Surgical Neurology International

OPEN ACCESS

For entire Editorial Board visit : http://www.surgicalneurologyint.com

Editor: **James I. Ausman,** MD, PhD University of California, Los Angeles, CA, USA

Case Report

Recanalization of a ruptured vertebral artery dissecting aneurysm after occlusion of the dilated segment only

Jun Tanabe, Junta Moroi, Shotaro Yoshioka, Tatsuya Ishikawa

Department of Surgical Neurology, Research Institute for Brain and Blood Vessels-AKITA, 6-10 Senshu-Kubota-Machi, Akita, Japan

E-mail: *Jun Tanabe - j.tanabe@akita-noken.jp; Junta Moroi - moroi@akita-noken.jp; Shotaro Yoshioka - shotaroh@akita-noken.jp; Tatsuya Ishikawa - teddyish@akita-noken.jp
*Corresponding Author

Received: 10 March 14 Accepted: 30 September 14 Published: 21 October 14

This article may be cited as:
Tanabe J, Moroi J, Yoshioka S, Ishikawa T. Recanalization of a ruptured vertebral artery dissecting aneurysm after occlusion of the dilated segment only. Surg Neurol Int 2014;5:150.
Available FREE in open access from: http://www.surgicalneurologyint.com/text.asp?2014/5/1/150/143362

Abstract

Background: Internal trapping in which the dissecting aneurysm is occluded represents reliable treatment to prevent rebleeding of ruptured vertebral artery (VA) dissecting aneurysms. Various methods of internal trapping are available, but which is most appropriate for preventing both recanalization of the VA and procedural complications is unclear.

Case Description: A 61-year-old male presented with subarachnoid hemorrhage caused by rupture of a left VA dissecting aneurysm. Only the dilated segment of the aneurysm was occluded by coil embolization. Sixteen days after embolization, angiography showed recanalization of the treated left VA with blood supplying the dilated segment of the aneurysm, which showed morphological change between just proximal to the coil mesh and just distal to a coil, and antegrade blood flow through this part. Pathological examination showed that the rupture site that had appeared to be the most dilated area on angiography was located just above the orifice of the entrance. However, we think that this case of ruptured aneurysm had an entrance into a pseudolumen that existed proximal to the dilated segment, with antegrade recanalization occurring through the pseudolumen with morphological change because of insufficient coil obliteration of the entrance in the first therapy.

Conclusions: This case suggests that occlusion of both the proximal and dilated segments of a VA dissecting aneurysm will prevent recanalization, by ensuring that any entrance to a pseudolumen of the aneurysm is completely closed. Careful follow-up after internal trapping is important, since antegrade recanalization via a pseudolumen may occur in the acute stage.

Key Words: Dissecting aneurysm, internal trapping, recanalization, subarachnoid hemorrhage

Access this article online

Website: www.surgicalneurologyint.com

DOI: 10.4103/2152-7806.143362

Quick Response Code:

INTRODUCTION

Vertebral artery (VA) dissecting aneurysms often cause subarachnoid hemorrhage (SAH). A high incidence of rebleeding is seen during the acute phase, particularly within 24 h from onset, and is associated with high morbidity and mortality rates.[6] Early surgical treatment has therefore been recommended.

Endovascular treatment has been widely applied to VA dissecting aneurysms, because these procedures are quicker and less invasive than direct surgery.[2,3,8,13] Proximal occlusion of the VA carries a risk of rebleeding due to the presence of retrograde flow through the contralateral VA. Internal trapping in which the dissecting aneurysm is occluded represents a reliable treatment for preventing rebleeding of ruptured VA dissecting aneurysms.[2,3,8,12,13]

Various methods are available for internal trapping, including occlusion of the dilated segment of the aneurysm and distal and proximal VA, occlusion of the dilated segment of the aneurysm and proximal VA, and occlusion of the dilated segment of the aneurysm only.[1,4,10,11,13] Which method is most appropriate for preventing recanalization of VA and procedural complications remains unclear.

We report herein a case of antegrade VA recanalization without obvious coil compaction after internal trapping for acute-phase occlusion of only a dilated segment of the aneurysm.

CASE REPORT

A 61-year-old male without any noteworthy medical history presented with sudden severe headache (World Federation of Neurosurgical Societies grade II). Computed tomography (CT) revealed SAH, which was particularly prominent in the posterior fossa (Fisher group 3). Subsequent CT angiography revealed dissecting aneurysm of the left VA arising distal to the origin of the posterior inferior cerebellar artery (PICA). Both VAs were co-dominant.

Endovascular treatment under general anesthesia was performed immediately after diagnostic angiography [Figure 1]. A 6-Fr introducer sheath was placed into the femoral artery via a percutaneous route and a 6-Fr guiding catheter (Envoy; Cordis Endovascular, Miami Lakes, FL, USA) was introduced into the left VA. A microcatheter (Neurodeo; Medico's Hirata, Osaka, Japan) was passed into the distal left VA via the aneurysm over a microguidewire (Silverspeed-10; Micro Therapeutics, Irvine, CA, USA), then navigated to the true lumen of the dilated segment of the aneurysm in an attempt to occlude the dissection site. Nine Guglielmi detachable coils (Target; Stryker, Fremont, CA, USA) were placed in the dilated segment only. The dissecting aneurysm and affected left VA were completely occluded with preservation of the left PICA. The opposite right VA adequately supplied the posterior circulation and left VA perforators arising from the left VA distal to the aneurysm with retrograde flow [Figure 2].

The patient showed good recovery from general anesthesia and his consciousness was clear. Posttreatment clinical course seemed uneventful. However, 16 days after embolization, routine follow-up magnetic resonance angiography (MRA) performed to ascertain improvement of cerebral vasospasm showed suspected recanalization of the aneurysm because of newly apparent flow in the left VA distal to the aneurysm in comparison with the examination on day 1 after the first operation [Figure 3]. Additional angiography was therefore performed. This demonstrated recanalization of the treated left VA with blood supplying the dilated segment of the aneurysm, which showed morphological changes between just proximal to the coil mesh and just distal to a coil. Antegrade blood flow into the basilar artery (BA) was seen through the region of morphological change, not through the dilated segment of aneurysm [Figure 4]. Additionally, skull radiography did not show coil compaction of framing coil in comparison with the examination at first day after first operation [Figure 5].

Further endovascular treatment was performed under local anesthesia, occluding the dilated segment of aneurysm, which showed morphological changes and

Figure 1: Anteroposterior (left) and lateral (right) left VA angiograms demonstrate a dissecting aneurysm arising from the left VA distal to the origin of the PICA

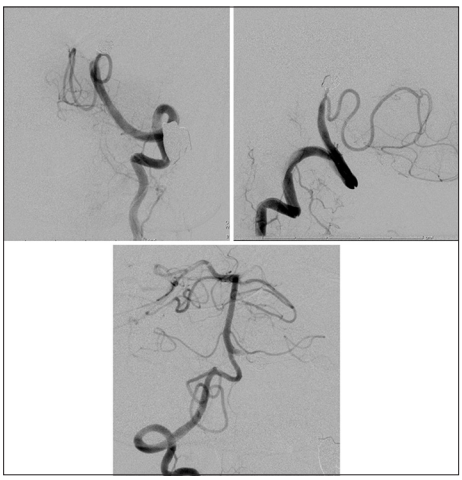

Figure 2: Anteroposterior (upper left) and lateral (upper right) left VA angiograms after coil embolization demonstrate complete obliteration of the dissecting aneurysm and affected left VA. Anteroposterior right VA angiography (lower) depicts obliteration of the aneurysm

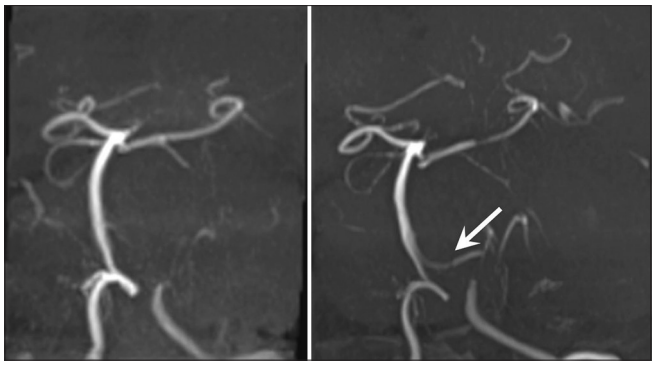

Figure 3: Follow-up MRA performed 16 days after the first operation (right) shows suspected recanalization of the aneurysm, because of newly apparent flow in the left VA distal to the aneurysm (arrows) in comparison with the examination on day 1 after the first operation (left)

the segment of the left VA proximal to the dilated segment [Figure 6]. At both 1 and 7 months after initial treatment, follow-up MRA showed no sign of recanalization of the aneurysm [Figure 7]. As of the last clinical follow-up, the patient had made a complete recovery and had returned to his previous work.

DISCUSSION

In the present case, we performed internal trapping for ruptured VA dissecting aneurysms in the acute stage. This first treatment occluded only the dilated segment of the aneurysm, followed by recanalization of the occluded VA in antegrade fashion after 16 days. Antegrade recanalization flow occurred in the lateral compartment of first coil embolization, which was accompanied by morphological change. Antegrade blood flow was provided from proximal to distal to the coil mass, not through the region of first coil embolization. Recanalization of a coil-occluded VA is a well-known endovascular phenomenon.[1,2,4,8,10,11] In particular, coil compaction due to loose packing of the lesion frequently causes recanalization.[4,10,11] However, we considered that recanalization had not been caused by coil compaction, because the framing coil remained unchanged in comparison with the first operation and antegrade blood flow to proximal to the coil mass was seen.

Sawada *et al.* first reported recanalization of VA aneurysms during follow-up (3-6 months) for two cases of ruptured VA dissecting aneurysms treated using internal trapping.[10] Several investigators have subsequently documented this type of recanalization.[1,4] They suggest that the mechanism underlying this recanalization involves occlusion of a pseudolumen in the initial procedure, allowing the compressed true lumen to reexpand and undergo recanalization by gradual healing. Because their reports demonstrated a morphologically normal arterial configuration for the recanalized route,

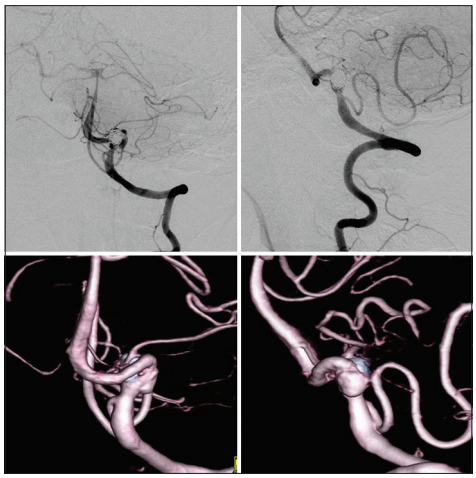

Figure 4: Anteroposterior (upper left) and lateral (upper right) left VA angiograms, and the 3-dimensional reconstruction image (lower) obtained 16 days after first operation, revealing recanalization of the treated left VA with blood supplying the dilated segment of the aneurysm showing morphological change and antegrade flow into the BA through the part where the morphology had changed, not through the dilated segment of aneurysm

recanalization by the antegrade blood stream was suggested to flow via the true lumen. In the present case, recanalization occurred only 16 days after first operation and morphology of the recanalized route transformed into aneurysmal dilatation. Accordingly, there is less possibility of recanalization via the true lumen, since this requires occlusion of the pseudolumen in the initial procedure. Furthermore, in order to place a microcatheter in the true lumen, we first navigated a microcatheter to the VA distal to the aneurysm over a microguidewire, which smoothly crossed through the aneurysm to the distal VA. We then drew back the microcatheter into the dilated segment of aneurysm. This procedure in the first therapy supports our hypothesis, but confirmation in endovascular therapy may be difficult. In our case, we think that occlusion of the true lumen was performed in the first operation and recanalizing blood flow into the pseudolumen was seen with morphological change.

On pathological examination, the majority of aneurysms show one entrance into the pseudolumen (entry-only type).[7,9] The rupture site is located just above the orifice of the entrance and corresponds to the portion of aneurysm that appears most dilated on angiography. In the present case, there was some possibility of dissected VA involving the PICA, but we occluded only the dilated segment of the aneurysm in the first operation in order to preserve the PICA and conduct prompt prevention of rerupture. If our case of aneurysm had been entry-only type, we would have succeeded in occluding the rupture site and entrance to the pseudolumen of the aneurysm without any risk of delayed recanalization. We therefore think that our case of ruptured aneurysm had both an entrance and

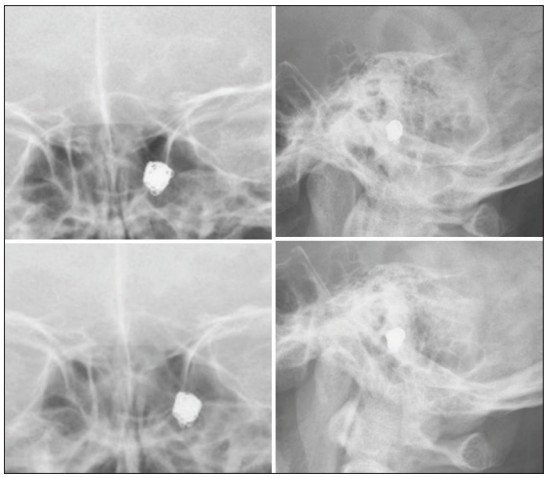

Figure 5: Skull radiography performed 16 days after the first operation (lower) shows no compaction of the framing coil in comparison with the examination on day 1 after the first operation (upper)

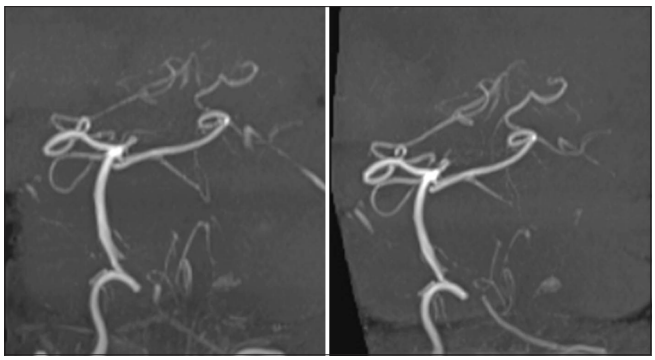

Figure 7: At 1 month (left) and 7 months (right) after initial treatment, follow-up MRA shows no sign of recanalization of the aneurysm

exit, and antegrade recanalization occurred through the pseudolumen (entry-exit) due to short-term changes in the intramural clot generated in the process of hemostasis of the initial bleeding event. We conjecture that coil obliteration of the entrance into the pseudolumen was insufficient, because blood flow to the PICA needed to be preserved in the first operation [Figure 8]. Because we suspected the above-mentioned mechanism of recanalization, our additional endovascular treatment mainly occluded the pseudolumen after a microcatheter was navigated into the pseudolumen via the entrance. We achieve good obliteration of the aneurysm and affected left VA with long-term preservation of the left PICA. Based on such findings, we consider that the entrance to the pseudolumen existed distal to the origin of the PICA. Recanalization of a ruptured dissecting VA aneurysm through a pseudolumen in the acute stage is rare, because ruptured entry-exit cerebral dissecting aneurysms are assumed to occur less frequently than entry-only aneurysms.[7,9]

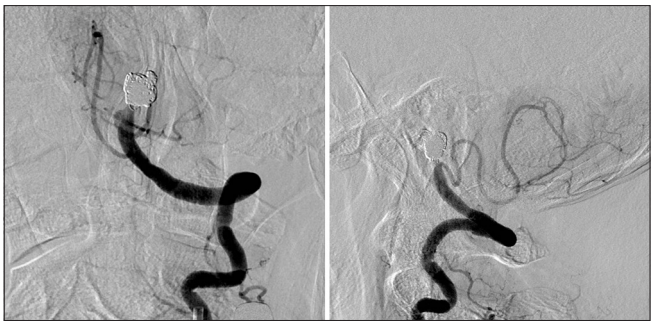

Figure 6: Anteroposterior (left) and lateral (right) left VA angiograms after additional coil embolization demonstrate complete obliteration of the aneurysm and affected left VA with preservation of the left PICA. The pseudolumen was mainly occluded after a microcatheter was navigated into the pseudolumen via the entrance in additional endovascular treatment

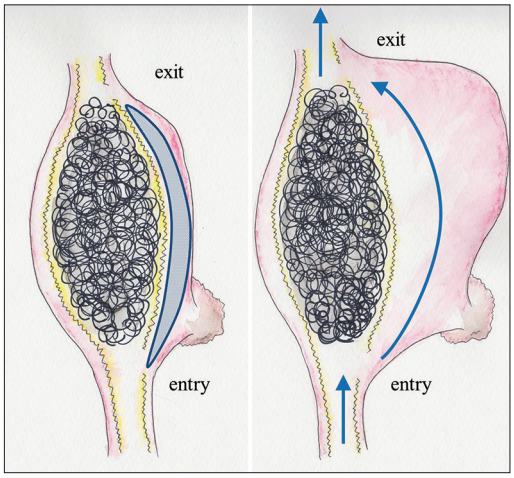

Figure 8: (Left) First operation for entry-exit VA dissecting aneurysm in this case. Oblique line pattern represents intramural clot. (Right) Recanalization of the aneurysm showing morphological change 16 days after postoperatively. Wavy line represents the internal elastic laminar. Arrows demonstrates blood flow through the pseudolumen

We suggest that occlusion of the proximal segment as well as the dilated segment of a VA dissecting aneurysm will prevent recanalization by definitively occluding the entrance to the aneurysm pseudolumen. We do not know preoperatively whether a ruptured VA dissecting aneurysm represents the entry-only or entry-exit type, and high blood pressure from antegrade flow across the entrance to a pseudolumen may cause recanalization if only the dilated segment is occluded for ruptured entry-exit cerebral dissecting aneurysms as in the present case. We think that additional occlusion of the distal VA should not be performed, because occlusion of the distal VA before the dilated segment of the aneurysm risks causing intraoperative rupture owing to high blood pressure directly on the dilated segment. In addition, there is a risk of ischemic complications associated with occlusion of the perforators arising from the VA near the vertebral

basilar junction, especially in VA dissecting aneurysms distal to the origin of the PICA.[5] One of the most important issues in the above-mentioned treatment is navigation of a microcatheter into the true lumen. It may be valuable alternative procedure for securing the true lumen and preventing intraoperative rupture to navigate a microcatheter to the VA proximal to the aneurysm across the vertebrobasilar junction from the contralateral VA, and then draw back the microcatheter, occluding the affected VA and aneurysm.

Occlusion of only the dilated segment of the aneurysm to preserve the PICA and conduct prompt prevention of rerupture in the first treatment may cause antegrade recanalization via a pseudolumen in the acute stage owing to the same mechanisms as in the present case. Accordingly, careful follow-up with angiography and MRA is required, and open surgical clip trapping of the affected VA and creation of a PICA bypass should be considered as an additional treatment.

CONCLUSION

Based on this unique case, we suggest that occlusion of the proximal segment as well as the dilated segment of a VA dissecting aneurysm showing no hypoplasia of the contralateral VA will prevent recanalization, by ensuring that any entrance to a pseudolumen of the aneurysm is completely closed. However, further studies are needed to assess the radical and safety of internal trapping, as a single case, is inadequate to draw solid conclusions from. Careful follow-up after internal trapping, especially only obliteration of dilated segment, is important since antegrade recanalization via a pseudolumen may occur in the acute stage.

REFERENCES

1. Ihn YK, Sung JH, Byun JH. Antegrade recanalization of parent artery after internal trapping of ruptured vertebral artery dissecting aneurysm. J Korean Neurosurg Soc 2012;51:301-4.
2. Iihara K, Sakai N, Murao K, Sakai H, Higashi T, Kogure S, *et al*. Dissecting aneurysms of the vertebral artery: A management strategy. J Neurosurg 2002;97:259-67.
3. Jin SC, Kwon DH, Choi CG, Ahn JS, Kwun BD. Endovascular strategies for vertebrobasilar dissecting aneurysms. AJNR Am J Neuroradiol 2009;30:1518-23.
4. Kojima A, Okui S, Onozuka S. Long-term follow up of antegrade recanalization of vertebral artery dissecting aneurysm after internal trapping: Case report. Neurol Med Chir (Tokyo) 2010;50:910-3.
5. Mahmood A, Dujovny M, Torche M, Dragovic L, Ausman JI. Microvascular anatomy of foramen caecum medullae oblongatae. J Neurosurg 1991;75:299-304.
6. Mizutani T, Aruga T, Kirino T, Miki Y, Saito I, Tsuchida T. Recurrent subarachnoid hemorrhage from untreated ruptured vertebrobasilar dissecting aneurysms. Neurosurgery 1995;36:905-13.
7. Mizutani T, Kojima H, Asamoto S, Miki Y. Pathological mechanism and three-dimensional structure of cerebral dissecting aneurysms. J Neurosurg 2001;94:712-7.
8. Rabinov JD, Hellinger FR, Morris PP, Ogilvy CS, Putman CM, Endovascular management of vertebrobasilar dissecting aneurysms AJNR Am J Neuroradiol 2003;24:1421-8.
9. Ro A, Kageyama N. Pathomorphometry of ruptured intracranial vertebral arterial dissection: Adventitial rupture, dilated lesion, intimal tear, and medial defect. J Neurosurg 2013;119:221-7.
10. Sawada M, Kaku Y, Yoshimura S, Kawaguchi M, Matsuhisa T, Hirata T, *et al*. Antegrade recanalization of a completely embolized vertebral artery after endovascular treatment of a ruptured intracranial dissecting aneurysm. Report of two cases. J Neurosurg 2005;102:161-6.
11. Sugiu K, Tokunaga K, Ono S, Nishida A, Date I. Rebleeding from a vertebral artery dissecting aneurysm after endovascular internal trapping: Adverse effect of intrathecal urokinase injection or incomplete occlusion?-case report. Neurol Med Chir (Tokyo) 2009;49:597-600.
12. Wong GK, Tang HB, Poon WS, Yu SC. Treatment of ruptured intracranial dissecting aneurysms in Hong Kong. Surg Neurol Int 2010;1:84.
13. Yamaura I, Tani E, Yokota M, Nakano A, Fukami M, Kaba K, *et al*. Endovascular treatment of ruptured dissecting aneurysms aimed at occlusion of the dissected site by using Guglielmi detachable coils. J Neurosurg 1999;90:853-6.