

Case Report

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Penetration of the Optic Nerve by an Unruptured Internal Carotid Artery-Ophthalmic Artery Aneurysm: Case Report

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Abstract

Internal Carotid Artery (ICA)-ophthalmic artery aneurysms are relatively rare aneurysms, constitute 0.3% to 1% of intracranial aneurysms and 0.9% to 6.5% of aneurysms of the ICA. Including them, large and giant aneurysms developing around the optic nerve sometimes press it and make it thin, but rarely penetrate it. There have been very few reports that they could predict the ICA-ophthalmic artery aneurysm penetrated the optic nerve with preoperative Magnetic Resonance Imaging (MRI), and it is very useful. We present a case that we could predict penetration of the optic nerve by an ICA-ophthalmic artery aneurysm before the operation, and could confirm it in the operation.

Keywords: Fenestration; Internal carotid artery-Ophthalmic artery aneurysm; Penetration; Optic nerve; Unruptured aneurysm

Clinical Presentation

The patient was a 61-year-old female with history of hypertension who presented with an episode of slight staggering. Humphrey's perimeter demonstrated partial lower visual field defect of her left eye (Figure 1), but she did not have apparent visual disturbance and subjective symptom. The rest of neurological examination results were unremarkable. Magnetic resonance angiography demonstrated an ICA aneurysm. Cerebral angiograms confirmed that the size of aneurysm was 11mm (height) × 11mm (width) with a 5.2mm neck and confirmed the aneurysm originated from just distal to the origin of the ophthalmic artery (Figure 2). Balloon occlusion test of left ICA

with xenon computed tomography demonstrated that left cerebral blood flow was only about 60% of contralateral side. MRI-Fast Imaging Employing Steady State Acquisition (FIESTA) imaging suggested that the aneurysm penetrated the left optic nerve (Figure 3), and the fusion image of 3 dimension (3D) image of cerebral angiogram and

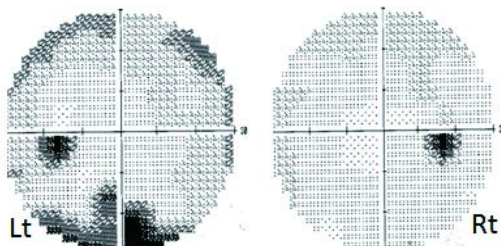


Figure 1: Humphrey's perimeter demonstrating partial lower visual field defect of the left eye.

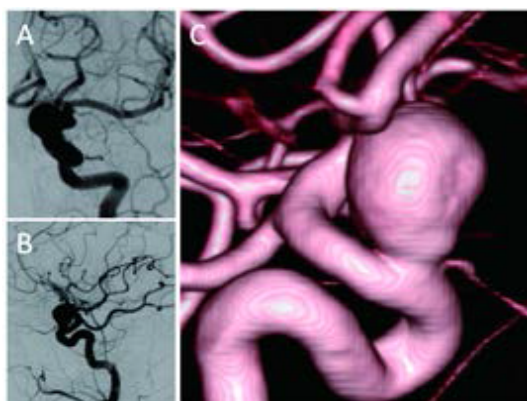


Figure 2: Cerebral angiograms, anteroposterior view (A), lateral view (B), and 3D image (C) showing the aneurysm originating just distal to the origin of the ophthalmic artery.

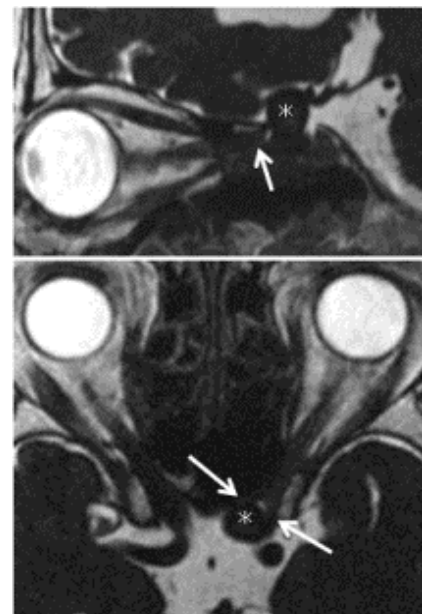


Figure 3: FIESTA-MRI image showing the aneurysm (asterisk) splitting the left optic nerve (arrow).

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MRI-Interactive Decomposition Of Water/Fat Using Echo Asymmetry And Least-Squares Estimation (IDEAL) image showed that there were fibers of optic nerve around both medial and lateral side of neck of the aneurysm (Figure 4) and suggested that the aneurysm penetrated left optic nerve. We had planned to do neck clipping, and we prepared to harvest a Radial Artery (RA) graft for high flow bypass in case we cannot do neck clipping.

We placed Visual Evoked Potential (VEP) before we started the operation. A left frontotemporal craniotomy was performed following exposure of left ICA in the neck. The dissection was continued to the left optic nerve-chiasm junction. There was the aneurysm in the bifurcation of ICA-ophthalmic artery which was projecting upward and thinning and penetrating the left optic nerve (Figure 5). We could see the neck of aneurysm from lateral side, but it attached to the nerve strongly. If we had separated the aneurysm from the optic nerve, visual disturbance might happen. And if we had done neck clipping without separating, the optic nerve would turn and visual disturbance might happen, so we changed the strategy, that is, trapping of the aneurysm with high flow bypass by the RA graft. VEP monitoring was not reliable for our technical error in this operation.



Figure 4: Fusion imaging of the 3D image of the cerebral angiogram and the MRI-IDEAL image, showing fibers of the optic nerve (arrow) around both the internal and external side of the neck of the aneurysm.

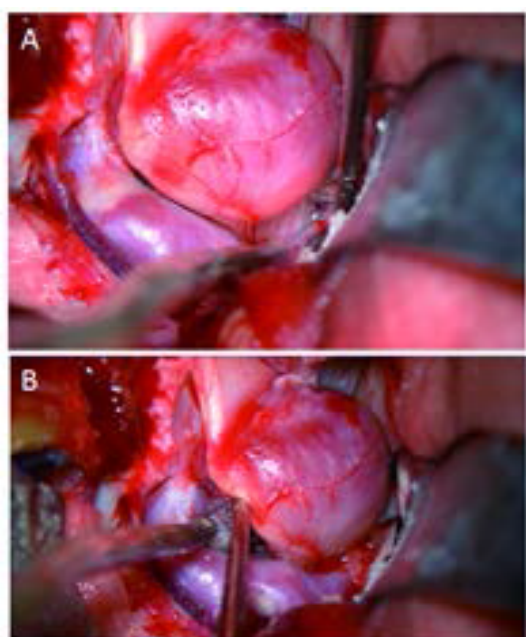


Figure 5: Intraoperative view. Upper: the aneurysm penetrating the left optic nerve. Lower: the neck of the aneurysm firmly attached to the optic nerve.

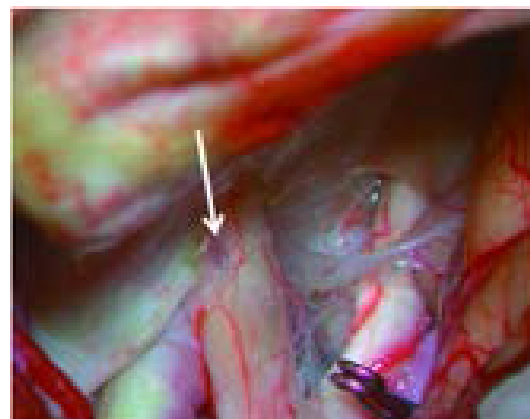


Figure 6: A different case showing splitting of the optic nerve, detected incidentally, with no arteries present.

Postoperative MRI demonstrated there was no apparent abnormal lesion, and cerebral angiogram demonstrated blood flow via bypasses was good. Her visual acuity of left eye did not get worsened.

Discussion

16 cases of penetration of the optic apparatus by an intracranial aneurysm have been reported [1-14]. 7 cases were anterior communicating artery aneurysms, 9 cases were ICA aneurysms. There have been very few reports that they could predict the aneurysm penetrated the optic nerve by preoperative imaging [2]. Jea et al. reported that MRI T1 weighted coronal image could demonstrate an anterior communicating artery aneurysm penetrated the right optic nerve and they could confirm it. In our case, MRI-FIESTA image and the fusion image of 3D image of cerebral angiogram and MRI-IDEAL image suggested that the ICA-ophthalmic artery aneurysm penetrated the left optic nerve, and therefore we could planned for the operation enough and confirm it in the operation. Incidentally, IDEAL image is the technical method of separating fat from water based the 3-point Dixon Method. We can use it by the MRI made in GE healthcare company. We made the 3 dimension image of the optic nerve by it because it can suppress fat signal more and it is affected by surrounding air less than the Chemical Shift Selective (CHESS) method or short T1 inversion recovery (STIR) method.

There are some hypotheses about mechanisms of penetration of the optic nerve by aneurysms. Beatty [3] proposed the aneurysm originated from the artery which had been penetrated the optic nerve congenitally [3]. Jea et al. [2] proposed gradually growing aneurysms enter into congenital splitting optic nerve [2]. Fujita et al. [4] proposed rapidly growing aneurysms split the optic nerve and enter into it [4]. Date et al. proposed rupturing of the aneurysm penetrated the optic nerve [5]. We have seen the splitting optic nerve in our other case incidentally (Figure 6). We thought that splitting was congenital or caused by pressure from ICA because there were not any aneurysms. In present case, we supposed that the aneurysm grew up slowly and entered into the congenital splitting optic nerve or originated from the artery which had been penetrated the optic nerve congenitally because the aneurysm was unruptured and the patient did not notice her visual disturbance, but we could not prove them.

Conclusion

We presented the rare case of ICA-ophthalmic aneurysm splitting the optic nerve. We could plan enough before the operation by a close analysis of preoperative imaging including the fusion imaging.

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