CASE REPORT

Stent-assisted coil embolization on down-the-barrel view with spring-shaped microcatheter in patient with M1 ultrawide necked circumferential aneurysm

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Accepted 10 December 2017

SUMMARY

Herein, we describe a technique for stent-assisted coil embolization with a spring-shaped microcatheter in a patient with an M1 ultrawide-necked circumferential aneurysm in the middle cerebral artery (MCA). A 49-year-old man was referred for treatment of an incidentally detected M1 large-circumference aneurysm on magnetic resonance angiography. Subsequent digital subtraction angiography revealed an 18.2×16.5 mm ultrawide-necked circumferential aneurysm on the distal M1 portion of the left MCA, and we planned stent-assisted coil embolization using a spring-shaped microcatheter. After we deployed the stent, we performed coil embolization under the down-the-barrel view by pulling out the microcatheter little by little. Using this technique, we could fill the coil mass evenly into the aneurysmal sac around the stent. And there were no immediate or delayed complications after the procedure. Stent-assisted coiling using a spring-shaped microcatheter is a useful and safe technique for treating ultrawide-necked circumferential aneurysm or fusiform aneurysms.

BACKGROUND

The use of endovascular treatment for intracranial aneurysms has been increasing, and advances in endovascular techniques and devices have allowed the treatment of most wide-necked aneurysms. Nevertheless, ultrawide-necked circumferential aneurysms still frequently present therapeutic challenges to neurointerventionists. Even though a down-the-barrel view may be helpful for identifying the lumens of parent vessels, it is not always available, and even if a down-the-barrel view is available as a working projection, it is difficult to fill the coil evenly in the aneurysm around the stent. Here, we report our experience using a spring-shaped microcatheter to treat an M1 ultrawide-necked circumferential aneurysm under the down-the-barrel view.

CASE PRESENTATION

A 49-year-old man was referred from a department of nephrology with an incidentally detected left M1 large ultrawide-necked circumferential aneurysm of the middle cerebral artery (MCA) on magnetic resonance angiography. The patient had a 20-year history of hypertension and attended ongoing hemodialysis three times a week for chronic kidney disease.

INVESTIGATIONS

The subsequent distal subtraction angiography revealed a 15.2×13.5 mm ultrawide-neck circumferential aneurysm on the distal M1 portion of the left MCA. There were no thrombus inside the aneurysm on T2-weighted MRI, and a 3D time-of-flight image revealed no perforators arising from the dome of the aneurysm (figure 1A–C). After a multi-disciplinary meeting including neurosurgeons and neurointerventionists, we planned a stent-assisted coil embolization.

TREATMENT

The patient received dual antiplatelet therapy (100 mg of aspirin, 75 mg of clopidogrel) for 7 days prior to the procedure, which was performed under general anesthesia. After right femoral artery puncture, a 100 cm 8F guide catheter (Guider Softip; Stryker, Natick, Massachusetts, USA) was advanced to the left cervical portion of the internal carotid artery. Systemic heparinization was started immediately after arterial access was obtained. Under roadmap guidance, a Headway 21 microcatheter (MicroVention, Tustin, California, USA) was navigated to an M2 inferior division of the MCA to deliver the stent. Because the diameter of M1 portion of MCA was larger than 4 mm, we planned the double microcatheter technique for the procedure. Then second and third spring-shaped Headway 17 microcatheters (MicroVention) for coil delivery were inserted into the distal portion of the aneurysm sac (figure 1D). Then, an LVIS BLUE (MicroVention) 4.5×32 mm stent was deployed from the M2 proximal portion to the M1 proximal portion. After the stent was fully deployed, coil embolization was initiated under the down-the-barrel view (figure 1E). The procedure was carried out by pulling out the spring-shaped microcatheter little by little while identifying the patency of the parent artery with a down-the-barrel view (figure 1F, G). Throughout the procedure, coils encroaching into the stent were not allowed (figure 1H). Using this technique under the down-the-barrel view, we could fill the coil mass evenly and compactly around the stent without encroaching on the parent artery lumen.

OUTCOME AND FOLLOW-UP

Postprocedural angiography demonstrated partial (85%) occlusion of the aneurysm with no

To cite: Kwak HS, Park JS, Koh EJ. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2017-013597

Figure 1 A 49-year-old man presenting with a large ultrawide-necked circumferential aneurysm in the left M1 portion of the middle cerebral artery. (A) Digital subtraction angiography shows a 15.2×13.5 mm ultrawide-necked circumferential aneurysm. (B and C) T2-weighted and 3D time-of-flight MR image reveals that there were no thrombus inside the aneurysm and no perforators arising from the dome of the aneurysm. (D) During the initial stage of the endovascular procedure, the first microcatheter was navigated to an M2 inferior division of MCA for stent delivery (arrow). The second and third microcatheters for coiling were inserted into the distal portion of the aneurysm sac (arrow head). (E) An LVIS BLUE stent was successfully deployed across the aneurysm, and coiling was initiated. (F and G) The procedure was carried out by pulling out the spring-shaped microcatheter little by little while identifying the patency of the parent artery with a down-the-barrel view. (H) Coils encroaching into the stent were not allowed (arrow). (I and J) Final angiogram shows partial occlusion of the aneurysm with no compromise of the parent artery. (K) On 6 month follow-up cerebral angiography, there was no recurrent filling or parent artery compromise.

Figure 2 Photographs of the spring-shaped microcatheter. (A) Spring-shaped microcatheter tip with a mandril. (B) Poststeam reveals a larger spring-shaped tip.

compromise of the parent artery ([figure 1I, J](#)), and there were no immediate or delayed complications after the procedure. On 6 month follow-up cerebral angiography, there was no recurrent filling or parent artery compromise ([figure 1K](#)).

DISCUSSION

Since the electrolytically detachable platinum coil was approved by the US Food and Drug Administration in 1995, endovascular techniques and devices have developed dramatically. These advances increased the scope of lesions amenable to embolization by facilitating the treatment of aneurysms with more complex anatomy and wider necks.¹ Nevertheless, ultrawide-necked circumferential aneurysms and fusiform aneurysms still frequently present extreme therapeutic challenges, particularly if the parent vessel must be saved. Although a stent-assisted coiling technique provides durable parent vessel protection, as coils are placed into the aneurysm, the coil mass overlaps the patent artery in working projection. In this overlapping state in

Figure 3 Schematic illustrations of stent-assisted coil embolization with a spring-shaped microcatheter for an ultrawide-necked circumferential aneurysm. (A) At the beginning of the procedure, the microcatheter tip is located in the distal portion of the aneurysmal sac with rotation around the deployed stent. (B and C) Coiling was performed with the microcatheter pulled back little by little, and then the microcatheter was moved to the proximal portion of the aneurysmal sac with natural rotation around the stent.

working projection, the neurointerventionist would hesitate to progress the coil packing out of concern about displacing the microcatheter into the parent vessel or passing the coil mass through the stent mesh into the parent vessel. Thus, balloon-in-stent and multiple overlapping stent and coiling techniques were introduced to secure the parent artery lumen.^{1–3} However, not only are these techniques somewhat difficult and complex, they also cannot guarantee the patency of the parent artery.

Recently, flow-diverting devices are increasingly being used to treat complex aneurysms. A number of previous studies have demonstrated high rates of aneurysm occlusion with relatively low complication rates.^{4–6} However, the stable deployment of flow-diverting devices is difficult and requires a skillful neurointerventionist compared with other intracranial stents because it should result in a combination of tight wall apposition and dense coverage of the target lesion. Also, previous studies of a flow-diverting device reported that 2%–4% of patients will have intraparenchymal hemorrhage, and all patients who experienced intraparenchymal hemorrhage had either major morbidity or mortality.^{7,8}

If a down-the-barrel view is available as a working projection, stent-assisted coil embolization could be an alternative option for treating ultrawide-necked circumferential aneurysm. On the down-the-barrel view, it is easy to identify the patency of the parent artery, whether the coil mass is protruding into the deployed stent and whether the coils are packed evenly in the aneurysmal sac around the stent. However, in cases of ultrawide-necked aneurysms in which the aneurysm sac encompasses the parent artery >180°, microcatheter action is often not sufficient to fill the coils evenly into the aneurysmal sac.

In the present case, we used a spring-shaped microcatheter by steam shaping using mandril to deliver the coils (figure 2).

Learning points

- ▶ Ultrawide-necked circumferential aneurysms still present extreme therapeutic challenges.
- ▶ Stent-assisted coil embolization could be an alternative option for treating for circumferential aneurysms.
- ▶ Stent-assisted coiling technique using a spring-shaped microcatheter could be a useful and safe technique for treating ultrawide-necked circumferential aneurysms.

Initially, we shaped the microcatheter into a spring shape that was larger in diameter than the parent artery. Then, we delivered microcatheter to the distal portion of the aneurysmal sac. We used two microcatheters for coiling, which were the purpose of insurance in case one microcatheter did not provide adequate coverage or pull out. In the next step, we deployed the stent so that the microcatheters were located around the deployed stent by itself because the microcatheter for stent delivery was located in the middle of aneurysm and the spring shaped microcatheters were rotating near the inner surface of the aneurysm. At this stage, we used LVIS BLUE (MicroVention) to minimize the coil encroaching into the stent and to gain flow diversion effect when the coils were insufficiently filled using its high metal coverage rate. We performed the coiling with the microcatheter pulled back little by little, and then the microcatheter was moved to the proximal portion of the aneurysmal sac, rotating naturally around the stent (figure 3). Through this catheter action, we could pack the coils evenly in the aneurysmal sac around the stent. This stent-assisted coiling technique using a spring-shaped microcatheter could be a useful and safe technique for treating ultrawide-necked circumferential aneurysms or some of fusiform aneurysms.

Contributors All authors contributed significantly to the planning, conduct and reporting of the work described in the paper.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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