

Embolization of an Aneurysm of the Basilar Artery by Balloon-Assisted Coiling and Double Microcatheter Technique

S. Sirakov¹, A. Sirakov²

Abstract: Aneurysms of the vertebral artery are rare and represent 0.5% to 3% of all intracranial aneurysms and less than 20% of those of the posterior brain circulation. Considering their surrounding regional anatomy, treatment of such aneurysms of the vertebral artery poses a major challenge to traditional neurosurgery. Endovascular techniques in the treatment of intracranially ruptured aneurysms increasingly prove their safety and effectiveness. In patients with ruptured aneurysms, endovascular techniques, such as coiling or balloon-assisted coiling, are well applicable in the acute period of subarachnoid hemorrhage, since they reduce the risk of re-bleeding after treatment [1, 2]. However, even today treatment of aneurysms with wide necks remains an extreme challenge. Balloon-assisted coiling (BAC) was adopted as an additional technique to endovascular treatment of complex intracranial aneurysms with wide necks and complex anatomy. The technique allows rapid placement of the required number of coils in the aneurysmal sac, within the maximum time of five minutes for the anterior circulation and up to four minutes for the basin of posterior circulation. This allows the formation of a stable structure of coils, "a basket", which significantly facilitates the emplacement of additional threads. Thus, the standard technique of embolization with coils proves to be insufficiently effective in this type of aneurysms.

Keywords: embolisation, balloon-assisted , coiling, aneurysm , double microcatheter, basilar artery

1. Case Report

A 57-year old man was referred to the clinic for a Fisher grade 4 subarachnoid hemorrhage having lasted for 5 days, as a consequence of a suspected aneurysm in the posterior brain circulation (according to the plain scan evidence from another hospital).

After conducting a CT angiography, the ruptured aneurysm was visualized on the top of the basilar artery. Due to the width and complex anatomy of the aneurysmal neck and having in mind that the two posterior cerebral arteries and

the left supracerebellar artery run out from the aneurysmal sac, the use of balloon-assisted coiling was considered appropriate as being the lowest-risk therapeutic technique.

The patient was put under general anesthesia and prophylactically administered with 2500 units of heparin to increase the activated partial thromboplastin time.

Following the catheterization by Seldinger of the right and left femoral arteries, a preoperative diagnostic, 3D angiography of the brain vessels was carried out.



Figure 1: Conventional angiography, revealing the saccular aneurysm on the top of the basilar artery

In the region of the top of the basilar artery, an aneurysmal dilatation was visualized, with its neck entirely open to the basilar artery (neck - widest part of the sac ratio >1). The two posterior cerebral arteries and the two supracerebellar arteries originated from the aneurysmal sac.

At the next stage, 7F Guider and Chaperon6F system guiding catheters were provided to the two vertebral arteries, to give reliable stability of the system.

A total of three Excelsior SL-10 microcatheters were used for the reliable delivery of the coils during the procedure.

Two of the microcatheters were inserted in the aneurysmal sac with the aim to achieve simultaneous coil winding (double microcatheter technique), necessary for the formation of a stable basket. The third microcatheter was placed along the left posterior cerebral artery in order to protect and ensure a steady flow through the artery in case of eventual compression of the placed coils.

The complex anatomy of the aneurysm and its vaguely shaped neck required the placement of a balloon-catheter in

the right posterior cerebral artery, ensuring reliable and secure coiling. A Scepter XC balloon-catheter was inserted into the lumen of the right posterior cerebral artery. Following the balloon infiltration with contrast medium for less than 2 minutes and the simultaneous coil winding with the twomicrocatheters in the aneurysmal sac, the formation of a reliable and stable "basket" of coils was achieved, allowing the complete embolization of the aneurysm.

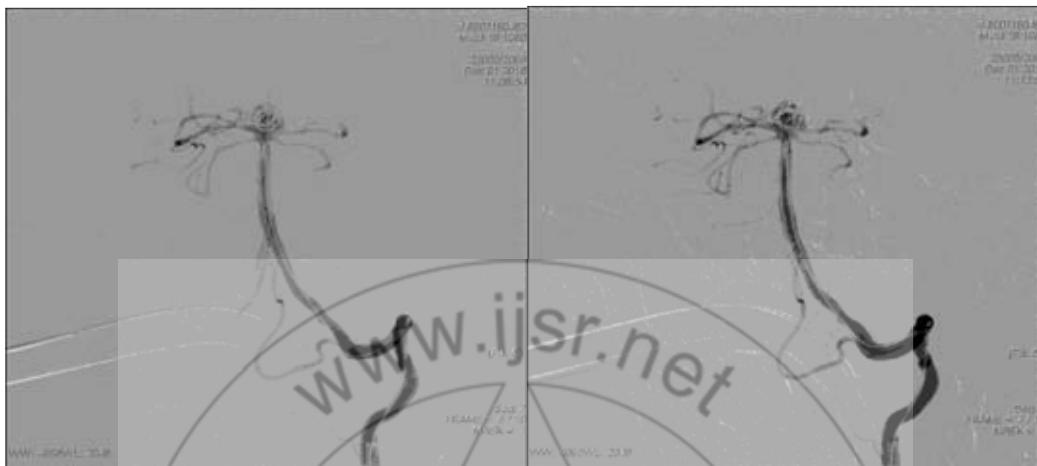


Figure 2: Angiographic images of the placed coils and the system of three microcatheters with the unexpanded balloon

A total of 9 coils of different sizes (from a larger to a smaller size) were placed in the aneurysm, enabled by the balloon-catheter system stability, which led to the complete embolization of the aneurysm without compromising the two posterior cerebral arteries and the basilar artery by prolapsing coils. The control angiography at the end of the procedure revealed contrast medium filling of the two posterior cerebral arteries and the two supracerebellar

arteries without reduction in their volume or delay in the filling of their branches.

The patient passed the acute period of subarachnoid hemorrhage without added neurological deficit and was discharged from clinic 17 days after the intervention.

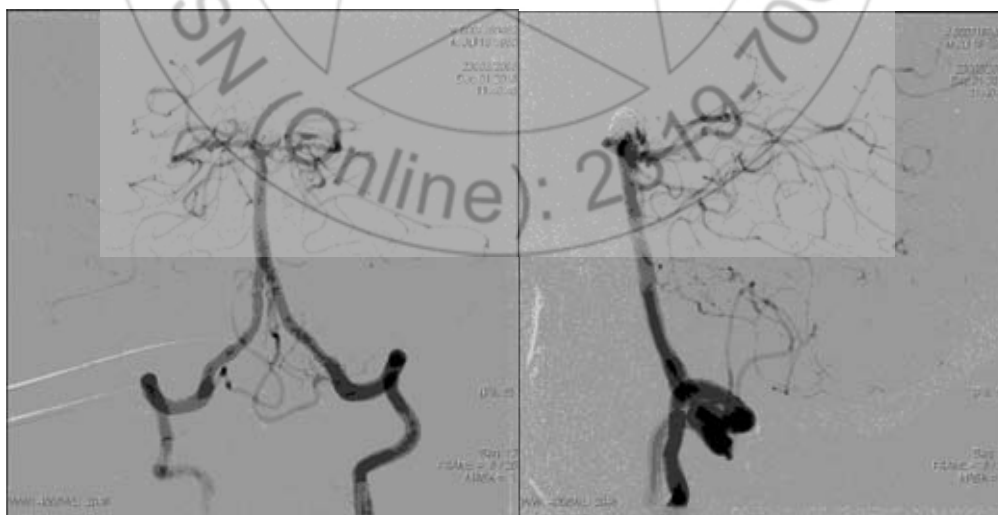


Figure 3: Angiographic images of the complete embolization of the aneurysm. The blood flow in the two posterior cerebral arteries, the basilar artery and the two supracerebellar arteries is not compromised

2. Conclusion

Although rare, aneurysms of the vertebral artery are extremely difficult to be resolved by conventional surgical methods. By its techniques, such as ordinary coiling or balloon-assisted coiling, endovascular treatment is a safe and

more reliable modern approach in the treatment of such lesions. Balloon-assisted coiling allows fast and good compacting of the coils for achieving a stable configuration of coils within the time window of a few minutes. Balloon-assisted coiling and double microcatheter technique extend the range of aneurysms, which can be successfully

resolved with endovascular treatment, even in situations of emergency.

ruptured brain aneurysms. *Roentgenologia & Radiologia*, 2016, LV: 203-205

Roentgenologia &

References

- [1] Ahn JY, Han IB, Kim TG, Yoon PH, Lee YJ, Lee BH, et al. Endovascular treatment of intracranial vertebral artery dissections with stent placement or stent-assisted coiling. *AJNR Am J Neuroradiol*.2006;27:1514–1520
- [2] Ding H, He M, You C, Deng L. [Application of endovascular covered stent for treating vertebral dissecting aneurysm and carotid-cavernous fistula] *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi*.2009;23:215–218.
- [3] Cloft HJ, Joseph GJ, Tong FC, et al. Use of three-dimensional Guglielmi detachable coils in the treatment of wide-necked cerebral aneurysms. *AJNR Am J Neuroradiol* 2010;21:1312–1314
- [4] Raymond J, Guilbert F, Roy D. Neck-bridge device for endovascular treatment of wide-neck bifurcation aneurysms: initial experience. *Radiology* 2001;221:318–326
- [5] Cottier JP, Pasco A, Gallas S, et al. Utility of balloon-assisted Guglielmi detachable coiling in the treatment of 49 cerebral aneurysms: a retrospective, multicenter study. *AJNR Am J Neuroradiol* 2001;22:345–351
- [6] Moret J, Cognard C, Weill A, et al. [Reconstruction technic in the treatment of wide-neck intracranial aneurysms: long-term angiographic and clinical results apropos of 56 cases]. *J Neuroradiol* 1997;24:30–44
- [7] Tumialan LM, Zhang YJ, Cawley CM, et al. Intracranial hemorrhage associated with stent-assisted coil embolization of cerebral aneurysms: a cautionary report. *J Neurosurg*. 2008;108(6):1122–1129.
- [8] Shima H, Nomura M, Muramatsu N, et al. Embolization of a wide-necked basilar bifurcation aneurysm by double-balloon remodeling using HyperForm compliant balloon catheters. *J Clin Neurosci*.2009;16(4):560–562.
- [9] Fiorella D, Woo HH. Balloon assisted treatment of intracranial aneurysms: the conglomerate coil mass technique. *J Neurointerv Surg*. 2009;1:121–131.
- [10] Baxter BW¹, Rosso D, Lownie. Doublemicrocatheter technique for detachable coil treatment of large, wide-necked intracranial aneurysms. *SP AJNR Am J Neuroradiol*. 1998 Jun-Jul;19(6):1176-8.
- [11] Shin YS, Kim DI, Lee SI, et al. The usefulness of the new double-catheter technique in the treatment of parent artery incorporated wide-necked aneurysm with Guglielmi detachable coils. *Interventional Neuroradiology*. 2000;6:61–64.
- [12] Kwon OK, Kim SH, Kwon BJ, et al. Endovascular treatment of wide-necked aneurysms by using two microcatheters: Techniques and outcomes in 25 patients.
- [13] S. Sirakov, B. Kamenov, M. Penkov, K. Romansky, Internal carotid artery blister aneurysm embolization *Roentgenologia & Radiologia*, 2015, LIV:184-186
- [14] S. Sirakov, M. Penkov, A. Sirakov, K. Minkin, Y. Todorov et al. Endovascular embolization of mirror brain aneurysms *Roentgenologia & Radiologia*, 2016, LV: 200-202
- [15] S. Sirakov, M. Penkov, A. Sirakov, K. Minkin, Y. Todorov et al. Balloon assisted coiling of wide neck