"Mirror" Aneurysms Involving the Bilateral Distal Posterior Cerebral Artery

A Case Report of Endovascular Treatment and Literature Review

S.K. BAIK, C.H. SOHN, S.K.WOO

Department of Diagnostic Radiology, Dongsan Medical Center, Keimyung University School of Medicine; Korea

Key words: mirror aneurysms, posterior cerebral artery, endovascular treatment

Summary

We report the case of patient with bilateral and symmetrical aneurysms, mirror image, of the distal posterior cerebral artery (PCA) who presented with subarachnoid haemorrhage. The aneurysms were treated by endovascular approach using Guglielmi detachable coils (GDCs). A review of the pathophysiology, clinical manifestations and management of mirror aneurysms is presented and discussed.

Introduction

Mirror-image aneurysms comprise fewer than 5% of aneurysms [1]. However, distal PCA aneurysms are rare. Only 13% of all PCA aneurysms are considered to be distal to the posterior temporal branch [2]. The combination of distal aneurysms and bilaterality is more unusual. Mirror-image aneurysms at the distal PCA have not been reported in the literature despite large series with multiple aneurysms [1,3]. Mirror-image aneurysms commonly pose significant decision-making dilemmas for surgeons [1]. Surgical treatment usually consists of separate operative interventions, initially targeting the ruptured aneurysm. In some patients, however, the location of the aneurysm, its size, or its morphology hinder surgical clipping. We report a case of mirror image aneurysms at the distal PCA that underwent endovascular treatment with GDCs. One was treated by occlusion of the aneurysm sac and parent artery, the other was successfully treated with preservation of the parent artery.

Case Report

A 63-year-old female, who had a history of semicoma (Hunt and Hess Grade IV) after acute severe headache, was admitted to another hospital where computed tomography (CT) and angiography were done. CT revealed subarachnoid haemorrhage predominantly in the left ambient and quadrigeminal cistern (figure 1). Angiography revealed bilateral and symmetrical aneurysms, mirror shaped, at the distal PCA and she was referred to our institution for endovascular treatment. The patient's medical history was hypertensive. She was negative for trauma, previous neurological disease and substance abuse. Her family history was not contributory.

The endovascular treatment was performed under general anesthesia and systemic heparinization. The adequacy of systemic anticoagulation was monitored by frequent measurements of the activated clotting time (ACT). A baseline ACT was obtained prior to bolus infusion of heparin (50IU/kg body weight), and hourly thereafter. The bolus infusion of he-

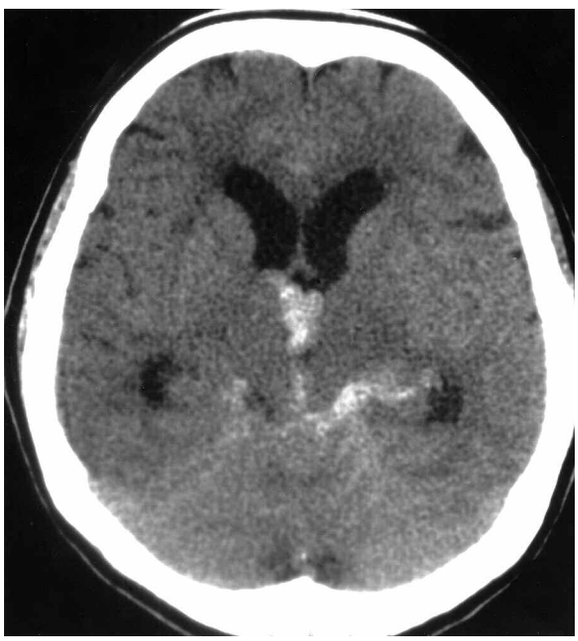

Figure 1 Non-contrast CT scan of the head shows subarachnoid haemorrhage in the ambient and quadrigerminal cistern, associated with intraventricular haemorrhage in 3rd ventricle.

parin was followed by a continuous injection (1000 to 2000 IU/h), with the purpose of doubling the baseline ACT. Preembolic cerebral angiography revealed bilateral small distal PCA aneurysms. The aneurysms arose on the P2-P3 junction. The right side aneurysm showed a lobulated saccular aneurysm with no defined neck, 7 mm in its largest diameter. The left side one revealed a small saccular aneurysm with narrow neck, 4 mm in its largest diameter (figure 2).

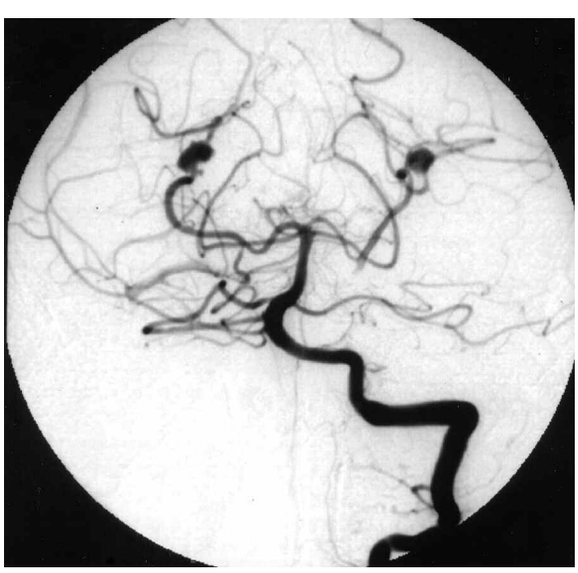

Figure 2 Towne's view of left vertebral angiogram shows a lobulated saccular aneurysm with no defined neck in the right P2-3 junction and a small saccular aneurysm with well defined neck in the left P2-3 junction.

After the induction of general anesthesia, a 5F guiding catheter was positioned in the left vertebral artery. Initial embolization was attempted in the right side aneurysm. A microcatheter (Fastracker, Target Therapeutics) was passed in a coaxial technique through the introducer catheter followed by selective catheterization of the right PCA. The tip of the catheter was placed within the aneurysm sac. The aneurysm and the parent artery were permanently occluded. A second embolization was then attempted via the left vertebral artery initially. The microcatheter did not advance beyond the P1-P2 junction. So the 5F guiding catheter was repositioned in the left internal carotid artery. A microcatheter was advanced through the left posterior communicating artery and into the aneurysm sac of the left PCA (figure 3). The aneurysm sac was obliterated successfully while preserving the parent PCA (figure 4).

The patient experienced no change in neurologic condition during coil embolization. After endovascular treatment, she was transferred to the referred hospital. Two weeks after her aneurysm treatment, CT demonstrated a small infarction in the right PCA territory. The postoperative course was uneventful, except for focal visual field defect.

Discussion

Bilateral symmetrical aneurysms, mirror image aneurysms, are usually located in the ophthalmic artery, posterior communicating artery, the bifurcation of the internal carotid artery, the middle cerebral artery, pericallosal artery and posterior inferior cerebellar artery. Mirror image aneurysms represent fewer than 5% of cases. However, mirror-image aneurysms at the P2-P3 junction of posterior cerebral artery have not been reported in the literature despite large series with multiple aneurysms [1,4,5,6].

The cause and time course of cerebral aneurysm formation is still unclear. Aneurysms occurred at the same or mirror-image sites in sibling pairs and twins in 69% - 70% of patients.

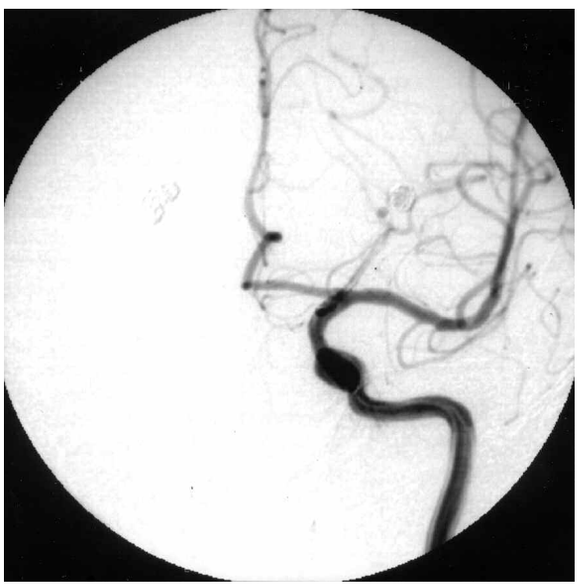

Figure 3 Towne's view of left internal carotid angiogram, during the occlusion of the left aneurysm, reveals a microcatheter in the left posterior cerebral artery and aneurysm sac through the left posterior communicating artery.

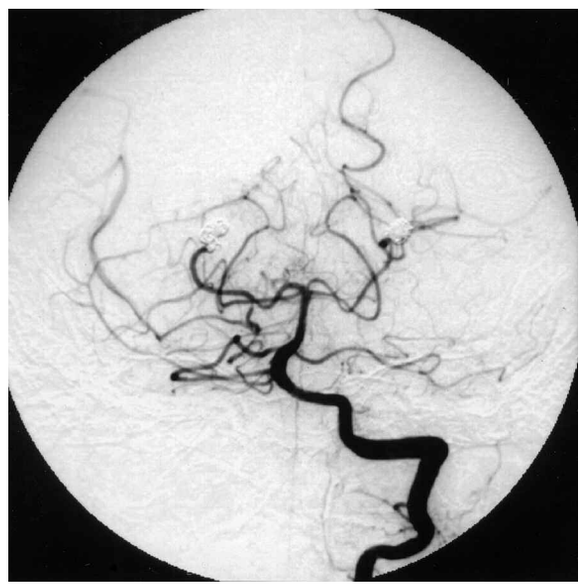

Figure 4 Towne's view of the post-treatment vertebral angiogram shows occlusion of an aneurysmal sac and the parent artery on the right side and successful obliteration of a saccular aneurysm with preservation of the parent artery on the left side with GDC.

The incidence is reported to be 51 to 65% for familial aneurysms, which was significantly higher than the 21% expected from randomly selected sporadic aneurysm pairs [4]. The characteristics of intracranial aneurysms in families, siblings and identical twins provide evidence of genetic factors. In a recent report [5] Campos et al suggested that a cause could be an embryological endothelial defect leading to dysfunctional vessel wall remodeling in the presence of repeated or long-lasting triggers. This defect can occur in one or two (usually consecutive) embryonic segments of the neural crest or mesoderm.

Mirror aneurysms with symmetrical locations and similar size would correspond to bilateral impairment of cells in the same embryological territory. Formation of new aneurysms, both single and multiple, at different sites in cases in which there have previously been subarachnoid haemorrhage is rare, but does occur. This underlines the importance of structural alterations by acquired factors, as does the relatively rare occurrence of aneurysms in children and the increasing prevalence of these lesions with advancing age.

The most common clinical presentation of mirror-image aneurysms described in the literature is the subarachnoid haemorrhage [6,7,8]. In our case, the subarachnoid haemorrhage was probably related to a rupture of the left side distal PCA aneurysm. The natural history of multiple intracranial saccular aneurysms parallels that of significant unruptured lesions with a significant rate of subsequent rupture [1].

The decision whether and when to treat multiple aneurysms is based on many factors and is individualized for each patient. Surgical treatment usually consists of separate operative interventions, initially targeting the ruptured aneurysm, even though some cases underwent bilateral clipping at one operative sitting [6,8].

The surgical strategy for a patient such as ours may be more complex. Endovascular treatment at this condition may be an alternative method of treatment. Endovascular treatment of the distal PCA aneurysms has included selective endovascular obliteration with GDC, with preservation of the parent artery, and occlusion of the parent artery and aneurysm sac. In the case of small aneurysms with a small neck, selective endovascular obliteration with preservation of the parent artery is the treatment of choice for berry aneurysms of the PCA and is safe and effective and associated with good anatomic results as our left side aneur-

ysm. Preservation of antegrade flow in the PCA must naturally be one of the prime objectives in the treatment of aneurysms arising from this vessel. However, in the case of aneurysm with no defined neck, parent artery occlusion becomes inevitable in order to obliterate the aneurysm. In our right side aneurysm, the aneurysm and the parent artery were permanently occluded.

In patients whose treatment of the PCA aneurysm required permanent artery occlusion, such as ours, visual field deficits may occur. However, there was a relatively low incidence of visual field defect, even though focal visual field defect in our patient occurred. The low incidence of visual field defect complicating parent artery occlusion is related to the rich anastomotic collaterals that exist between the territory of the PCA and that of other arteries[9]. Anatomic knowledge of the various segments of the PCA and their functional territories are necessary in order to predict and/or avoid the neurologic deficit that may occur as a result of their purposeful occlusion.

Conclusions

We describe a very rare case of mirror aneurysms involving bilateral distal PCA. Endovascular treatment may be an alternative method of treatment for those patient who have mirror aneurysms in distal PCA.

References

1 Yasargil MG: Microneurosurgery. Stuttgart, Georg Thieme Verlag, 1984.
2 Zeal AA, Rhoton AL Jr: Microsurgical anatomy of the posterior cerebral artery. J Neurosurg 48: 534-559, 1978.
3 Locksley HB: Report on cooperative study of intracranial aneurysms and subarachnoid haemorrhage: Section V, Part 1-Natural history of subarachnoid haemorrhage, intracranial aneurysms and arteriovenous malformations: Based on 6386 cases in the cooperative study. J Neurosurg 25: 219-239, 1966.
4 Kasuya H, Onda H et Al: Clinical Features of Intracranial Aneurysms in Siblings Neurosurgery 46: 1301-1306, 2000.
5 Campos C, Churojana A et Al: Multiple intracranial arterial aneurysms: a congenital metameric disease? Interventional Neuroradiology 4: 293-299, 1998.
6 Wellman BJ, Loftus CM: Bilateral (Mirror-image) Aneurysms at the Origin of the Posteroinferior Cerebellar Artery. Neurosurgery 42: 938-940, 1998.
7 Yamada K, Nakahara T et Al: Multiple "Mirror" Aneurysms Involving Intracavernous Carotid Arteries and Vertebral Arteries: Case Report. Surg Neurol 54: 361-365, 2000.
8 Sousa J, Iyer V, Roberts G: "Mirror Image" Distal Anterior Cerebral Artery Aneur-ysms A Case Report of two Patients with Review of Literature Acta Neurochir 144: 933-935, 2002.
9 Elisa FC, Richard PK et Al: Aneurysms of the Posterior Cerebral Artery: Classification and Endovascular Treatment. Am J Neuroradiol 22: 27-34, 2001.

Seung Kug Baik, M.D.
Department of Diagnostic Radiology,
Dongsan Medical Center,
Keimyung University School of Medicine,
194 Dongsan-Dong, Jung-ku, Taegu 700-712, Korea
E-mail: skbaik@dsmc.or.kr