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Case Report

Salvage Surgical Treatment for Failed Endovascular Procedure of a Blood Blister-Like Aneurysm

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The blood blister-like aneurysm (BBA) of the internal carotid artery (ICA) is a rare but clinically important cause of subarachnoid hemorrhage (SAH), which accounts for 0.5% of incidences of ruptured intracranial aneurysms. BBA is a thin-walled, broad-based aneurysm that lacks an identifiable neck and is one of the most difficult lesions to treat. In this paper, a case is presented of a 57-year-old woman with SAH. Her cerebral angiography demonstrated a small BBA on the dorsal wall of her right ICA. Endovascular treatment that consisted of a stent-within-a-stent was attempted, but the replacement of the second stent failed, and the aneurysm became bigger. Surgery was performed by clipping the BBA with a Sundt slim-line encircling graft clip. The patient completely recovered with no complications. This treatment may be a salvageable option for BBA, especially when endovascular treatment has failed.

Keywords Blood-blister like aneurysm, Internal carotid artery, Subarachnoid hemorrhage, Encircling graft clip, Endovascular stent

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INTRODUCTION

Blood blister-like aneurysm (BBA) refers to an aneurysm that protrudes from the anterior wall of the internal carotid artery (ICA). It is also described as a dorsal wall, anterior wall, and superior wall aneurysm.[7)9)] BBA of the ICA is rare but is a clinically important cause of spontaneous subarachnoid hemorrhage (SAH). These lesions account for 0.5-2.0% of ruptured intracranial aneurysms and prelude unusually high morbidity and mortality rates compared with typical ruptured saccular aneurysms of the ICA.[5)6)9)12)] The optimal treatment of BBAs remains uncertain. The reported outcomes of most BBA surgical series have been poor because of the relatively high incidence of premature rupture during the dissection and post-operative rebleeding.[6)] While the use of endovascular treatment is increasing, endovascular coiling is difficult and is normally insufficient by itself to prevent the recurrence or rebleeding of BBAs.[6)9)] In this paper, a case is reported of SAH caused by a ruptured BBA and the use of an encircling graft clip with an endovascular stent when the use of an endovascular double stent has failed.

CASE REPORT

A 57-year-old woman was presented at the authors' hospital with decreased consciousness. A brain computed tomography (CT) scan revealed an SAH (Fig. 1-A). The patient's initial Hunt-Hess grade was III and her Fisher group was IV. As the CT angiogram did not definitively reveal an aneurysm(Fig. 1-B), conventional four-vessel cerebral angiography was performed. It demonstrated a 4.4 × 1.16 mm BBA dilation at the right dorsal wall of the distal internal car-

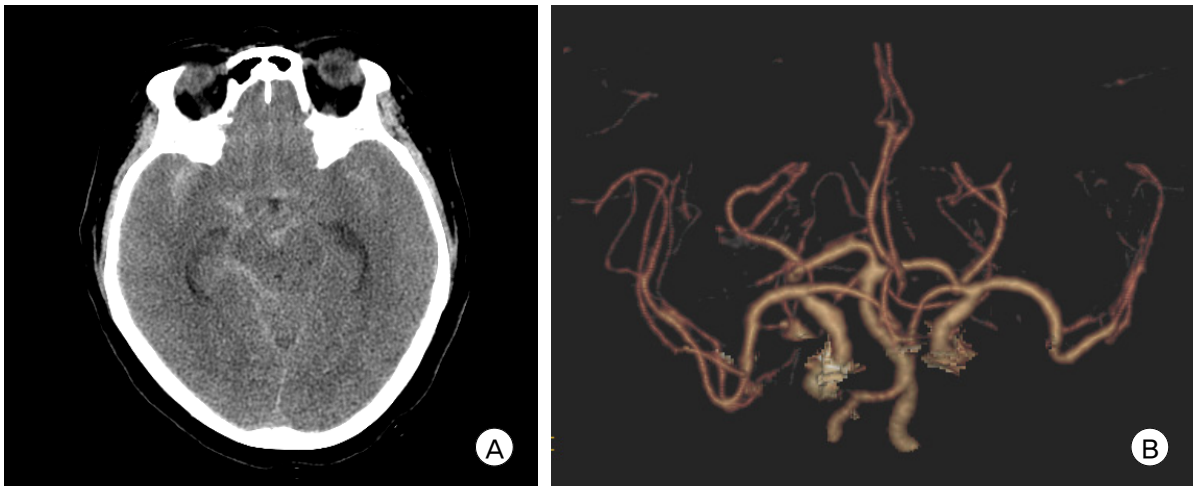

Fig. 1. On brain computed tomography (CT) scan, subarachnoid hemorrhage is detected (A). On CT angiogram, any aneurysm is not seen definitely (B).

Fig. 2. Conventional 4-vessel cerebral angiography demonstrates a blood blister-like aneurysmal dilatation at the dorsal wall of the distal internal carotid artery on right. The size is 4.4 x 1.16 mm (A). The next day, angiogram reveals thin dorsal wall aneurysm in right distal ICA which has been increased (B). Four days later, the angiogram reveals dorsal wall aneurysm in right distal ICA which has been increased again (C).

otid artery (Fig. 2-A).

The patient was scheduled to be treated using an endovascular stent-in-a-stent(a double stent). The next day, an angiogram revealed that the thin dorsal wall aneurysm in the right distal ICA had increased in size from the previous day. After the microcatheter was positioned at M1 of the right middle cerebral artery, the stent was deployed. A final angiogram revealed filling of the contrast in the dorsal wall aneurysm without signs of branch vessel occlusion (Fig. 2-B). The second stent insertion failed, though. Four days later, angiography was performed for the insertion of a secondary stent, which revealed further enlargement of the dorsal wall aneurysm in the right distal ICA(Fig. 2-C). After the stent insertion and setting of the microwire at the right distal M1 of the MCA, it was discovered that the microcatheter could not reach the right M1 because of the previous stent. Mild stent migration was noted. A final angiogram revealed filling of the contrast in the dorsal wall aneurysm, without signs of branch vessel occlusion.

At this point, the manner of further treatment should be decided. First, the option of following up the patient while retaining the first stent was ruled out since the risk of rebleeding was high because of the increasing size of the aneurysm. Second, re-insert-

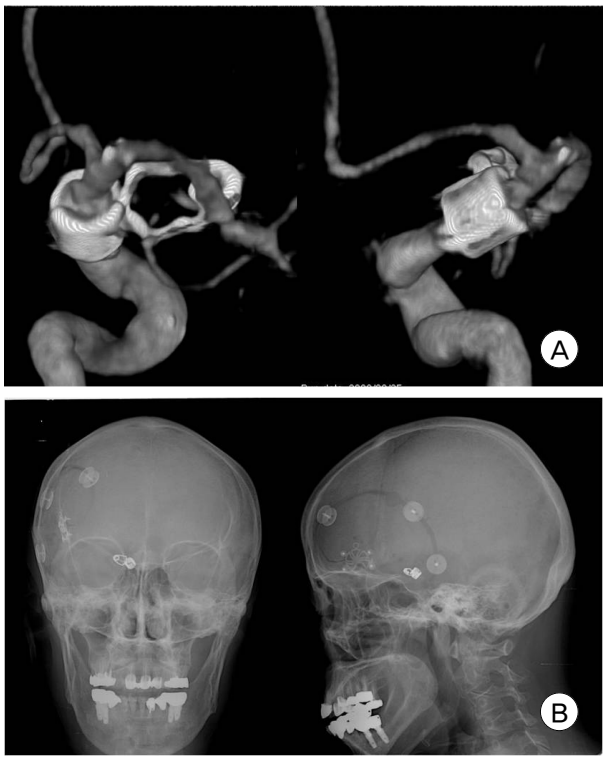

Fig. 3. After surgical treatment, follow-up angiography reveals good placement of the clip and no leakage of hemorrhage. Mild vascular stenosis developed at the junctional area of the encircling clip, however the blood flow is well preserved (A). At six month later from surgery, no migration of the clip is observed on follow-up skull X-rays (B).

ing the stent was considered inappropriate since approaching it would be difficult and the possibility of rebleeding during the procedure was high. Third, surgical procedures such as ICA trapping and direct clipping were considered. ICA trapping was excluded because the risk of rupture and infarction was high, and consequently, direct clipping was chosen.

The incision and dissection were done along medial margin of right sternocleidomastoid muscle. After common carotid artery and ICA were exposed, vessel loop was applied at ICA, because temporary clipping was impossible due to the stent. An ipsilateral pterional craniotomy was performed. Right ICA and optic nerve were exposed. After further dissection, ICA-MCA bifurcation was exposed and an aneurysm at dorsal wall of ICA was identified. Macroscopic feature of the ICA at inserted a stent was no significant anomaly. After the temporary clipping of the cervical ICA and the middle and anterior cerebral arteries, dissection of aneurysm was performed. Adhesion was severe and aneurysmal sac was ruptured during lateral to medial dissection. Over the secure a clear view using suction, the aneurysmal direct clipping was performed with a Sundt slim-line encircling graft clip(4 mm diameter, 5 mm lengths, clip no. 20-1769; Codman, Inc.).

A follow-up angiography that was performed four days later revealed good placement of the clip and no leakage of the hemorrhage. Mild vascular stenosis developed at the junctional area of the encircling clip, but the blood flow was well-preserved (Fig. 3-A). Antiplatelet agent (Aspirin 100 mg) was taken at postoperative two days after. The patient recovered well and was discharged 6 weeks later without any neurologic deficit. Six months later, she had no neurologic deficit and no migration of the aneurysmal clip on her follow-up skull X-rays (Fig. 3-B).

DISCUSSION

BBA is a rare but clinically important cause of SAH, accounting for 0.5% of ruptured intracranial aneurysms.[4] They are thin-walled, broad-based aneurysms that lack an identifiable neck and are known to be among the most difficult lesions to treat. They are fragile and can rupture during microsurgery.[1)8)] A cadaveric study showed that such lesions are focal wall defects covered with thin fibrous tissue and are thus not true aneurysms.[2)14)]

Endovascular treatment (EVT) was recently attempted for BBA.[3-5)9)] A stent-assisted coil embolization was used to treat an acute BBA because of the typical appearance of a BBA with a small hemispherical bulge.[4] Then an additional stent was inserted into the ICA using the stent-within-a-stent technique to provide additional support to the fragile aneurysm neck and to decrease the flow impingement so as to accelerate the aneurysmal thrombosis and healing. Despite this successful treatment, it is still difficult for EVT to be an optimal treatment method for BBA and further studies on it will be needed. Park

et al.[9] concluded that endovascular coiling of BBAs cannot be recommended due to the high rates of procedural rupture, aneurysmal regrowth, and rebleeding. They concluded that the endovascular ICA trapping, including the lesion segment, should be considered a first option for definitive BBA treatment if a balloon occlusion test reveals satisfactory results. Also, Meling et al.[6] concluded that internal carotid BBAs are difficult to treat endovascularly, with only two of 14 patients successfully treated with coil placement. The authors believed that the ideal treatment of an ICA aneurysm such as BBA is aneurysm repair with parent artery preservation.

There are surgical strategies available for BBA treatment. The main surgical problem in this case, however, is the extremely fragile nature of the aneurysm walls. The direct clip application could lead to avulsion of the aneurysm or to obliteration of the parent vessel. Reconstruction techniques may involve direct suture, Sundt clip application, vascular titanium clamps, and bypass procedures.[11] Parallel clipping of the ICA (including the normal arterial wall beyond the lesion) under the decreased pressure produced by the temporary clamping of the cervical ICA is recommended to prevent breakage of the transitional zone between the normal ICA and the aneurysm wall.[8] Another report described BBA repair by suturing and covering the aneurysm with an encircling aneurysm clip.[14] Another clip option is the Sundt encircling clip that was developed for direct ICA reconstruction.[10]

The Sundt Slim-line graft clip is lined with woven fabric and is produced with various diameters and lengths for ease of fit. The required clip size can be estimated from pre-operative angiographic studies. Most blister-like lesions of the carotid artery may be repaired with clips with 3-4 mm diameters and 3 or 5 mm lengths, which are applied with a straight or right-angle clip holder.[13]

A study on BBA treatment using Sundt clip alone reported that clipping was performed in combination with ICA stenosis because rebleeding or regrowth might occur if the patent arterial wall was not caught.[12] However, in this case the encircling clip is performed with the stent already inserted into the ICA, the stent could reduce clipping-induced stenosis to some extent by serving as vessel frame. In addition, it is possible that the use of an encircling clip while the stent is in the vessel could allow reinforcement both inside and outside the aneurysm. In the present case, postoperative angiography showed mild vascular stenosis at the junctional area of the encircling clip. The blood flow, however, is well preserved and the clinical outcome was good. If BBA endovascular treatment fails and a further approach is not viable, the method described in this paper could be a treatment option.

CONCLUSION

When treating BBA aneurysm using the endovascular approach, the feasibility of the approach should be fully assessed by sufficiently reviewing the preoperative angiograph prior to the procedure. If the procedure fails, a surgical procedure that initially uses an encircling clip can be considered.

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