left middle cerebral artery (Fig. 1D). One month after discharge, the patient was examined again. She was doing well clinically.

Discussion

Additional vessels paralleling the middle cerebral artery can arise from the internal carotid artery or the anterior cerebral artery. In an autopsy series of 347 cases, Crompton [1] described 10 cases (2.9%) in which the additional vessel originated from the internal carotid

artery and one case (0.29%) in which it originated from the anterior cerebral artery. Jain's [2] series of 300 autopsies reversed the relative prevalence of origin. Eight vessels originated from the anterior cerebral artery, and two originated from the internal carotid artery. These vessels supplied the lateral part of the orbital surface of the frontal lobe. Jain noted abundant anastomoses on the cortical surface between branches of these vessels and the middle cerebral arteries. He postulated that these vessels could serve as a source of collateral blood supply to the middle cerebral artery territory. Umansky et al. [3] dissected 104 human brain hemispheres. Two accessory middle cerebral arteries were detected. Both supplied perforating branches to the anterior perforated space.

Teal et al. [4] clarified the terminology for these vessels. An accessory middle cerebral artery was defined as a vessel arising from the region of the anterior communicating artery that passes into the sylvian fissure with the middle cerebral artery. By contrast, duplication of the middle cerebral artery was defined as a vessel originating between the anterior choroidal artery and the terminal bifurcation of the internal carotid artery.

Angiographic visualization of the accessory middle cerebral artery has been reviewed by Watanabe and Togo [5] and by Takahashi et al. [6]. In the series of Watanabe et al., accessory middle cerebral arteries were detected in 0.32% of 1240 carotid angiograms. Takahashi et al. reviewed the angiograms of 200 patients and detected accessory middle cerebral arteries in 4%. Umansky et al. [3] reviewed the association between anomalies of the middle cerebral artery and intracranial aneurysms. In the literature, 24 anomalies were reported, and 35 aneurysms were described. Only six aneurysms arose at the site of the anomaly. Umansky et al. emphasized that a structural defect in the walls of anomalous vessels has not been verified by anatomic or pathologic study.

Our case offers an excellent illustration of this anomaly. The accessory middle cerebral artery filled from a right carotid artery injection only; therefore it was not obscured by a left anterior cerebral artery. The effectiveness of this vessel as a source of collateral blood flow was dramatic. After occlusion of the left middle cerebral artery,

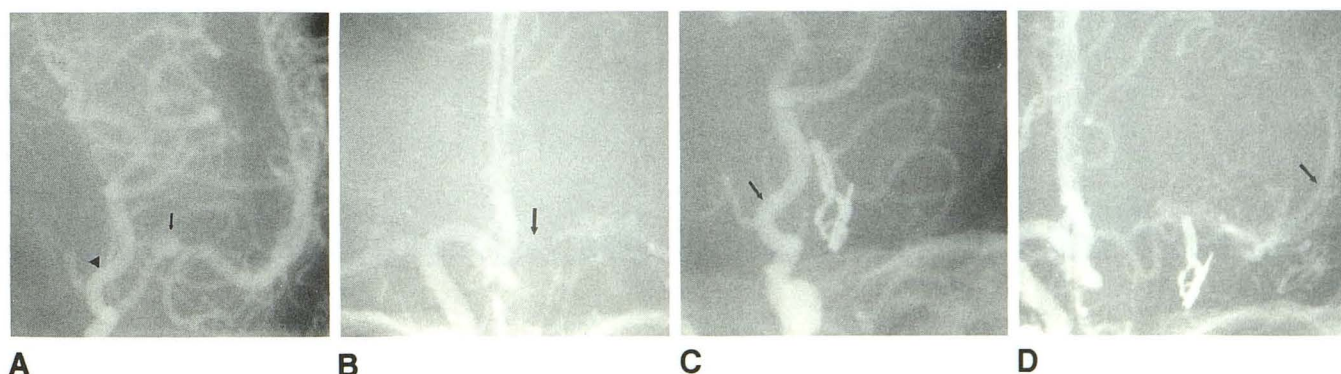


Fig. 1.—Accessory middle cerebral artery as a source of collateral blood flow.

A, Preoperative left carotid angiogram, frontal view, shows aneurysm (arrow) of left middle cerebral artery and fetal origin of left posterior cerebral artery (arrowhead). Anterior cerebral artery is not visualized.

B, Preoperative right carotid angiogram, frontal view, shows filling of left accessory middle cerebral artery (arrow).

C, Postoperative left carotid angiogram, frontal view, shows opacification of posterior cerebral artery (arrow) and lack of opacification of anterior or middle cerebral arteries.

D, Postoperative right carotid angiogram, frontal view, shows increased opacification of left insular branches (arrow) via accessory middle cerebral artery.

the accessory middle cerebral artery became the sole vascular supply to the lenticulostriate arteries. The accessory middle cerebral artery assisted by posterior cerebral artery collaterals supplied the remainder of the left middle cerebral artery distribution. Despite this change in vascular flow pattern, the patient did not have a clinical deficit.

The presence of a ruptured aneurysm in a 15-month-old child is unusual and would support the possibility of underlying vascular abnormalities in persons with anomalies of the middle cerebral artery. We agree, however, with Umansky et al. [3] that further studies are necessary to verify the relationship between these anomalies and saccular intracranial aneurysms.

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