

Preoperative evaluation of the origins of the perforating arteries using 7T MRI in patients with unruptured aneurysms

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INTRODUCTION:

In intravascular or microsurgical intervention for cerebral aneurysm, it is important to preoperatively understand the microanatomy surrounding the aneurysm including the origins of the perforating arteries. To assess the microanatomy, several kinds of radiological modalities are used. Digital subtraction angiography (DSA) is the gold standard for such objective. However, DSA is invasive and carries a 1-2% complication risk. Three-dimensional computed tomography angiography (3D-CTA) was usually employed to evaluate the aneurysms before surgery¹⁻³. However, 3D-CTA cannot evaluate the origins of the perforating arteries such as the hypothalamic artery, lateral striate artery, or anterior choroidal artery. In addition, DSA and 3D-CTA must need administration of contrast agents that may induce the allergic shock. The purpose of the present study was to determine whether 7-Tesla magnetic resonance image (7T MRI) can evaluate the origins of the perforating arteries in patients with unruptured aneurysms by comparing with intraoperative findings through microscope.

METHODS:

Six patients with an unruptured aneurysm were included in this study: anterior communicating artery (Acom) aneurysm in three patients, middle cerebral artery (MCA) aneurysm in two patients and internal carotid-posterior communicating artery (IC-PC) aneurysm in one patient. Before microsurgical clipping for the aneurysm, all patients underwent 3D time-of-flight spoiled gradient echo MRA (3D-TOF MRA). 3D-TOF MRA using a 7T MRI scanner (Discovery MR950, GE healthcare) with the following parameters: echo time, 3.6 ms; reception time, 13 ms; flip angle, 15°. The field of view, 120 × 120 mm; the matrix size, 512 × 384 mm; and slice thickness, 0.6 mm. Maximum intensity projection (MIP) image and volume rendering (VR) image were made from the axial source dataset of 3D-TOF MRA. First, whether these images can display relationship of the origins of the perforating arteries to the aneurysms was assessed preoperatively. Second, whether the relationship on the preoperative MRA corresponded with findings of intraoperative view through microscope was assessed postoperatively.

RESULTS:

In three (Acom aneurysm in one patient, MCA aneurysm in one patient, and IC-PC aneurysm in one patient) of 6 patients studied, relationship of the origins of the perforating arteries to the aneurysms was clearly displayed on the MRA and the relationship on the MRA corresponded with findings of intraoperative view through microscope. Figure 1 and 2 show MRA and intraoperative finding in a patient with Acom aneurysm. Figure 3 shows MRA and intraoperative finding in a patient with IC-PC aneurysm. In the remaining three patients (Acom aneurysm in two patients and MCA aneurysm in one patient), the origins of the perforating arteries were not confirmed on MRA.

DISCUSSION:

Although 7T MRI displayed relationship of the origins of the perforating arteries to the aneurysms only in half of patients with a cerebral aneurysm, the relationship on the MRA corresponded with findings of intraoperative view through microscope.

CONCLUSION:

3D-TOF MRA on 7T MR imager without administration of contrast agents can evaluate relationship of the origins of the perforating arteries to the aneurysms.

REFERENCES:

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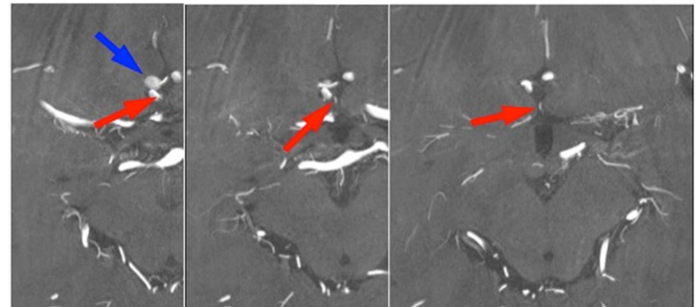


Fig. 1. 7T MRI axial image. The hypothalamic artery (red arrow) arises from the right side of the Acom aneurysm (blue arrow)

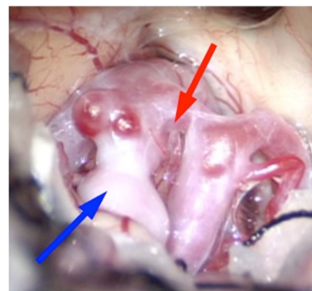


Fig. 2. Intraoperative finding through microscope. The hypothalamic artery (red arrow) arises from the right side of the Acom aneurysm (blue arrow).

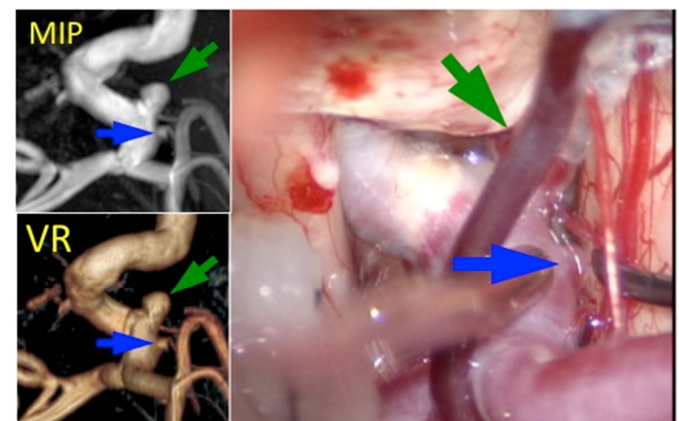


Fig. 3. Green arrow indicates IC-PC aneurysm. Left upper: 7T MRI displays dilatation of the origin of Acho A (blue arrow). Right: In intraoperative finding, the origin of Acho A is dilated.