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Y-configured Double Stent-assisted Coil Embolization with Double Microcatheter Technique for Complex Basilar Bifurcation Aneurysm

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ABSTRACT

Y-configured double stent technique is useful for coil embolization of a bifurcation wide neck aneurysm while preserving the patency of the two important vessels. However, if the important vessels emanating directly from the aneurysm comprised four vessels, two vessels not deployed, Y-stents might not be preserved with the Y-stent technique by itself. We report a case treated with Y-configured double stent-assisted coil embolization with a double microcatheter technique for complex basilar bifurcation aneurysm. A 78-year-old woman presented with a subarachnoid hemorrhage (SAH) of poor grade. CT-angiography showed a wide neck and shallow aneurysm of complex basilar bifurcation involving both posterior cerebral arteries (PCAs) and superior cerebellar arteries (SCAs). In the chronic stage of SAH, Y-configured double stent-assisted coil embolization with a double microcatheter technique was performed. After Y-stent (two Enterprise) deployment from both the PCAs to the basilar artery, coil embolization of a basilar bifurcation aneurysm was performed using a double microcatheter technique to preserve both SCAs.

Key words: *Complex basilar bifurcation aneurysm, Double microcatheter, Subarachnoid hemorrhage, Y-stent*

The Y-configured double stent technique is useful for coil embolization of a bifurcation wide neck aneurysm while preserving the patency of the two important vessels[5]. However, if the important vessels emanating directly from the aneurysm consist of four vessels, with two important vessels not deployed, the Y-stents might not be preserved with only the Y-stent technique in coiling. We report a case treated with Y-configured double stent-assisted coil embolization with a double microcatheter technique for complex basilar bifurcation aneurysm.

CASE REPORT

A 78-year-old woman presented with subarachnoid hemorrhage (SAH) of Hunt and Hess Grade V. Computed tomography (CT) showed thick SAH around the prepontine cistern (Fig. 1a). CT-angiography showed a posteriorly projecting shallow aneurysm of complex basilar bifurcation with a diameter of 7 mm, and with both posterior cerebral arteries (PCAs) and superior cerebellar arteries (SCAs) emanating directly from the aneurysm (Fig. 1b-d). Because of the very poor-grade SAH, the patient received conservative treatment during the acute stage of SAH. 17 days later, endovascular coil embolization of the ruptured aneurysm was decided on because the SAH grade has gradually improved to Hunt and Hess Grade III. The procedure was performed under general anesthesia. A 4Fr diagnostic catheter was placed within the right vertebral artery (VA). Cerebral angiography revealed a complex basilar bifurcation aneurysm (3.5 mm height, 7.0 mm width) with posterior projection,

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involving both PCAs and SCAs like CT-angiography (Fig. 2a and b). Because of the very wide neck of 7.6 mm and shallow aneurysm with a height of 3.5 mm, balloon or single stent assisted coiling was thought to be inadequate to protect both PCAs and SCAs from coil protrusion.

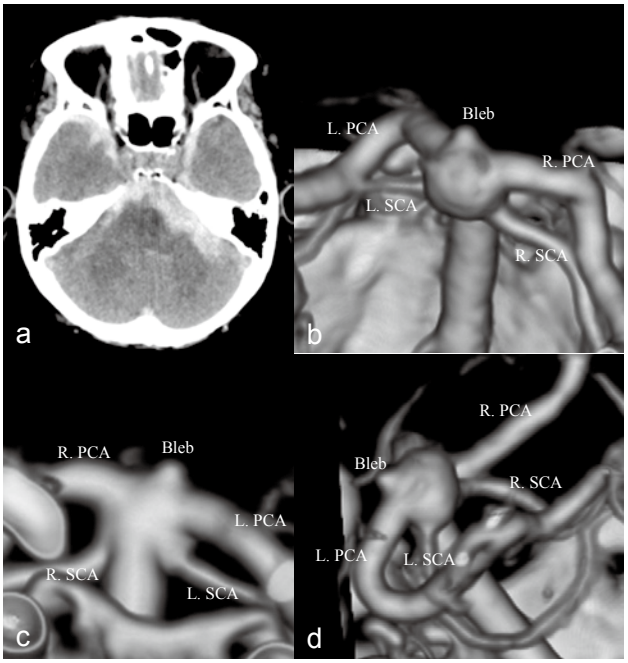

Fig. 1

a. CT showed a thick subarachnoid hemorrhage around the prepontine cistern.
b. Posteroanterior view of CT-angiography showed a posteriorly projecting complex basilar bifurcation aneurysm with a superiorly projecting bleb. Both posterior cerebral arteries and superior cerebellar arteries emanated directly from the aneurysm.
c. Anteroposterior view of CT-angiography showed a posteriorly projecting aneurysm of complex basilar bifurcation with a superiorly projecting bleb.
d. Left-lateral view of CT-angiography showed a posteriorly projecting shallow aneurysm of complex basilar bifurcation with a superiorly projecting bleb. The left posterior cerebral arteries and superior cerebellar arteries emanated directly from the aneurysm.

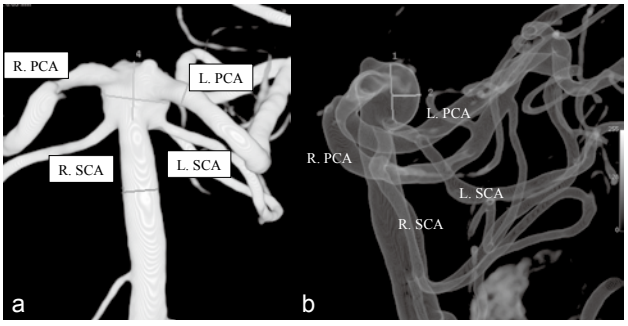

Fig. 2. Anteroposterior (a) and left-lateral (b) view of three-dimensional digital subtraction angiography revealed a shallow aneurysm of complex basilar bifurcation with posterior projection, involving both posterior cerebral arteries and superior cerebellar arteries.

Therefore, we decided to place Y- stents before coiling. The antiplatelet agents of 300 mg clopidogrel and 300 mg aspirin were given through a stomach tube. A 6Fr guiding catheter was placed within the left VA. During the procedure, the activated clotting time was maintained between 300 to 350 sec by intravenous administration of heparin. After placing the Prowler Select Plus (Johnson & Johnson, Miami, FL, USA) microcatheter into the left PCA, an Excelsior SL-10 (Boston Scientific, Natick, MA, USA) microcatheter was placed into the aneurysm sac before deployment of the first stent via the left VA. The first 4.5 mm × 22 mm Enterprise stent (Johnson & Johnson) was deployed from the left PCA with a 2.0 mm diameter to the basilar artery (BA) with a 3.5 mm diameter. Then, a Prowler Select Plus microcatheter with a 0.018-inch microguidewire (Terumo, Tokyo, Japan) was inserted into the right PCA through the stent struts without any difficulty. The second 4.5 mm × 22 mm Enterprise stent was deployed from the right PCA with a 2.0 mm diameter to the BA (Fig. 3a and b). Coiling was attempted through the jailing SL-10 microcatheter. However, because of the wide neck and shallow aneurysm, we could not make a stable coil frame not to protrude into both SCAs through a single microcatheter. Therefore, we decided to make a stable coil frame using a double microcatheter technique. We placed another Excelsior SL-10 microcatheter into the aneurysm sac through double stent struts without any difficulty via the left VA. Two coils (Target360ULTRA; 4 mm × 8 cm, 3 mm × 6 cm) were deployed via two microcatheters. Each coil occupied a different part of the aneurysm, and they were simultaneously mixed at the central part, and made a stable coil frame (Fig. 4a-f). The final angiogram showed a slightly aneurysmal body filling with bleb obliteration by six coils (Target360ULTRA; 4 mm × 8 cm, 3 mm × 6 cm, 3

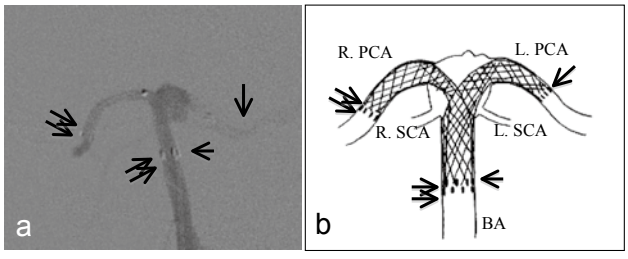

Fig. 3

a. Angiography showed double 4.5 mm × 22 mm Enterprise stents deployed from both posterior cerebral arteries to basilar artery. Single arrows indicate both ends of first stent, and double arrows indicate both ends of second stent.
b. Illustration shows double stents deployed from both posterior cerebral arteries to basilar artery. Single arrows indicate both ends of first stent, and double arrows indicate both ends of second stent.

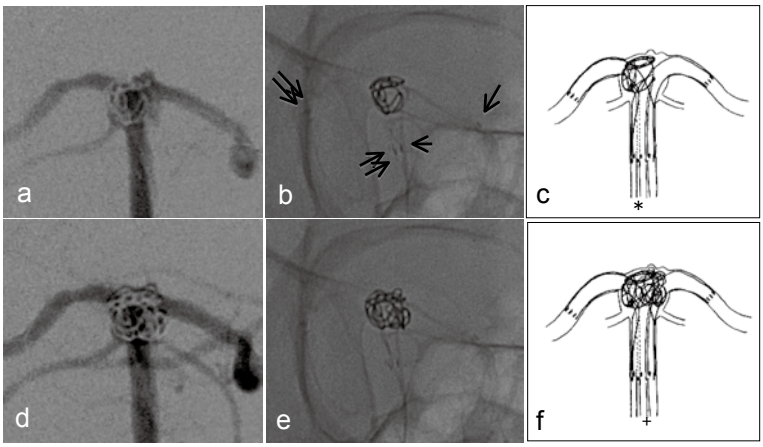

Fig. 4

a. Angiography showed the coil frame of the aneurysm and the preserved superior cerebellar arteries.
b. Fluoroscopic image showed double 4.5 mm × 22 mm Enterprise stents deployed from both posterior cerebral arteries to basilar artery (single and double arrows) and the coil frame of the aneurysm through the jailing microcatheter.
c. Illustration shows double stents deployed from both posterior cerebral arteries to basilar artery and the coil frame of the aneurysm through the jailing microcatheter (*).
d. Angiography showed the stable coil frame of the aneurysm and preserved superior cerebellar arteries.
e. Fluoroscopic image showed the stable coil frame made by using the double microcatheter technique.
f. Illustration shows double stents deployed from both posterior cerebral arteries to basilar artery and the stable coil frame made through another microcatheter (+) (double microcatheter technique).

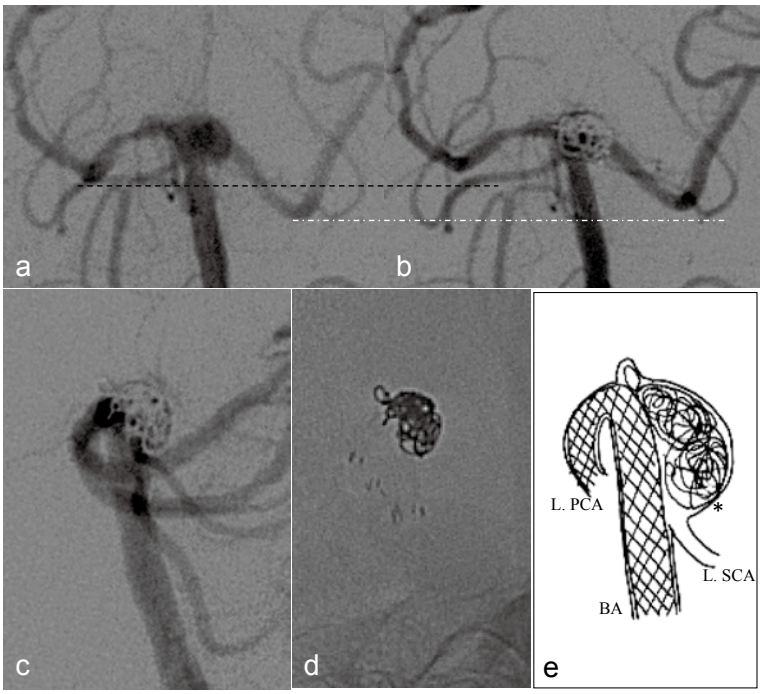

Fig. 5. Vessel geometry of both posterior cerebral arteries before (a) and after (b) procedure was slightly changed by double stent placement. Lateral view of final angiography (c) and fluoroscopic image (d) reveals a complex basilar bifurcation aneurysm embolized by a coil and the preserved both posterior cerebral arteries and superior cerebellar arteries. Illustration (e) of lateral view showed stents to protect both posterior cerebral arteries and coils (*) designed not to protrude into both superior cerebellar arteries.

mm × 4 cm, 3 mm × 4 cm, GALAXY COMPLEX; 2.5 mm × 2.5 cm, 2.5 mm × 2.5 cm). We protected both PCAs by Y-stents and performed a coil embolization of the aneurysm by using a double microcatheter technique to preserve both SCAs, and the vessel geometry of both PCAs was slightly changed by double stent placement (Fig. 5a-e). After the procedure, intravenous administration of heparin was finished, and argatroban was administered for 24 hr. The patient received clopidogrel (75 mg/day) and aspirin (100 mg/day) from the following day. Two months after the onset of SAH, the patient was transferred to a rehabilitation hospital with modified Rankin Scale 3.

DISCUSSION

The development of intracranial self-expanding stents for endovascular treatment has allowed the safe and effective coiling of wide neck intracranial aneurysms[3,4]. However, some wide neck aneurysms, such as those located at a parent vessel bifurcation, are not amenable to treatment with a single stent because such morphological features can result in the failure of a single stent to provide adequate protection from coil herniation into the parent vessel. To assist coil embolization of bifurcation aneurysms, Chow et al[5] reported a Y-configuration stent technique. Furthermore, Thorell et al[10] reported 7 patients with wide-necked basilar tip aneurysms treated with Y-configured dual intracranial stent-assisted coil embolization. They concluded that the technical and clinical results were highly encouraging, and that this technique might significantly improve the endovascular treatment of intracranial aneurysms. Furthermore, hemodynamic assessment has shown the Y-configuration to be advantageous with respect to reduction in the strength of flow vortices and peak flow velocity inside the aneurysm sac[2,9]. Cekirge et al[3] reported a Y-stent flow diversion technique for management of 8 bifurcation aneurysms without endosaccular coiling. Flow diversion with double stent placement in a Y-configuration provided successful and stable aneurysm occlusion. The technical and clinical results achieved were highly encouraging that this technique might contribute to the endovascular treatment of these complex bifurcation aneurysms. Multiple stent placement across the aneurysm neck seems to have an additional benefit of reducing wall-shear stress, an advantage unique to the Y-configuration compared to alternative approaches[7,9]. Huang et al[6] analyzed the vascular geometry change due to intracranial stent placement. They concluded that stent placement significantly changes the angle between efferent and afferent vessels. This may play an important role in changes in local hemodynamics, promoting the healing of aneurysms.

Even a Y-configuration stent may provide only partial protection from coil herniation into an important branch if the important vessel emanating directly from the aneurysm consisted of four vessels. Baxter et al[1] reported a double microcatheter technique for endovascular treatment of aneurysms with an unfavorable configuration such as an important branch from the fundus. Kwon et al[8] reported 25 patients with wide-necked aneurysms treated by using two microcatheters. The double microcatheter technique is both feasible and safe for coil embolization of aneurysms with unfavorable configurations.

In the present case, because the basilar bifurcation aneurysm was a posteriorly projecting and shallow aneurysm, both PCAs and SCAs emanated directly from the aneurysm. Therefore, we protected both PCAs by Y-stents and could perform a coil embolization of the aneurysm by using a double microcatheter technique to preserve the two SCAs. Furthermore, because the vessel geometry of both PCAs is changed by double stent placement, it may result in local hemodynamic changes[6]. Although difficulty in stent deployment has been reported during delivery of the second stent[9], we were fortunately able to placed second stent and another microcatheter into the aneurysm sac through the double stent struts without any difficulties. Y-configured double stent-assisted coil embolization using a double microcatheter technique may be effective when important vessels emanating directly from the aneurysm exceed three in number.

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REFERENCES

1. **Baxter, B.W., Rosso, D. and Lownie, S.P.** 1998. Double microcatheter technique for detachable coil treatment of large, wide-necked intracranial aneurysms. AJNR. Am. J. Neuroradiol. **19:** 1176-1178.
2. **Cantón, G., Levy, D.I. and Lasheras, J.C.** 2005. Hemodynamic changes due to stent placement in bifurcating intracranial aneurysms. J. Neurosurg. **103:** 146-155.
3. **Cekirge, H.S., Yavuz, K., Geyik, S. and Saatci, I.** 2011. A novel "Y" stent flow diversion technique for the endovascular treatment of bifurcation aneurysms without endosaccular coiling. AJNR. Am. J. Neuroradiol. **32**: 1262-1268.
4. **Cho, J.S. and Kim, Y.J.** 2011. Modified 'y-configured stents with waffle cone technique' for broad neck basilar top aneurysm. J. Korean Neurosurg. Soc. **50:** 517-519.
5. **Chow, M.M., Woo, H.H., Masaryk, T.J. and Rasmussen, P.A.** 2004. A novel endovascular

treatment of a wide-necked basilar apex aneurysm by using a Y-configuration, double-stent technique. AJNR. Am. J. Neuroradiol. **25:** 509-512.

6. **Huang, Q.H., Wu, Y.F., Xu, Y., Hong, B., Zhang, L. and Liu, J.M.** 2011. Vascular geometry change because of endovascular stent placement for anterior communicating artery aneurysms. AJNR. Am. J. Neuroradiol. **32:** 1721-1725.
7. **Kim, M., Levy, E.I., Meng, H. and Hopkins, L.N.** 2007. Quantification of hemodynamic changes induced by virtual placement of multiple stents across a wide-necked basilar trunk aneurysm. Neurosurgery **61:** 1305-1312.
8. **Kwon, O.K., Kim, S.H., Kwon, B.J., Kang, H.S., Kim, J.H., Oh, C.W. and Han, M.H.** 2005. Endovascular treatment of wide-necked aneurysms by using two microcatheters: techniques and outcomes in 25 patients. AJNR. Am. J. Neuroradiol. **26:** 894-900.
9. **Lozen, A., Manjila, S., Rhiew, R. and Fessler, R.** 2009. Y-stent-assisted coil embolization for the management of unruptured cerebral aneurysms: report of six cases. Acta Neurochir (Wien). **151:** 1663-1672.
10. **Thorell, W.E., Chow, M.M., Woo, H.H., Masaryk, T.J. and Rasmussen, P.A.** 2005. Y-configured dual intracranial stent-assisted coil embolization for the treatment of wide-necked basilar tip aneurysms. Neurosurgery **56:** 1035-1040.