



## Image Report

# Unruptured aneurysm at bifurcation of super short middle cerebral artery mimicking duplicated middle cerebral artery aneurysm

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## ABSTRACT

**Background:** Duplicated middle cerebral artery (DMCA) is a normal variation of the middle cerebral artery (MCA), and distinguishing DMCA from other arteries based only on the angiographical findings is sometimes difficult.

**Case Description:** Preoperative angiography of a 60-year-old woman revealed two MCAs originating near the top of the right internal carotid artery and a 6-mm-sized aneurysm located between these two MCAs. The ipsilateral A1 segment of the anterior cerebral artery was not visualized due to hypoplasia. The patient was diagnosed with an unruptured aneurysm at the bifurcation between MCA and DMCA, preoperatively. However, during clipping surgery, the hypoplastic A1 segment was observed at approximately 2 mm proximal to the bifurcation of the MCA, indicating that these two MCAs were not “true” MCA and DMCA, but rather two normal MCA trunks bifurcated from the very short prebifurcation segment of M1. This difference in interpretation was due to the fact that the hypoplastic A1 was not visualized on preoperative examinations. The patient was discharged following the surgery without any neurological deficits.

**Conclusion:** The distinction between DMCA and MCA trunks from the very short prebifurcation segment of MCA might be difficult, especially when the ipsilateral A1 segment is hypoplastic. Such an M1 with a length of 2–3 mm might be named super short M1. Thus, it is necessary to confirm the anatomy during aneurysm surgery.

**Keywords:** Aneurysm, Clipping, Duplicated middle cerebral artery, Short middle cerebral artery

A 60-year-old woman diagnosed with an unruptured intracranial aneurysm was admitted to our hospital for surgery. The patient presented no neurological symptoms and had a history of hypertension and surgery for oral cancer.

Magnetic resonance angiography revealed an aneurysm located near the top of the right internal carotid artery (ICA) between two middle cerebral arteries (MCAs) [Figure 1a]. Cerebral angiography demonstrated two MCAs originating from the top of the right ICA and revealed a 6-mm-sized aneurysm located between these two MCAs [Figure 1b]. These MCAs appeared

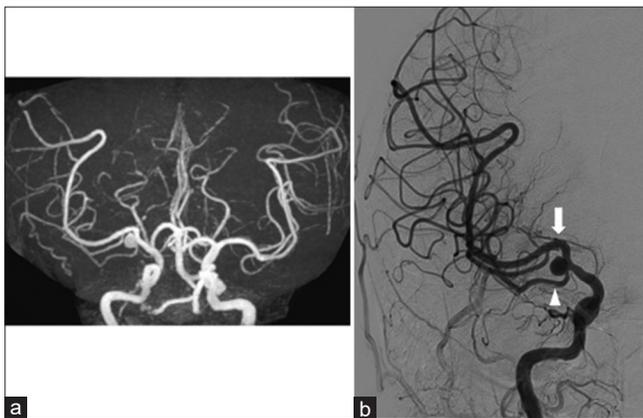
to be the “true” MCA and anomalous MCA originating from the ICA, referred to as the duplicated middle cerebral artery (DMCA). However, the exact location of the top of the right ICA was not clear in the angiography, because the ipsilateral A1 segment of the anterior cerebral artery (ACA) was not visualized due to hypoplasia. Based on these findings, the patient was diagnosed with an unruptured aneurysm at the bifurcation between the MCA and DMCA, preoperatively.

Surgical clipping of the aneurysm was performed through a transsylvian approach. The aneurysm was observed at the bifurcation of the two MCAs [Figure 2a]. After complete clipping of the aneurysm [Figure 2b], the hypoplastic A1 was observed at approximately 2 mm proximal to the bifurcation of the MCAs [Figures 2c and d]. Postoperative examinations revealed disappearance of the aneurysm and no adverse

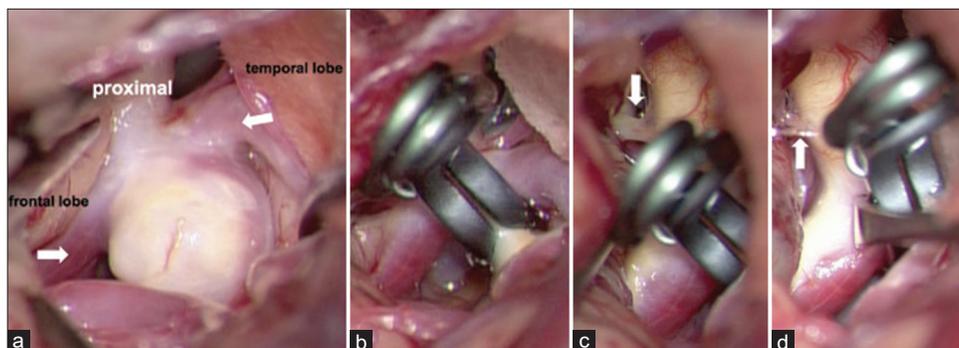
events, the patient was discharged at 8 days after the surgery with no neurological deficits.

In the present case, based on the preoperative neuroimaging findings, the aneurysm was assumed to be located at the bifurcation of MCA and DMCA. However, during the surgery, the hypoplastic A1 segment, which was not visualized by angiography, was observed at approximately 2 mm proximal to the bifurcation of the MCAs. Thus, a very short prebifurcation segment of M1 segment of MCA existed on the distal side of the site, where the ICA branched into the ACA. Such an M1 with a length of 2–3 mm might be named super short M1. Considering these anatomical findings, these two MCAs were not “true” MCA and DMCA, but rather two normal MCA trunks that bifurcated from the super short prebifurcation segment of M1. This difference in interpretation was due to the fact that the hypoplastic A1 segment was not visualized on preoperative examinations. In cases wherein the position of the “second” MCA branches at the same as or proximal to the position where the ACA branches, the “second” MCA can be referred to as DMCA [Figures 3a and b]. When it branches distal to where the ACA branches are, it means that MCA trunk originates from the prebifurcation segment of M1 [Figures 3c and d]. This is a rare case of aneurysm, in which hypoplastic A1 and super short M1 segments coexisted.

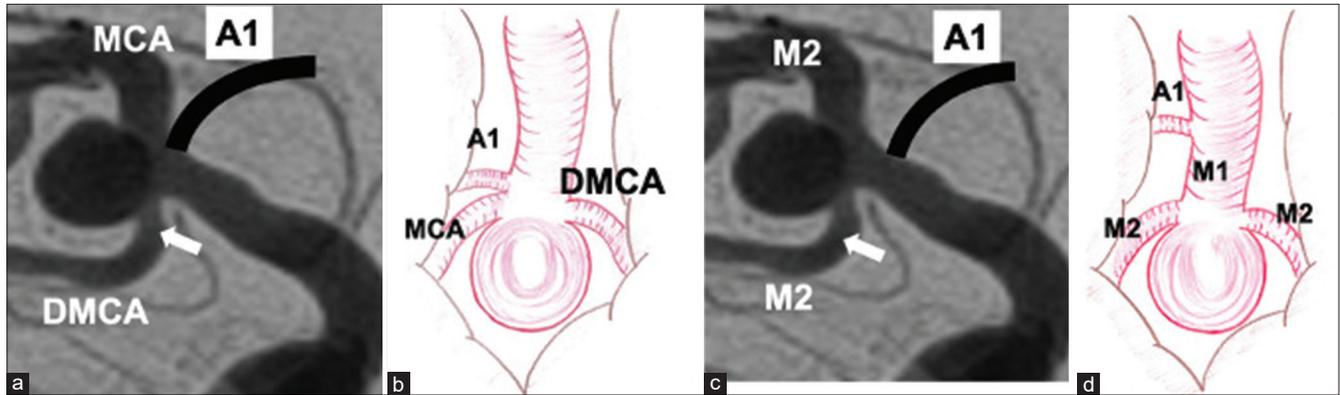
The frequency with which ipsilateral ACA is not imaged by internal carotid angiography has been reported to be 1.3%.<sup>[6]</sup> In the present case, hemodynamic stress had been directly applied to the MCA bifurcation with a short M1 segment, because the stress had not been dispersed to the A1 segment due to hypoplasia, possibly leading to the development of an aneurysm. DMCA is one of the variations of MCA observed through angiography with an incidence rate of 0.24–1.5%; it originates from the ICA between the origin of the anterior choroidal artery and the top of the ICA, passing into the Sylvian fissure.<sup>[5,8]</sup> Intracranial aneurysms associated with DMCA and their treatment have been reported previously.<sup>[1,4,7,9]</sup> Since the origin of DMCAs is close to that



**Figure 1:** (a) Magnetic resonance angiography revealing the aneurysm located near the top of the right internal carotid artery (ICA) between two middle cerebral arteries (MCAs). (b) Cerebral angiography demonstrating two MCAs originating from the top of the right ICA and revealing a 6-mm-sized aneurysm located between these two MCAs. These MCAs appeared to be the “true” MCA (arrow) and duplicated MCA (arrowhead). The ipsilateral A1 segment of the anterior cerebral artery was not visualized due to hypoplasia.



**Figure 2:** The aneurysm was located at the bifurcation of two middle cerebral arteries (MCAs) (arrows) (a). After clipping of the aneurysm (b), the hypoplastic A1 (arrow) segment of the anterior cerebral artery was observed at approximately 2 mm proximal to the bifurcation of the MCAs (c and d).



**Figure 3:** When the position of the “second” middle cerebral artery (MCA) (arrow) branches at the same as or proximal to the position where the A1 segment of the anterior cerebral artery branches, the second MCA can be called duplicated MCA (a and b). When it (arrow) branches distal to where the A1 branches, it means that the M2 trunk originates from the prebifurcation segment of M1 (c and d).

of the anterior choroidal artery, it might be occasionally difficult to distinguish them; however, given that they follow a different course after the origin, identifying them may not be difficult by careful observation.<sup>[1,2]</sup> Short M1 segments are defined as M1s with a length of  $\leq 15$  mm.<sup>[3]</sup> In the clipping surgery for aneurysms with a short M1 segment, as the MCA bifurcation is located deeper than the limen insulae, the visibility of the aneurysm neck is obstructed by the limen insulae. Therefore, wider dissection of the Sylvian fissure and avoiding clipping the perforators is required. These precautions are also common to clipping procedures for aneurysms located on top of the ICA or DMCA.

In conclusion, the present case suggests that the distinction between the DMCA and MCA trunks from the super short M1 is difficult, especially when the ipsilateral A1 is hypoplastic. Therefore, it is necessary to confirm the anatomy during aneurysm surgery.

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#### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

#### Conflicts of interest

There are no conflicts of interest.

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