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A Case of Anomalous Origin of the Middle Cerebral Artery

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A 54-year-old Asian female presented to hospital with gradual onset headache, binocular diplopia, and chest tightness. Her medical history included hypertension, hyperlipidemia, and previous hepatitis B. CT and MRI angiography of the head and neck identified a right M1 branch of the middle cerebral artery (MCA) occlusion with numerous collaterals concerning for moyamoya disease given her ethnicity (Figure 1). She was referred to the neurovascular surgery service and prescribed daily aspirin. Her diplopia self-resolved within 7 days and was attributed to a partial fourth nerve palsy. Digital subtraction angiography (DSA) found no occlusion of the right MCA but identified its origin arising from the anterior cerebral artery (ACA) (Figure 2). There was additionally no evidence of moyamoya disease or moyamoya syndrome.

The MCA is one of the most complex cerebral arteries arising from the internal carotid artery (ICA), supplying the lateral cortical surfaces of the brain including eloquent areas (e.g., primary motor and somatosensory cortices) and nearly all of the basal ganglia. Around day 28 of prenatal development, the ICA divides into a caudal and cranial branch where the ACA is considered a direct continuation of the cranial branch. By day 39-41, the MCA becomes a prominent stem with plexiform arteries that supply the striatum.[1] Interruption during the fusion

and regression of these plexiform arterial twigs may result in anomalies including an accessory MCA, duplicated MCA, duplicated origin of the MCA, and fenestration.[2-7]

The incidence of an accessory MCA is between 0.3-4%.[8] It was first described in 1962 by Crompton[2] as a vessel passing into the Sylvian fissure with the MCA, and later refined by Teal et al. (1973)[3] as an MCA origin arising from the ACA often near the anterior communicating artery. Theories regarding its development have been limited. One theory postulates that this anomaly represents a hypertrophied recurrent artery of Heubner[9] (RAC) that normally originates at the A1-A2 junction of the ACA. This theory was disputed by Teal et al.[3] who demonstrated the presence of the RAC in conjunction with the accessory MCA and suggested that the accessory MCA courses lateral to the RAC and sends cortical branches to areas normally supplied by the MCA.

We present a case of an anomalous origin of the MCA from the ACA, without associated accessory or duplicated MCA. To our knowledge, only one other case has been reported.[10] In our case, there is evidence of a "stump" off the terminal ICA (Figure 2). Matanov et al. (2022)[10] similarly identified presence of this "stump"; thus it is possible this represents a remnant of the traditional origin of the MCA off the ICA that did not normally develop versus a terminal ICA aneurysm. Understanding the anatomical variants of the MCA is critical to perform safe and successful endovascular procedures, including endovascular thrombectomy for acute ischemic stroke. In the present case, the "stump" requires longitudinal follow-up and if an aneurysm develops in the right MCA territory, treatment should be considered given the complexity and tortuosity of the anomalous origin of the MCA.

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Competing interests

The authors do not have any conflicts of interest to disclose.

Statement of authorship

AMK performed a literature review and drafted the manuscript. GD, CAE, CMH, and LDC contributed to the writing of the manuscript. All authors contributed to the care of the patient.

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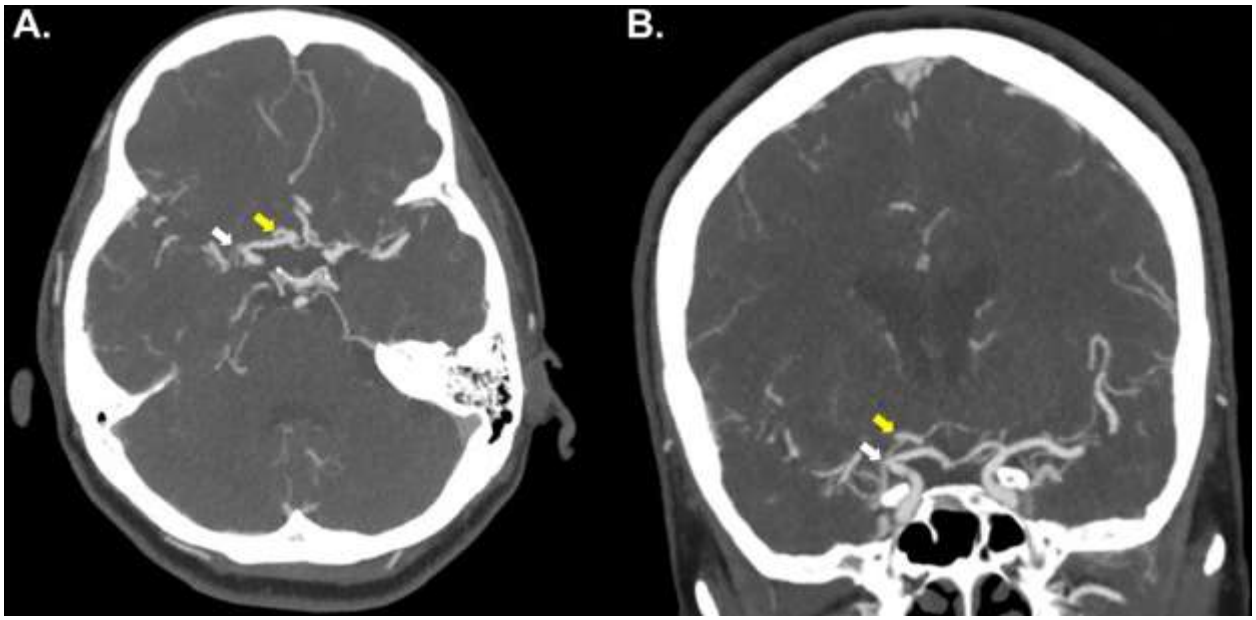

Figure 1. CT angiography of the reported right M1-MCA occlusion and an artery originating from the right ACA. Axial (A) and coronal (B) slices are depicted. The white arrow demonstrates the reported MCA occlusion and the yellow arrow demonstrates the additional vessel off the right ACA.

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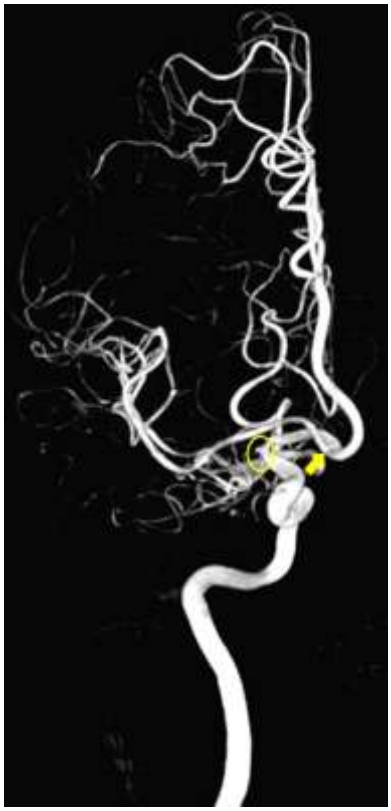

Figure 2. Digital subtraction angiography (DSA) with 3D reconstruction from contrast injection into the right ICA, anterior-posterior view. The yellow circle encompasses the "stump" off the terminal right ICA. The yellow arrow identifies the origin of the right M1-MCA off the right ACA.

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