Internal Trapping of a Symptomatic Unruptured Giant Vertebral Artery Aneurysm Using the Coiling-in-bridging-stent Technique: A Case Report

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Objective: We report a patient in whom a devised stent-assisted internal trapping was effective to eliminate the mass effect of a symptomatic giant vertebral artery (VA) aneurysm.

Case Presentation: A 63-year-old female. Detailed examination of gait disorder showed a brainstem-compressing, non-thrombotic, giant, fusiform aneurysm at an area distal to the posterior inferior cerebellar artery (PICA) bifurcation of the left VA. Endovascular internal trapping was planned, but the exacerbation of mass effects related to the coils inserted into the aneurysm cavity was concerned. Thus, before the usual internal trapping procedure, a self-expanding stent was deployed across the aneurysm to limit the coils in the stent during the internal trapping procedure. Six months later, the aneurysm decreased markedly in size with a complete relief of neurological symptom.

Conclusion: Our devised stent-assisted internal trapping method, coiling-in bridging-stent technique, was successful to exclude a symptomatic giant VA aneurysm from the circulation with a minimum amount of coil in the aneurysm cavity. With this method, marked decrease in size could be expected since coils would not interfere with the shrinkage of the aneurysm. This method would be useful in giant cerebral aneurysms which need endovascular internal trapping.

Keywords ► giant aneurysm, trapping, mass effect, vertebral artery, stent

Introduction

Endovascular treatment has been increasingly indicated for non-saccular vertebral artery (VA) aneurysms.1–5) Deconstructive treatment by parent artery occlusion (PAO), and internal coil trapping,5–7) reconstructive treatment by stent-assisted coiling, stenting, and flow diverter,1,3,8,9) and combined treatment consisting of endovascular treatment and direct surgery10,11) are performed. Therapeutic strategies are selected in accordance with individual patients. In the present case, we planned internal trapping of an unruptured, symptomatic, non-thrombotic, giant VA aneurysm, but speculated that mass effects related to coil insertion into the aneurysm might exacerbate. Furthermore, the length of parent artery distal and proximal to the aneurysm, where coil insertion was considered to be possible, was short; therefore, we considered intra-aneurysmal blood flow blockage by coil involving a normal vascular area alone difficult. To overcome these problems, we performed internal trapping with a stent and coil (coiling-in-bridging-stent technique). We report the treatment procedure and course after treatment.

Case Presentation

A 63-year-old female. She consulted a local clinic with a 3-month history of a headache and dizziness on gait, which had gradually deteriorated. CT revealed a mass compressing...
the brainstem, and she was referred to our hospital. Her medical history was not contributory, excluding depression. On the initial consultation, consciousness was clear, and slight muscle weakness of the limbs and increased deep tendon reflex were noted. MRI showed a giant, fusiform aneurysm in the V4 portion of the left VA. The brainstem was markedly compressed (Fig. 1). There was no mural thrombus or calcification.

After 1 week, the patient was admitted to our department. Cerebral angiography was performed (Fig. 2). In the left V4 portion, an aneurysm measuring 30 mm in maximum diameter and involving the VA trunk was observed. The origin of the left posterior inferior cerebellar artery (PICA) was located at an area 9.1 mm proximal to the aneurysm, and the VA union at an area 11 mm distal to the aneurysm. Narrowing of the right VA associated with aneurysm-related compression was noted, with a vascular diameter of 2.0 mm. The anterior spinal artery was present as an ascending vessel from the V2 segment of the right VA. It was not visualized through the left VA. Allcock tests were positive on the bilateral sides.

In the present case, aneurysm-related mass effects were marked, and it was necessary to minimize coil insertion into the aneurysm. Coil insertion to normal vascular areas proximal and distal to the aneurysm alone was considered, but the distance between the proximal end of the aneurysm and PICA and that between the distal end of the aneurysm and VA union were short; therefore, complete aneurysmal occlusion was considered to be difficult. We adopted a method of blocking blood flow by internal trapping through stent bridging between the VAs proximal and distal to the aneurysm and coiling into the stent (coiling-in-bridging-stent technique). Combination therapy with two antiplatelet drugs (100 mg/day of aspirin and 75 mg/day of clopidogrel) was started 1 week before treatment.

Endovascular treatment (Fig. 3)
Under local anesthesia, a 5 Fr sheath was inserted into the right femoral artery, and a 6 Fr sheath into the left femoral artery. Systemic heparinization was performed, and the activated clotting time (ACT) was regulated so that it was maintained at approximately 300 seconds. A 5 Fr Launcher guiding catheter (Medtronic, Minneapolis, MN, USA) was inserted into the right VA, and a 6 Fr Launcher into the left VA. An XT-27 microcatheter (Stryker, Kalamazoo, MI, USA) was guided using a CHIKAI black-18 microguidewire.
Finally, the left VA was occluded at an area distal to the bifurcation of the left PICA, and the procedure was completed with slight intra-aneurysmal blood flows remaining via the distal left VA from the right VA.

An improvement in gait disorder was achieved the day after treatment. The patient was discharged 5 days after treatment. The oral administration of clopidogrel was completed 1 week after treatment. After 1 month, aspirin administration was completed. MRI after 1 month showed intra-aneurysmal thrombosis, but there was no reduction of the aneurysm size (Fig. 4A). After 3 months, angiography confirmed the disappearance of the aneurysm (Fig. 5). MRI after 6 months (Fig. 4B and 4C) and after 1 year (Fig. 4D–4F) showed a marked reduction of the aneurysm size and an improvement in compression of the brainstem.

**Discussion**

As reconstructive treatments for unruptured, non-saccular aneurysms in the posterior circulation, overlapping stenting, and treatment with a flow diverter have been performed, and favorable results have been reported. However, many studies investigated small aneurysms. According to a
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A meta-analysis by Kiyofuji et al. regarding treatment with a flow diverter, the obliteration rate of large aneurysms in the posterior circulation was 28%, and the incidence of ischemic complications was high, with a mortality rate of 27%. On the other hand, the results of PAO for dissecting VA aneurysms were favorable. In particular, Lubicz et al. performed PAO by endovascular treatment in 13 patients with giant posterior-circulation aneurysms, and reported one patient with an ischemic complication and one patient died. In the present case, it was considered difficult to occlude the giant aneurysm using an overlapping stent. Furthermore, a consensus regarding the use of a flow diverter for posterior-circulation aneurysms has not been reached; currently, it is not covered by health insurance in Japan. Therefore, in the present case, we selected deconstructive vascular occlusion, but not reconstructive treatment by stenting.

When deconstructively occluding non-saccular aneurysms, PAO by blockage of a proximal artery, or internal trapping is performed in accordance with individual patients. In the present case, the distance between the VA union and distal end of the aneurysm was short, and aneurysm occlusion by blockage of a proximal artery alone was considered to be difficult due to residual retrograde blood flow from the distal area; therefore, we considered internal trapping necessary. Moreover, the distance between the distal edge of the aneurysm and VA union and that between the proximal edge of the aneurysm and PICA bifurcation was relatively short; therefore, we considered it impossible to achieve blood flow blockage by coil insertion into the parent blood vessel alone. However, coil insertion into an aneurysm may enhance mass effects. In the present case, we speculated that it might exacerbate compression of the brainstem or right VA. Under such circumstances, bridging a stent over the parent artery and in-stent coiling facilitate blood flow blockage through short-segment embolization without coil insertion into an aneurysm; therefore, this method may be effective.

![Fig. 4 Follow-up MRI at 1 month (A), 6 months (B and C), and 12 months (D–F) after treatment. T1WI at 1 month (A) shows thrombotic changes in the aneurysm. T1WI (B) and T2WI (C) at 3 months show the remarkable shrinkage of the aneurysm and brainstem compression is improved. In T1WI (D), T2WI (E), and MRA (F) at 12 months, the aneurysm has almost disappeared. T1WI: T1-weighted image; T2WI: T2-weighted image.](image)

![Fig. 5 Follow-up angiogram at 3 months after treatment. Left (A) and right (B) vertebral angiograms (both seen from right anterior oblique direction) show the complete obliteration of the aneurysm.](image)
In the standard internal coil trapping method, we perform coiling loosely into an aneurysm and densely placed additional coils in a parent artery. However, the intra-aneurysmal coil does not function as an adequate anchor in some cases, making dense coil packing in parent artery difficult. When this method is used, coils inserted into a stent functions as a strong anchor, facilitating dense coil packing to gain blood flow blockage with relatively short segment coiling into parent artery.

Operations for in-stent coiling slightly differ from those for standard coiling into the vascular lumen due to the presence of a stent; loose packing may be achieved. Therefore, catheter support must be strengthened by adopting an intermediate catheter or hard microcatheter at an area where dense embolization is necessary. In the present case, an intermediate catheter was used for embolization of the proximal VA, and it was effective. However, slight blood flow from the distal VA into the intra-aneurysmal area, which may lead to thrombosis, remained immediately after treatment. In the present case, coil embolization was performed by retrogradely inserting a microcatheter into the distal VA through the contralateral VA. However, to place a coil more densely, it may have been necessary to strengthen support using an intermediate catheter from the distal side. However, when narrowing of the contralateral VA is observed, as demonstrated in the present case, much attention should be paid so that intermediate-catheter insertion may not result in blood flow congestion.

In the present case, we planned to densely embolize the proximal and distal VA utilizing a coil inserted into an intra-aneurysmal stent as an anchor; therefore, two microcatheters were inserted via different routes. If coils are simultaneously inserted through two microcatheters to entangle them, it may be difficult to remove microcatheters inserted via different routes when strongly entangled coil removal is difficult. In the present case, coils were inserted at different timings through two microcatheters. When entangling coils for embolization, it may be necessary to insert two microcatheters from the ipsilateral side. However, distal embolization may be insufficient.

In the present case, the distance between arteries proximal and distal to the aneurysm was long, and an open-cell type stent, of which the pressure bonding to the vascular wall is favorable, was used so that the stent might not drop into the aneurysm. However, closed-cell-type stents may less markedly interfere with coil movement compared with open-cell-type stents. This should be further examined in the future.

### Conclusion

When performing internal coil trapping of giant cerebral aneurysms, the method of inserting a coil into a bridging stent (coiling-in-bridging-stent method) may be useful for reducing the mass effects of aneurysms.

### Disclosure Statement

There is no conflict of interest for the first author and coauthors.

### References

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