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*Case Report*

# Fusiform superior cerebellar artery aneurysm treated with flow diversion: A case report

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## ABSTRACT

**Background:** Fusiform aneurysms of the distal superior cerebellar artery are rare and challenging to treat. Due to the rarity of these lesions, there is little consensus regarding their management. Treatment options have traditionally included parent artery sacrifice with either an endovascular approach or microsurgical clipping. Given the small diameter of the superior cerebellar artery, flow diversion has not been typically considered as a viable treatment option for these aneurysms.

**Case Description:** A 67-year-old female presented complaining of severe sudden onset headache. Noncontrast head CT demonstrated no intracranial hemorrhage. Head CT angiogram demonstrated a 4.2 mm fusiform aneurysm in the distal right superior cerebellar artery. The patient underwent treatment with the Pipeline embolization device which was deployed in the right superior cerebellar artery covering the aneurysm. Six-month posttreatment follow-up angiogram demonstrated resolution of the aneurysm with patency of the parent vessel.

**Conclusion:** To the best of our knowledge, this is the first report of a distal superior cerebellar artery aneurysm treated with the Pipeline embolization device. The use of a Pipeline stent to create flow diversion should be considered in a case of a fusiform aneurysm of the right superior cerebellar artery. Treatment with flow diversion may allow for the treatment of the aneurysm while preserving patency of the parent vessel.

**Keywords:** Aneurysm, Endovascular, Flow diversion, Fusiform, Pipeline

## INTRODUCTION

Aneurysms of the vertebrobasilar system comprise fewer than 10% of all intracranial aneurysms. Among the posterior circulation aneurysms, superior cerebellar aneurysms (SCAs) are rare and account for 1.7% of all treated intracranial aneurysms, with the most typical location being the junction of the basilar artery and SCA.[8] Distal SCA aneurysms (those distal to the SCA-basilar junction) are even rarer and constitute <0.2% of all intracranial aneurysms.[2] When encountered, distal SCA aneurysms have been associated with arteriovenous malformations, trauma, certain conditions such as systemic lupus erythematous, and dissections.[6]

Fusiform aneurysms of the distal SCA are particularly challenging to treat. Treatment options for these aneurysms have typically consisted of parent artery sacrifice with either endovascular means or microsurgical clipping with or without bypass.[7] Flow diverters recently emerged as

a potential treatment option for fusiform aneurysms in the posterior circulation, with some cases involving dissecting aneurysms involving either the origin of the posterior inferior cerebellar artery (PICA) or basilar artery, where the flow diverter has been placed in the vertebral artery and the basilar artery, respectively.[7] However, there has been very limited experience with the use of flow diverters in the treatment of distal SCA aneurysms. We report a case of a fusiform distal SCA aneurysm successfully treated with flow diversion.

## CASE DESCRIPTION

A 67-year-old female with a medical history of hypertension and active smoking presented to the emergency department after experiencing a severe headache of sudden onset in the right side of her head. The patient had undergone elective screening colonoscopy the day prior. The morning following the colonoscopy procedure she woke up experiencing a right-sided headache associated with nausea, right-arm pain, right eye blurry vision, and slight fingertip numbness on her right side after which she decided to come to the hospital. She denied any recent trauma, fever, chills, or neck stiffness. On physical examination, she was neurologically intact.

Noncontrast head CT demonstrated no acute intracranial pathology, specifically no evidence of subarachnoid hemorrhage. CT angiogram (CTA) demonstrated a 4.2 × 4.2 × 4.2 mm fusiform aneurysm arising off the superior cerebellar artery, approximately 1.5 cm distal to its origin off the basilar artery. The headache subsided the following day. Diagnostic cerebral angiogram was performed and redemonstrated the fusiform aneurysm, essentially unchanged in appearance when compared to the CTA [Figure 1]. The patient was started on dual antiplatelet agents consisting of clopidogrel 75 mg daily and aspirin 325 mg daily. One week later, the patient underwent successful Pipeline embolization of the aneurysm [Figure 2]. Briefly, a 6-Fr sheath was inserted into the right common femoral artery and a 6-Fr Benchmark guide catheter (penumbra) advanced over a diagnostic catheter and glide wire into the right vertebral artery. Through the guide catheter, a Phenom Plus distal access catheter was advanced over a Phenom microcatheter and Synchro-2 microwire into the proximal basilar artery. The microcatheter was then advanced over the microwire into the right superior cerebellar artery distal to the aneurysm. A 2.5 mm wide and 10 mm length Pipeline embolization device was then deployed along the fusiform aneurysm. Postdeployment angiogram demonstrated excellent apposition of the device to the parent vessel and evidence of some contrast stagnation within the aneurysm.

The patient was neurologically intact postoperatively and was discharged home on postoperative day 2. A cerebral angiogram performed 6 months later demonstrated resolution of the aneurysm with patency of the superior cerebellar artery [Figure 2]. The patient had no complaints and was neurologically intact.

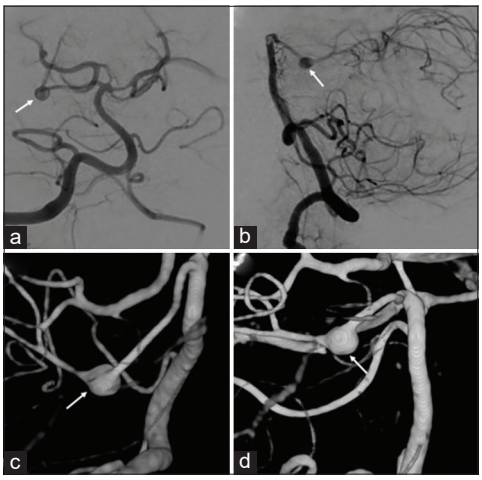


**Figure 1:** Frontal (a) and lateral (b) digital subtraction angiography images demonstrating a fusiform aneurysm of the right superior cerebellar artery (arrow). 3D rotational angiography images (c and d) further depict the aneurysm and its relation to the parent vessel.

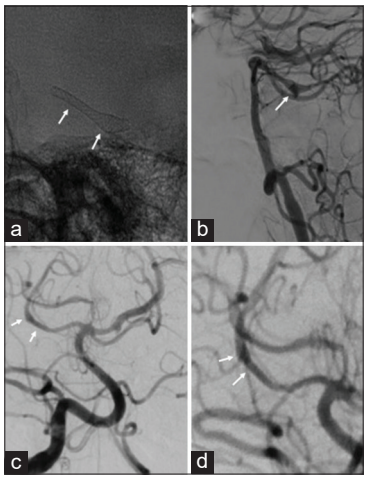


**Figure 2:** Native image (a) during the deployment of the Pipeline embolization device (PED) demonstrating the device already deployed (arrows). (b) Lateral digital subtraction angiography performed immediately following the deployment of the PED demonstrates contrast stagnation within the aneurysm and patency of the parent vessel. Six-month angiographic follow-up (c and d) demonstrates resolution of the aneurysm with patency of the superior cerebellar artery (arrows).

## DISCUSSION

Fusiform or dissecting aneurysms affecting the distal segments of the superior cerebellar artery are a rare entity. Review of the previous cases suggests that subarachnoid hemorrhage is the most common mode of presentation,

however, a myriad of clinical symptoms including cerebellar infarction or brainstem ischemia, hemifacial paralysis with hemiplegia, diplopia with ocular dysmotility due to trochlear nerve dysfunction, and sudden onset torticollis has also been reported previously.[8] Our patient presented with a severe right hemicranial headache of sudden onset following a routine screening colonoscopy procedure. Her neurological examination was intact and CT head did not reveal any subarachnoid hemorrhage. Considering the wide range of clinical presentation and nonspecific nature of the physical findings, a low threshold must be maintained for the diagnostic workup in these cases.

We explored both open and endovascular approaches for the treatment of this aneurysm. Open microsurgical techniques to treat distal SCA aneurysms include clipping of the aneurysm, wrapping the aneurysm to induce wall fibrosis, parent vessel occlusion, and trapping the aneurysms with or without vascular bypass to restore the distal circulation. A deep anatomical location in the brain and proximity to the brainstem renders these aneurysms difficult to access surgically. In addition, the morbidity related to the craniotomy and skull base microsurgical approaches is relatively high.[9] Given these reasons, we decided to initially consider an endovascular approach for treatment.

In contrast to the surgical approaches, an endovascular technique offers a more direct access to these aneurysms for treatment. Occlusion of the parent vessel through endovascular coil embolization has been a commonly utilized technique for fusiform aneurysms involving very small diameter arteries, such as the superior cerebellar artery.[7] More recently, the strategy to maintain the distal circulation through placement of flow diversion stents has emerged. Flow diversion offers a unique opportunity to preserve the distal circulation while excluding the aneurysm effectively. Bender *et al*. shared their experience of flow diversion device placement in 59 cases of various posterior circulation aneurysms which included 29% fusiform aneurysms and 25% of cases of dissecting aneurysms.[3] The study demonstrated high success rate of the procedure (98%) with complete occlusion rates of 68% at 6 months and 78% at 1 year of follow-up period. However, the majority of the cases in this study included aneurysms of the vertebrobasilar junction and for the two cases of SCA aneurysms, the aneurysms were located at the junction of the basilar and SCA, with the flow diversion device deployed in the basilar artery. In our report, the aneurysm was located in the distal SCA, therefore, the flow diversion device needed to be placed within the SCA.

Perforator infarction is a well-known complication of flow diverter treatment and can potentially lead to devastating consequences.[1] This can be particularly critical in the posterior circulation, likely because of the delicate perfusion and lack of collaterals to brain stem structures.[4] Careful evaluation of perforator vessels is essential before deploying a flow diverter stent. In our case, we performed a careful angiographic evaluation and found no significant perforator vessels arising off the affected segment. In addition, the distal location of this aneurysm gave us some reassurance, as most of the important SCA perforators to the brain stem arise from the proximal segment of the artery. The more distal aspects of the SCA give blood supply to the superior cerebellum, superior vermis, and cerebellar white matter, which tend to receive collaterals from the anterior cerebellar artery and the PICA.[5]

Vessel diameter plays a critical role while making the decision for flow diversion. A small vessel diameter poses a unique set of challenges to PED placement including difficulty in access as well as device placement, higher risk of kinking, vessel dissection, vasospasm, thrombosis, in-stent occlusion, and delayed ischemia due to intimal hyperplasia. Schob *et al*. successfully utilized Silk Vista Baby, a novel flow diverter, not yet available in the USA, with 2.25 mm and 2.75 mm diameter variants to treat 25 patients with small and distal vessel aneurysms arising from anterior communicating artery, pericallosal artery, and distal middle cerebral artery.[10] The smallest PED available right now is 2.5 mm in diameter, which was the one used in this report.

Considering all the above-mentioned technical nuances and potential risk of procedure-related complications, the use of flow diverting stents for fusiform aneurysms of the distal SCA remains limited. On our literature review, we found only one case of a ruptured distal SCA dissecting aneurysm which was successfully treated using flow-diverting device placement. Authors successfully utilized a low-profile visualized intraluminal support (LVIS Jr.) device (MicroVention, Tustin, CA) to cover a left distal fusiform aneurysm measuring 3 mm × 18 mm in size.[11] In contrast to this case, our patient presented with a presumably unruptured aneurysm diagnosed during the workup for headache. We opted to place a PED, which has been shown to have more flow diversion than other stents currently available in our market, including the LVIS Jr. To the best of our knowledge, this is the first report of a distal SCA aneurysm treated with PED.

On our 6-month angiographic follow-up, there was resolution of the aneurysm. We did notice some vessel irregularity in the vessel, which was otherwise patent. The patient will be followed up with angiogram in another 6 months and then 1 year later to confirm the obliteration of the aneurysm and stent and vessel patency.

## CONCLUSION

An effective obliteration of the aneurysm with preservation of the distal circulation is the ideal desirable goal for fusiform aneurysms. Flow diversion, though technically challenging

in distal vessels with smaller diameter, can be considered for treatment in patients with distal SCA aneurysms. However, a detailed knowledge of the vascular anatomy and technical expertise in the procedure is warranted.

### Ethical approval

All procedures performed in the studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

### Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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