

Case report

Progressive visual field defect caused by an unruptured middle cerebral artery aneurysm



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1. Introduction

Some cerebral aneurysms cause visual dysfunction by compressing the optic pathways, although it is an uncommon symptom. Some previous reports described visual dysfunction caused by cerebral aneurysms [1]. The aneurysms most commonly arise from the internal carotid, carotid-ophthalmic or anterior communicating artery, and the visual symptoms are caused by compression of the anterior visual pathway of optic nerves and optic chiasm. Since the posterior visual pathway including the optic tract and optic radiation also passes near the cerebral arteries anatomically, this portion could be impaired by cerebral aneurysms. A rare case of visual dysfunction caused by a posterior cerebral artery (PCA) aneurysm was reported [2]. However, there is no report of visual disturbance caused by middle cerebral artery (MCA) aneurysm.

We report a case of visual dysfunction of the right eye caused by a right MCA aneurysm.

2. Case report

A 50-year-old woman had a vague unusual feeling in the right eye and visited an ophthalmologist. No ophthalmologic abnormal-

ity was observed, and she was observed as an outpatient. Although the static visual field test (Humphrey visual fields test) showed no visual field defect initially, the patient developed visual field defect on the nasal side of the right eye one year later (Fig. 1). Magnetic resonance (MR) image and MR angiography demonstrated a right MCA aneurysm greater than 5 mm in diameter with perifocal brain edema in the right frontal lobe (Fig. 2A–D). She was referred to our department for further evaluations and treatment.

At presentation, cerebral angiography showed an unruptured aneurysm 7 mm in diameter protruding superiorly in an irregular shape with two blebs in the apex (Fig. 2E). The patient underwent neck clipping of the aneurysm to prevent rupture and deterioration of the visual field defect. Intraoperatively, the dome of the aneurysm was mostly buried in the right frontal lobe. A clip was applied to the neck of the aneurysm and the dome was detached gently from the cortex. After operation, no neurological deterioration was observed. Postoperatively, as the brain edema was reduced, visual field defect on the static visual field test improved gradually (Fig. 3A–D).

3. Discussion

Visual field disturbance is a relatively rare symptom in unruptured cerebral aneurysms. There are several reports related to the symptoms caused by cerebral aneurysms. Most of the reports described three common features: (1) the underlying cause of the symptom was aneurysm of the internal carotid artery or anterior

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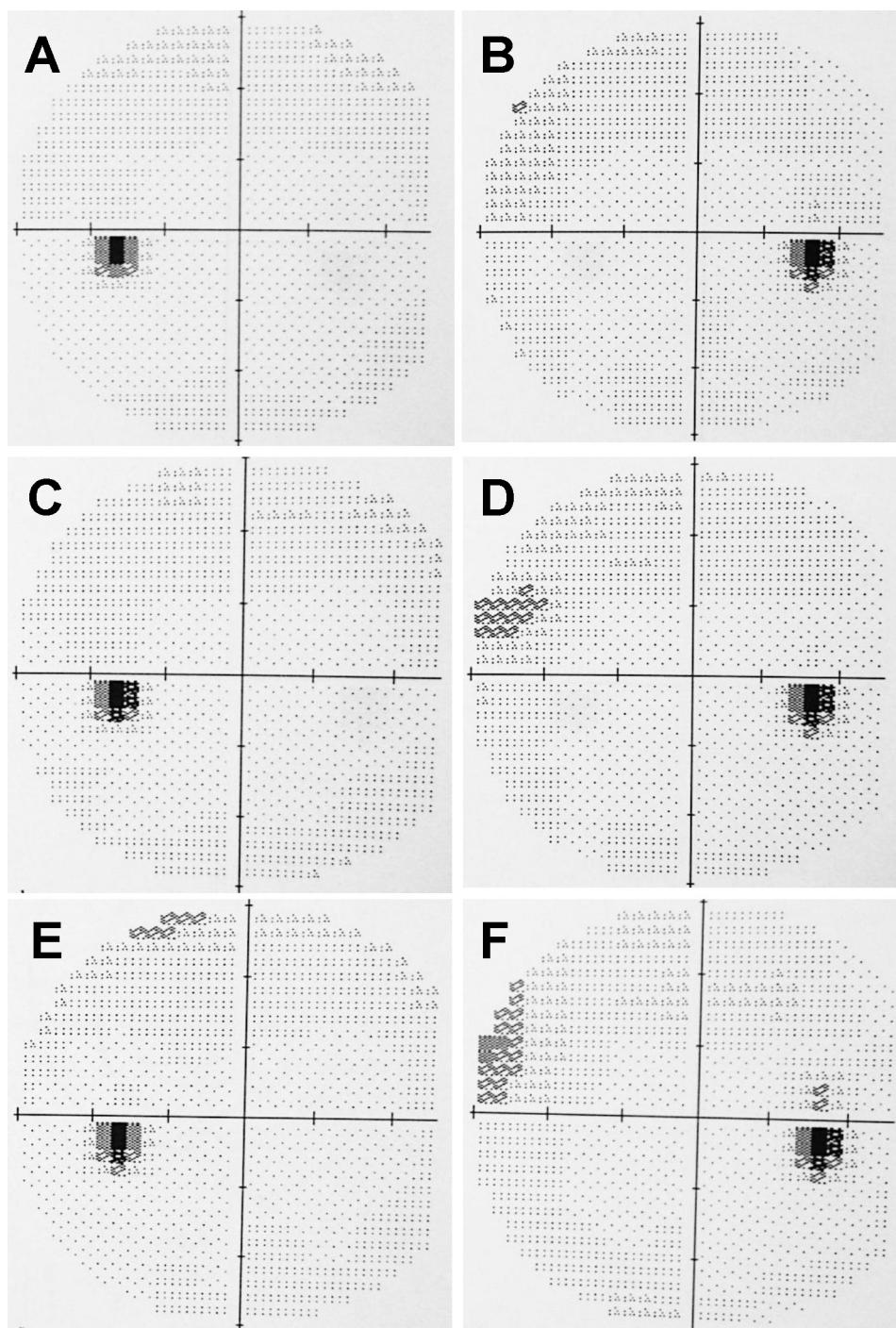


Fig. 1. Static visual field tests (Humphrey visual fields test) demonstrating progressive visual field defect on the nasal side of the right eye [A (left eye), B (right eye): 2 years before surgery; C (left eye), D (right eye): 1 year before surgery; E (left eye), F (right eye): 1 month before surgery].

communicating artery; (2) the aneurysm tended to be large or giant; (3) the symptom was due to compression of the optic nerve or optic chiasm [1].

The visual sensation is transmitted through a pathway consisting of the optic nerve, optic chiasm, optic tract, lateral geniculate nucleus and optic radiation. Because of the anatomical location of the optic nerve and optic chiasm, they are sometimes compressed by an aneurysm of the internal carotid artery or an anterior communicating artery. Theoretically, the optic tract and the optic radiation also may be compressed by a PCA aneurysm or a MCA aneurysm. The former was reported rarely and the latter had never been reported previously.

The optic radiation consists of three large fiber bundles: the anterior ventral fiber bundle, also termed Meyer's loop, the central bundle, and the dorsal bundle. The Meyer's loop runs anteriorly around the tip of the inferior horn, passes posteriorly along the lateral wall of the ventricle, and converges on the lower lip of the calcarine fissure. The dorsal bundle moves straight into a posterior direction to meet the upper part of the primary visual cortex [3]. The anatomical course of these bundles, especially the Meyer's loop, has considerable individual variations. Therefore, some radiographic studies assess the structural integrity of these fiber bundles using techniques such as diffusion tensor imaging (DTI)-based tractography for pre- and intraoperative guidance.

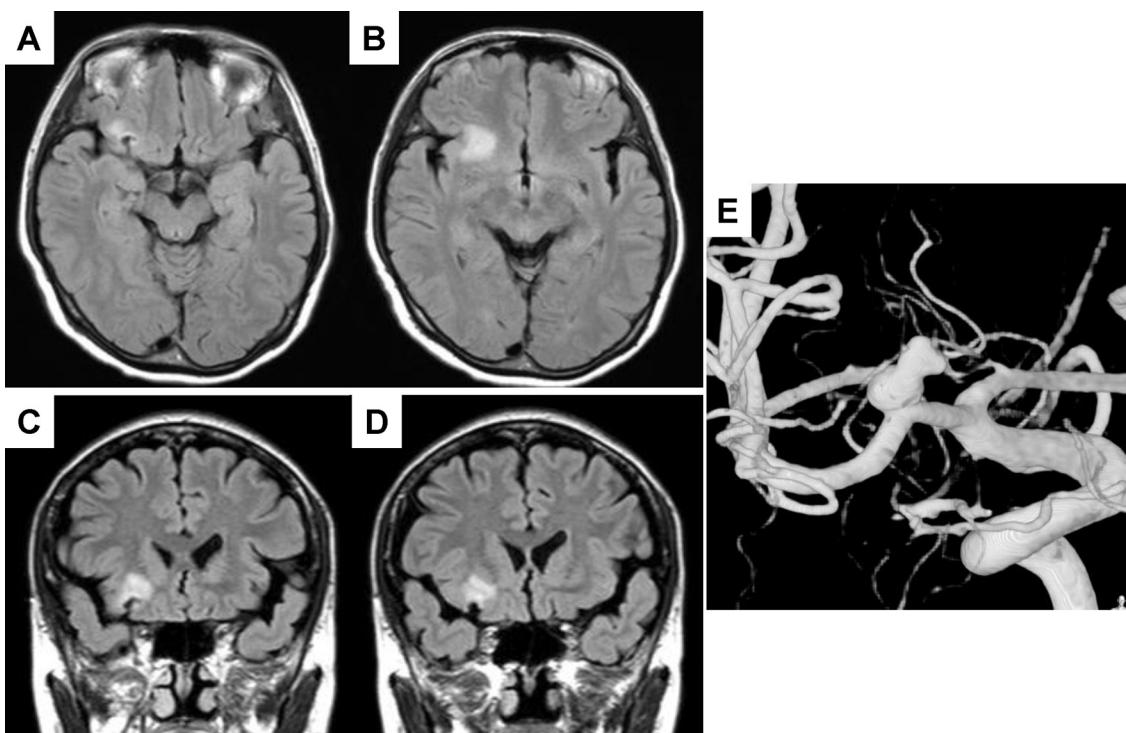


Fig. 2. Preoperative FLAIR magnetic resonance images (A and B: axial sections; C and D: coronal sections) showing a flow void in the right frontal lobe with perifocal brain edema. Preoperative three-dimensional cerebral angiography image (E) showing a middle cerebral artery aneurysm with irregular shape and two blebs in the apex.

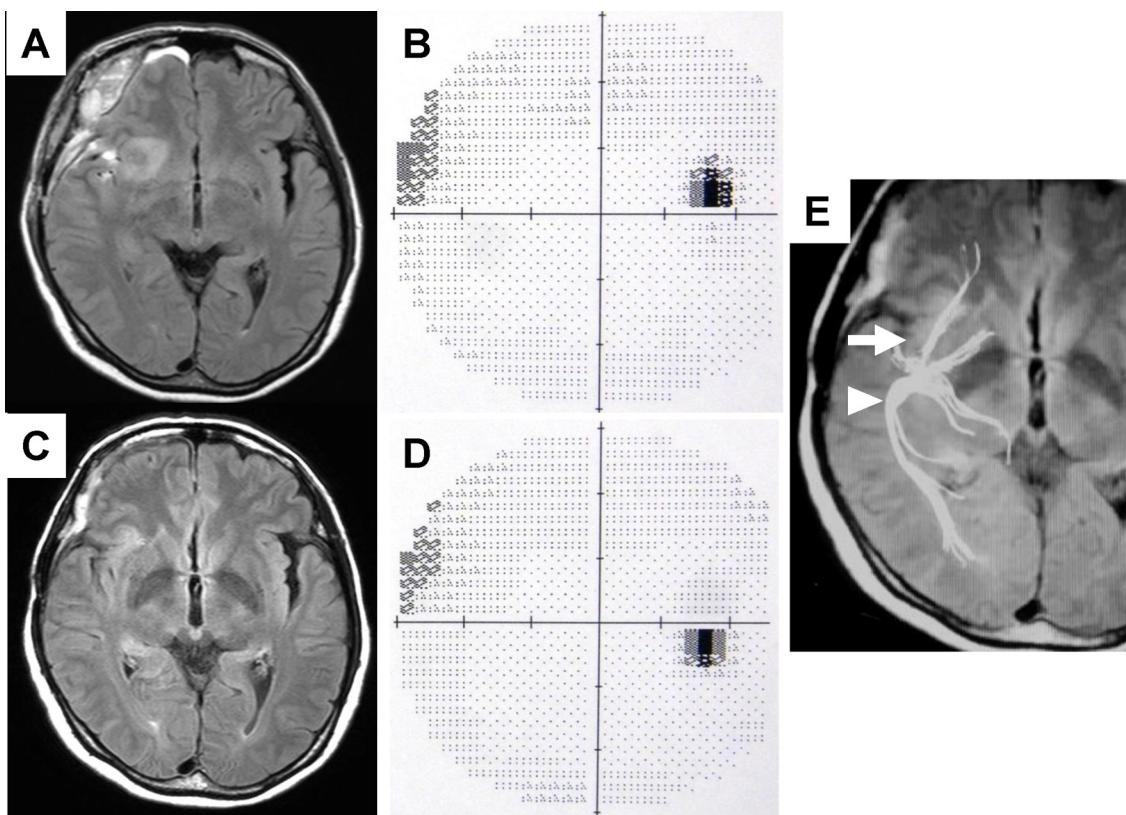


Fig. 3. Postoperative FLAIR magnetic resonance images (A and C: axial sections) and static visual field test (Humphrey visual fields test) of the right eye (B and D) demonstrating gradually improved visual field defect on the nasal side after operation accompanied with diminished perifocal brain edema around the aneurysm (A and B: 1 week after surgery; C and D: 3 months after surgery). E: Postoperative diffusion tensor imaging-based tractography of the Meyer's loop (arrow head) 3 months after surgery demonstrating the spatial relationship between the Meyer's loop and diminished perifocal brain edema (arrow).

However, because DTI-based tractography is still a relatively new technology, standard parameters for the optic radiation are not yet available [3]. This fact may impair the reliability of the studies. In our patient, DTI-based tractography was performed postoperatively and the fibers of the optic radiation did not overlap completely with perifocal brain edema around the MCA aneurysm, which was diminished gradually after surgery, although the fibers and brain edema were in close proximity (Fig. 3E). It is possible that some portions of the fibers of the optic radiation were involved in brain edema despite no complete overlap on the images, or that tractography demonstrated the fibers unreliable. A limitation of the present study was that we did not perform DTI-based tractography preoperatively in the present patient.

The Meyer's loop extends over the roof of the temporal horn, passes through the temporal stem, and travels along the lateral wall of the temporal horn. In the temporal stem, the uncinate fasciculus, the inferior occipitofrontal fasciculus, the anterior commissure and the inferior thalamic fibers are also included. The Meyer's loop is located deep inside the inferior occipitofrontal fasciculus throughout much of its course [4]. Since the brain edema around the MCA aneurysm extended to near the right temporal stem in our patient, we speculate that the edema may have compressed or involved the Meyer's lobe and resulted in visual field defect. Furthermore, the area of the visual field defect was consistent with damage to the Meyer's loop.

De Oliveira et al. [5] reported that microsurgical clip placement yielded a high rate of improvement of visual dysfunction caused by compression of intracranial aneurysms. Since deterioration of visual symptoms after endovascular surgery has been reported, neck clipping is a better choice than endovascular coiling. Furthermore, Date et al. [1] reported that all cases showing improvement of

visual function were treated surgically within 3 months of the onset of symptoms. Our patient fortunately achieved visual improvement after operation despite the delay after symptom onset, but surgical procedure for the aneurysm should have been performed as soon as visual symptoms were detected.

4. Conclusion

To ensure early surgical treatment, aneurysms should be suspected as a possible cause of visual disturbance. Visual field defect may be caused by a MCA aneurysm, although visual symptoms are extremely rare. DTI-based tractography is a developing technology, and is a promising modality for demonstrating underlying pathophysiology in patients with central nervous system symptoms.

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