Endovascular Treatment of a Small Aneurysm of the Superior Cerebellar Artery with a Flow-Diverter Device

A Case Report

F. BRIGANTI, M. MARSEGLIA, G. LEONE, G. BRIGANTI, D. PICCOLO, M. NAPOLI, F. CARANCI

Unit of Interventional Neuroradiology, Department of Advanced Biomedical Sciences, Federico II University; Naples, Italy

Key words: endovascular treatment, intracranial aneurysm, superior cerebellar artery, flow-diverter device, pipeline embolization device

SUMMARY – We describe the case of a 62-year-old woman who presented with a small fusiform left superior cerebellar artery (SCA) aneurysm. Aneurysms located on the SCA are uncommon and their presentation, natural history and clinical management are poorly understood. Reports on the endovascular or surgical management of SCA aneurysms are rare and usually incorporated in clinical series of basilar artery or posterior circulation aneurysms. The patient was treated by delivery of a flow-diverter Pipeline Embolization Device (PED - Chestnut Medical/ev3) at the origin of vessel. She had no procedural complications and the aneurysm volume was reduced. This paper presents additional evidence to literature reports suggesting that the new endovascular flow-diverter devices are an effective and well-tolerated treatment for complex aneurysms. Our review contributes data on the incidence of recurrence as a measure of long-term efficacy of this therapeutic approach.

Introduction

Aneurysms of the cerebellar arteries are rare, representing 0.8% of all cerebral aneurysms; approximately 0.2% are located on the superior cerebellar artery (SCA)^{1,2}. These aneurysms are strongly related to cranial nerves III, IV and V, and symptoms could depend on these nerve palsies. We describe a case of a small proximal fusiform SCA aneurysm successfully treated with a flow-diverter device (FDD). We also review the literature on aneurysms of the posterior circle treated with FDD.

Case Report

A 62-year-old woman was referred to our Institute for treatment of a small left superior cerebellar artery (SCA) aneurysm. She had a two-month history of diplopia and headache. After

an emotionally stressful episode the patient had acute onset nuchal headache and later diplopia, right brachial weakness, vomiting and loss of consciousness lasting about one minute. A computed tomography (CT) scan performed at another hospital did not show any pathological finding. The neurological disorders regressed in a short time. After about a week she presented again diplopia, evidence of ocular paresis and headache, but refused hospitalization. Another CT showed subarachnoid hemorrhage involving the peri-pontine and suprasellar cisterns, more on the right side and extending along the tentorium and the bulbo-medullary junction. CT Angiography (CTA) performed at the same time also disclosed a small quadrangular aneurysm at the origin of the left SCA.

The patient was hospitalized in our institution for further investigation. Neurological examination on admission showed deficiency of the sixth cranial nerve on the left. Digital angiography

Figure 1 Right vertebral artery angiogram. Frontal projection (A) and right oblique anterior projection (B) DSA show a left SCA aneurysm.

(DSA) showed an SCA aneurysm and another small right carotid-ophthalmic aneurysm (Figure 1 A,B). The origin of the right posterior cerebral artery (PCA), at pre-communicating (P1) level, appeared stenotic and the left PCA originated from the internal carotid artery (ICA). On the basis of the aneurysm's location and morphology and to avoid SCA occlusion, an endovascular approach with FDD was scheduled.

After two weeks a new angiography was performed but due to the persistence of vasospasm the treatment was postponed. The next week, one month after symptomatology onset, we proceeded to endovascular treatment.

The intervention was performed under general anesthesia and a loading dose of clopidogrel (375 mg) was given. Femoral access was obtained by means of single-wall puncture with a 6F vascular sheath. The patient received a heparin bolus of 5000 IU to achieve a targeted activated clotting time of 200-300s after femoral puncture, followed by bolus injections of 1000 IU after 60 minutes. A 6F guiding catheter (STR Envoy-Cordis) was advanced into the right vertebral artery. Diagnostic angiograms were obtained to define the optimal projections and the validity of the collateral network. A test occlusion was not performed. A microcatheter (Marksman Catheter) was advanced through the guiding catheter and placed in the right P1 segment; then the FDD (PED – Chestnut Medical / EV3 3×14 mm) was positioned between the right PCA and basilar artery to cover the SCA origin. Handling the detachment of the FDD, the distal guide ruptured but was recovered with an

Amplatz 2 mm goose neck snare (Figure 2). The early angiograms of the vertebral artery and ipsilateral ICA, after compliant delivery of the FDD, showed poor and delayed left SCA opacification without aneurysm visualization; the right SCA flow was delayed but efficient (Figure 3).

On awakening, the patient was torpid and VII nerve palsy was evident. So an intravenous bolus of 5 ml of abciximab was administered and a dose of 500 mg was given intravenously during 24 hours. The course after the procedure was uneventful, with no neurological deficits. A CT scan, performed 72 hours after treatment, showed the absence of ischemic lesions. Dual antiplatelet therapy was maintained for six months. During hospitalization, left ophthalmoplegia and headache gradually improved.

CT and CTA performed four months after the procedure showed a disappearance of the aneurysm and no infarct of the SCA territory. DSA at six months showed persistent obliteration of the left SCA aneurysm with normal flow (Figure 4). Contrast-enhanced magnetic resonance angiography (MRA) performed after 12 months confirmed the patency of the SCA and no infarct of the SCA territory. (Figure 5). The patient had a complete clinical remission.

Discussion

Aneurysms located on cerebellar arteries are uncommon, and their underlying pathology, presentation, natural history, and clinical management are poorly understood. Locksley

Figure 2 Right vertebral artery angiogram. Frontal projection: unopacified SCA aneurysm. Poor and delayed left SCA flow. Delayed but efficient right SCA opacification.

Figure 3 PED deployment. Frontal projection. Recovery of the broken guide with a 2 mm Amplatz goose neck snare.

reported six aneurysms arising from the superior cerebellar artery (SCA) in a series of 2349 aneurysms; Gacs et al. reported six peripheral SCA aneurysms in a surgical series of 910 vertebrobasilar aneurysms^{2,3}. Aneurysms involving the SCA are usually peripheral; they present with subarachnoid hemorrhage (SAH) or fourth nerve dysfunction, and in some cases, with cerebellar ischemic events without SAH. Aneurysms arising from peripheral segments of cerebral arteries may be congenital, but they are often acquired, reported as mycotic, traumatic or associated with an arteriovenous malformation^{1,3}.

When SCA aneurysms arise at its origin they are very difficult to treat and it is often necessary to sacrifice the parent vessel^{1,3-5}. There is generally a good collateral circulation between the SCA and both posterior inferior cerebellar and anterior inferior cerebellar arteries through the vermician arcade, which often allows reconstitution of the distal branches of the SCA if a more proximal occlusion of that artery occurs. Moreover there is a paucity of perforating branches arising from the anterior pontine and lateromesencephalic portions of the SCA, which are well collateralized with the paramedian and short circumferential perforators from the basilar artery (BA)^{6,7}. Although this anatomic arrangement probably reduces the likelihood of perforator ischemia to the ventral brainstem and despite aneurysm location and its irregular shape, we tried to avoid vessel embolization by reconstructing the BA and exploiting the flow-diversion mechanism of the new generation devices^{7,8}.

Based on the largest case studies, the percentage of complications in treating posterior circle aneurysms with flow-diversion devices varies from 0% to 33%.⁶⁻¹². In Saatci et al.'s study, one patient died due to thrombus formation in the right P1, resulting in brainstem infarct after placement of the PED extending from the left PCA to the BA, jailing the right P1, to treat a wide-neck left SCA origin aneurysm¹⁰⁻¹³.

Ischemic complication in the treatment of aneurysm by FDD was mostly in the posterior circulation because it predisposes perforator occlusion by the FDD or vessels traction. Instead the literature also reports ischemic complication due to in-stent thrombosis with BA or VA occlusion¹⁴. Hemorrhagic events, such as delayed rupture after device deployment, are reported in large, giant and fusiform aneurysms⁶. The case we present disclosed poor opacification of bilateral SCAs after stent deployment. Although this patient recovered without infarction probably due to good collateral circulation, this is not always possible particularly in patients with poor collateral circulation. Perhaps to avoid occlusion of perforators we chose a PED diameter larger than the BA (oversizing) which allows a wider area of the FD cells.

The concept of treating aneurysms of the origin of SCA using FDD positioning on the BA, avoiding the 'jailing' technique is not new. In order to treat the aneurysm without sacrificing the parent vessel, we exploited the flow diversion to decrease the blood rush into the SCA ectasia. Six-month follow-up DSA and

Figure 4 Right vertebral artery angiogram at 6 months. Frontal projection. No aneurysm is detected. Flow in the SCA appears increased.

Figure 5 MPR MRA coronal image at 12-months; regular opacification of the SCA without the aneurysm.

12-month MRA showed a striking reduction in volume of the SCA aneurysm with a decrease in ocular symptoms.

Conclusion

Endovascular treatment with FDD has emerged in patients with ‘uncoilable’ aneurysms. This case shows that in selected patients endovascular treatment of small SCA

aneurysm with PED in the basilar artery is an effective and well tolerated treatment, and the FDD allows adequate perfusion of the lateral branch of parent vessels.

In our experience, dysmorphic and small aneurysms of SCA origin can be treated safely with these new devices, avoiding sacrifice of the entire vessel.

A greater number of cases and longer follow-up are needed to demonstrate the long-term efficacy of this type of treatment.

References

- 1 Danet M, Raymond J, Roy D. Distal superior cerebellar artery aneurysm presenting with cerebellar infarction: report of two cases. *Am J Neuroradiol.* 2001; 22: 717-720.
- 2 Lubicz B, Leclerc X, Gauvrit JY, et al. Endovascular treatment of peripheral cerebellar artery aneurysms. *Am J Neuroradiol.* 2003; 24: 1208-1213.
- 3 Peluso JPP, Van Rooij WJ, Sluzewski M, et al. Distal aneurysm of cerebellar arteries: incidence, clinical presentation, and outcome of endovascular parent vessel occlusion. *Am J Neuroradiol.* 2007; 28: 1573-1578.
- 4 Briganti F, Cicala D, Tortora F, et al. Endovascular treatment of a giant dissecting aneurysm of the posterior cerebral artery: A case report and literature review. *Neuroradiol J.* 2012; 25 (6): 695-701.
- 5 Caranci F, Napoli M, Cirillo M, et al. Basilar artery hypoplasia. *Neuroradiol J.* 2012; 25 (6): 739-743.
- 6 Kulcsár Z, Houdart E, Bonafé A, et al. Intra-aneurysmal thrombosis as a possible cause of delayed aneurysm rupture after flow-diversion treatment. *Am J Neuroradiol.* 2011; 32: 20-25.
- 7 Briganti F, Napoli M, Tortora F, et al. Italian multicenter experience with flow-diverter devices for intracranial unruptured aneurysm treatment with periprocedural complications – a retrospective data analysis. *Neuroradiology.* 2012; 54: 1145-52. doi: 10.1007/s00234-012-1047-3. Epub 2012 May 9.
- 8 Fischer S, Vajda Z, Perez MA, et al. Pipeline embolization device (PED) for neurovascular reconstruction: initial experience in the treatment of 101 intracranial aneurysm and dissection. *Neuroradiology.* 2012; 54: 369-382.
- 9 Philips TJ, Wenderoth JD, Phatouros CC, et al. Safety of the pipeline embolization device in treatment of posterior circulation aneurysms. *Am J Neuroradiol.* 2012; 33: 1225-1231.
- 10 Saatci I, Yavuz K, Ozer C, et al. Treatment of intracranial aneurysms using the pipeline flow-diverter embolization device: a single-center experience with long-term follow-up results. *Am J Neuroradiol.* 2012; 33: 1436-46.
- 11 Caranci F, Briganti F, Cirillo L, et al. Epidemiology and genetics of intracranial aneurysms. *Eur J Radiol.* Epub 2013 Feb 8 . doi:pii: S0720-048X(13)00011-9. 10.1016/j.ejrad.2012.12.026.
- 12 Briganti F. Reply to comment of Dr. W-J van Rooij on: Italian multicenter experience with flow-diverter devices for intracranial unruptured aneurysm treatment with periprocedural complications a retrospective data analysis. *Neuroradiology.* 2012; 54 (10): 1181-1182.
- 13 Becske T, Kallmes DF, Saatci I, et al. Pipeline for uncoilable or failed aneurysms: results from a multicenter clinical trial. *Radiology.* Epub 2013 Feb 15.
- 14 Fiorella D, Hsu D, Woo HH, et al. Very late thrombosis of a pipeline embolization device construct: case report. *Neurosurgery.* 2010; 67 (3 Suppl Operative): onsE313-314.
- 15 Chaloupka JC, Putman CM, Awad IA. Endovascular therapeutic approach to peripheral aneurysm of the superior cerebellar artery. *Am J Neuroradiol.* 1996; 17 (7):1338-42.

Ferdinando Caranci, MD
Service of Neuroradiology
Department of Neurology
University Federico II
Via Pansini, 5
80131, Napoli
Italy
E-mail: ferdinandocaranci@libero.it