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Flow diverter stent and conservative approaches in the management of giant serpentine aneurysms: A series of six cases

Abstract

Background: Giant Serpentine Aneurysms (GSA) are rare vascular lesions characterized by partial thrombosis and a tortuous intra-aneurysmal flow channel, associated with high morbidity and mortality. This study presents six cases of serpentine aneurysms treated with Flow Diverter (FD) stents and compares the results with current literature.

Methods: Six patients (five males, one female; aged 25–84 years) diagnosed with serpentine aneurysms were treated with FD stents at our institution. Clinical and radiological data were retrospectively analyzed. Coil embolization was not suitable due to wide neck and partial thrombosis. Dual antiplatelet therapy and corticosteroids were used post-procedure.

Results: Presenting symptoms included frontal headache (n=3), epileptic seizures (n=2), and right hemiparesis with dysarthria (n=1). Three aneurysms were located in the ACA A2 segment and three in the MCA M2–M3 segments. Flow diverter implantation was technically successful in all treated cases. During 6 - 24 months of follow-up, three patients remained stable, one developed recurrent thrombosis and MCA infarction, one had distal ACA A3 occlusion with spontaneous thrombosis, and two small untreated aneurysms (<1 cm) remained stable. No rebleeding or mortality occurred.

Conclusions: Flow diverter stents offer a safe and effective reconstructive option for serpentine intracranial aneurysms. While most patients achieve long-term stability, ischemic complications such as distal occlusion may occur. Conservative management is suitable for small, asymptomatic lesions.

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Keywords: Giant serpentine aneurysm; Flow diverter; Intracranial aneurysm; Endovascular therapy; Thrombosis; Middle cerebral artery.

Abbreviations: ACA: Anterior Cerebral Artery; Acom: Anterior Communicating Artery; CTA: Computed Tomography Angiography; FD: Flow Diverter; GSA: Giant Serpentine Aneurysm; LMWH: Low-Molecular-Weight Heparin; MCA: Middle Cerebral Artery; MRA: Magnetic Resonance Angiography.

Introduction

Giant Serpentine Aneurysms (GSAs) are rare, large, partially thrombosed vascular lesions—typically exceeding 25 mm in diameter—characterized by a tortuous intra-aneurysmal flow channel and a distinct distal outflow artery [1,2]. Unlike classical saccular aneurysms, GSAs are considered reconstructive vascular disorders and exhibit unique hemodynamic properties, rendering both surgical and endovascular management particularly challenging.

The pathogenesis of GSAs is thought to involve a combination of chronic thrombosis, intramural dissection, mural cell proliferation, and compensatory vascular remodeling [3]. Clinically, these lesions most commonly present with progressive neurological deficits, seizures, or symptoms related to mass effect. Although rupture is relatively uncommon, progressive thrombosis and distal ischemia may lead to significant morbidity.

Conventional treatment modalities, including surgical clipping and coil embolization, are frequently ineffective in

GSAs due to their wide necks, extensive intra-aneurysmal thrombosis, and complex flow dynamics [4]. The advent of Flow Diverter (FD) technology has resulted in a paradigm shift in the management of these lesions. FD stents reduce intra-aneurysmal blood flow, promote endothelialization, and enable gradual vascular reconstruction with subsequent aneurysm occlusion [5,6].

In this study, we present six cases of giant serpentine aneurysms diagnosed and followed at our institution. The clinical presentation, radiological characteristics, and therapeutic strategies are analyzed in the context of the current literature. Four patients were treated with flow diverter stents, whereas two small, asymptomatic aneurysms were managed conservatively.

Methods

Study population

This retrospective study included six patients diagnosed with serpentine aneurysms who were evaluated at the Departments of Neurology and Interventional Neuroradiology, Ege University Faculty of Medicine, between 2011 and 2025. Demographic characteristics, presenting symptoms, aneurysm location, radiological features, treatment modality, and clinical outcomes were systematically reviewed.

Imaging protocol

All patients underwent multislice brain Computed Tomography Angiography (CTA) for initial diagnosis and follow-up evaluation. When indicated, Magnetic Resonance Angiography (MRA) was additionally performed to further assess vascular morphology, intra-aneurysmal thrombus burden, and the presence of perianeurysmal edema. Imaging follow-up was scheduled at 1, 3, and 6 months after diagnosis or treatment, and annually thereafter.

Treatment and follow-up

Endovascular treatment with flow diverter stent implantation was performed in four patients, whereas two small, asymptomatic aneurysms were managed conservatively. All patients undergoing endovascular intervention received dual antiplatelet therapy consisting of aspirin (100 mg daily) in combination with either prasugrel (10 mg daily) or ticagrelor (90 mg twice daily). In patients with giant aneurysms, adjunctive corticosteroid therapy was administered to control perianeurysmal edema during the post-treatment period.

Cases

Case 1: A 25-year-old man presented with a one-month history of pressure-like frontal–occipital headaches. Neurological examination was unremarkable. Computed Tomography Angiography (CTA) revealed a 3 × 4 cm partially thrombosed giant serpentine aneurysm with associated dissection and perianeurysmal edema involving the left Anterior Cerebral Artery (ACA) A2 segment. Coil embolization was deemed unsuitable; therefore, a Flow Diverter (FD) stent was deployed. Dual antiplatelet therapy and adjunctive corticosteroids were administered. Follow-up imaging at 1, 3, and 6 months, and annually thereafter, demonstrated preserved stent patency, marked reduction of intra-aneurysmal flow, regression of perianeurysmal edema, and no residual aneurysmal filling. FD treatment resulted in successful hemodynamic stabilization and endothelial remodeling.

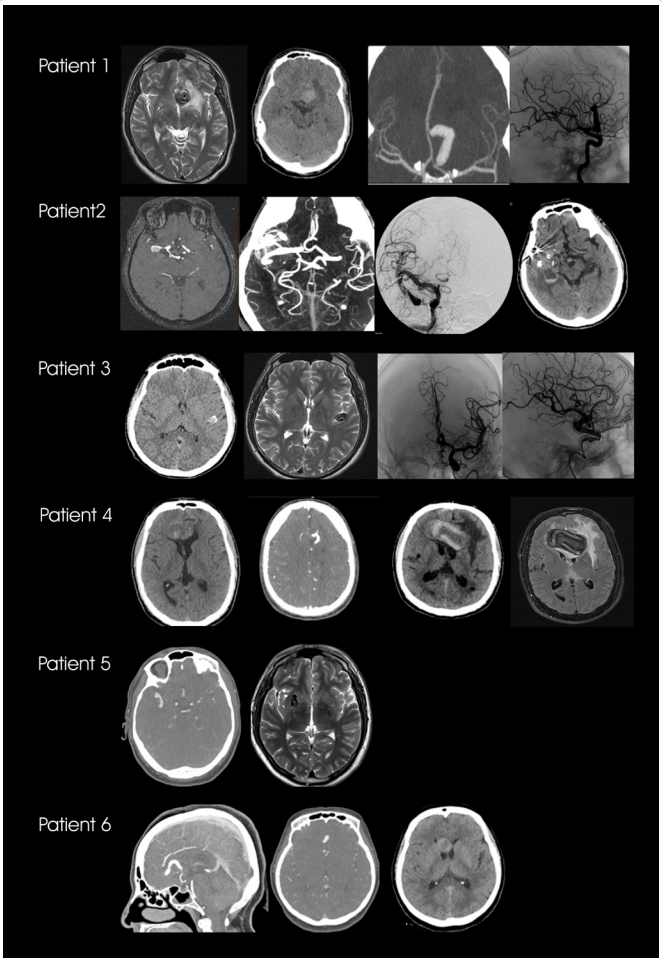

Figure 1: **Patient 1** had a partially thrombosed giant serpentine aneurysm measuring approximately 3×4 cm, located in the left Anterior Cerebral Artery (ACA) A2 segment, associated with an underlying dissection and perianeurysmal edema. **Patient 2** had a partially thrombosed giant serpentine aneurysm distal to the prior clip site, along with a coexisting anterior communicating artery saccular aneurysm. A second endovascular procedure was performed 3 years later because of recurrence at the previously stented right MCA bifurcation aneurysm. In the post-procedural period, intraparenchymal hemorrhage developed around the aneurysm site. Patient 3 had a partially thrombosed serpentine aneurysm, approximately 2 cm in diameter, involving the left MCA M3 segment. **Patient 4** presented a partially thrombosed aneurysmal dilatation measuring 3.8 cm in diameter at the left Anterior Cerebral Artery (ACA) A2–pericallosal artery level. The flow diverter stent placed in the left ACA A2 segment remained in position. **Patient 5** had partially thrombosed, serpentine-type fusiform aneurysm extending along the right Middle Cerebral Artery (MCA) M2 segment, with a maximum diameter of approximately 8 mm on CT and MRI. CT angiography of **Patient 6** showed a partially thrombosed, fusiform aneurysmal dilatation in the right Anterior Cerebral Artery (ACA) A2 segment, measuring 6 mm at its widest point.

Case 2: A 61-year-old man with a history of surgical clipping of a right Middle Cerebral Artery (MCA) M2 aneurysm in 2002 presented in 2011 with seizures and hemiparesis. Imaging revealed a partially thrombosed giant serpentine aneurysm distal to the surgical clip, as well as an additional anterior communicating artery (ACom) aneurysm. Endovascular treatment with flow diverter stent placement was performed. In 2014, aneurysm recurrence at the MCA bifurcation necessitated a second FD procedure, which was complicated by perianeurysmal hemorrhage. In 2015, the patient re-presented with MCA occlusion and basal ganglia infarction. Despite

antiepileptic therapy, recurrent thrombosis and seizures persisted, ultimately resulting in death. This case highlights that multiple prior interventions and cardiovascular comorbidities may increase the risk of delayed thrombotic complications following FD treatment.

Case 3: A 29-year-old man presented with a nine-month history of recurrent seizures. Imaging demonstrated a 2 cm partially thrombosed serpentine aneurysm in the left MCA M3 segment. Due to its distal location and unfavorable morphology, coil embolization was not feasible, and treatment with a flow diverter stent was performed. Dual antiplatelet therapy with ticagrelor and aspirin was initiated. During follow-up at 1, 3, and 6 months, no residual aneurysmal filling was observed, and the patient remained seizure-free with no neurological deficits. Both clinical and radiological outcomes remained stable.

Case 4: A 50-year-old man with a medical history of hypertension, coronary artery disease, and hypothyroidism presented with refractory headache. Imaging revealed a 3.8 cm giant, partially thrombosed serpentine aneurysm involving the left ACA A2–pericallosal segment. A flow diverter stent was implanted. Serial imaging demonstrated progressive enlargement of the aneurysm from 40 mm in 2023 to 55 mm in 2024, accompanied by increasing perianeurysmal edema. In October 2025, the patient developed speech disturbance and right lower extremity weakness; imaging revealed distal ACA A3 occlusion and marked perianeurysmal edema. Medical management with mannitol, corticosteroids, and low-molecular-weight heparin was initiated. No further endovascular or surgical intervention was planned due to spontaneous aneurysmal thrombosis. CTA performed in 2025 demonstrated a 75×70×57 mm giant thrombosed mass with compression of the ACA. Clinically, the patient remained stable. This case illustrates that pericallosal serpentine aneurysms may progress despite FD treatment, while spontaneous thrombosis can still result in a stable clinical outcome.

Case 5: A 41-year-old man was evaluated in 2014 for frontal headaches. Imaging revealed a small (8 mm) partially thrombosed serpentine fusiform aneurysm along the right MCA M2 segment, and conservative management was selected. In 2017, following a generalized seizure, imaging demonstrated a 21 × 13 mm partially thrombosed, posteriorly oriented aneurysm at the right MCA M1 segment, along with a second small bifurcation aneurysm. Levetiracetam therapy was initiated, resulting in good seizure control. By 2022, Magnetic Resonance Angiography (MRA) demonstrated normal vascular flow without aneurysmal progression. The patient remained neurologically stable during long-term follow-up, with headaches controlled medically.

Case 6: A 62-year-old woman was incidentally found to have a 6 mm partially thrombosed fusiform aneurysm of the right ACA A2 segment during evaluation for headache and tinnitus. Neurological examination and imaging revealed no evidence of perianeurysmal edema, mass effect, or ischemia. Given the small size of the aneurysm, minimal symptoms, and radiological stability, conservative management was preferred, and no antiplatelet therapy was initiated. Annual follow-up with CTA and MRA demonstrated no change in aneurysm size. This case supports the safety of conservative monitoring in small, minimally symptomatic serpentine aneurysms of the ACA.

Table 1: Clinical and radiological characteristics of six serpentine aneurysm cases.

Case	Age / Sex	Location	Aneurysm characteristics	Treatment method	Clinical findings	Outcome / Follow-up
1	25 / M	Left ACA A2	3×4 cm partially thrombosed fusiform–serpentine giant aneurysm on dissection background	Flow diverter stent	Frontal headache, no neurological deficit	Stable after treatment; antiplatelet + steroid therapy
2	84 / M	Right MCA M2	~3 cm partially thrombosed fusiform–serpentine giant aneurysm with ACom saccular aneurysm	Clipping (2002), flow diverter (2011, 2014)	Seizure, left hemiparesis, recurrent headache	Initially stable; rebleeding and occlusion after 3 years, MCA infarction
3	29 / M	Left MCA M3	1.6–2 cm partially thrombosed fusiform–serpentine aneurysm	Flow diverter stent (2025)	Seizure, no deficit	No procedural complication; stable course
4	50 / M	Left ACA A2 (pericallosal)	Progressive enlargement (3.8 → 5.5 → 7.5 cm), giant thrombosed serpentine aneurysm	Flow diverter stent (2022)	Right hemiparesis (4/5), dysarthria, ACA A3 occlusion	Progression; distal ACA A3 occlusion and spontaneous thrombosis, managed medically
5	41 / M	Right MCA M2	8 mm partially thrombosed fusiform–serpentine aneurysm	No treatment	Asymptomatic	Stable course under conservative follow-up
6	62 / F	Right ACA A2	6 mm partially thrombosed fusiform aneurysmal dilatation	No treatment	Asymptomatic	Stable appearance; conservative follow-up

Discussion

Serpentine intracranial aneurysms present major surgical and endovascular challenges due to their wide necks, partial thrombosis, and tortuous flow channels, often limiting the durability of clipping or coil embolization. Flow Diverter (FD) stents offer a reconstructive strategy by modifying parent vessel hemodynamics, reducing intra-aneurysmal flow, and promoting endothelialization [2-4]. Meta-analyses report occlusion rates of 80–85% with complication rates of 3–5% in large and giant aneurysms [3].

In this series, four patients underwent FD implantation. Three achieved sustained clinical and radiological stability, whereas one developed recurrent thrombosis with distal occlusion, resulting in a fatal middle cerebral artery infarction. One pericallosal artery aneurysm demonstrated spontaneous thrombosis and distal occlusion after FD placement but remained clinically stable. These findings highlight the potential risk of thrombosis when FD stents are deployed in small-caliber distal vessels.

Conversely, two small asymptomatic serpentine aneurysms managed conservatively remained stable on long-term CT and MR angiography, supporting non-interventional management in selected low-risk patients. Overall, FD stents appear effective for large or symptomatic serpentine aneurysms; however, delayed thrombosis and ischemic complications underscore the importance of careful patient selection, optimized antiplatelet therapy, and long-term imaging follow-up.

Limitations

This study is limited by its retrospective design, small sample size, and heterogeneous follow-up, which restrict generalizability and preclude statistical comparison. Individualized treatment decisions introduce potential selection bias, and antiplatelet regimens could not be fully standardized. The absence of a control group and quantitative hemodynamic analysis further limits conclusions regarding comparative treatment efficacy.

Conclusion

Serpentine intracranial aneurysms are rare and complex lesions with challenging management. In this six-patient series, flow diverter treatment achieved durable stability in most treated patients but was associated with a fatal ischemic complication in one case. Small, asymptomatic aneurysms remained stable with conservative management. Flow diverter stents represent an effective option for selected large or symptomatic aneurysms, while careful surveillance remains essential, and conservative management may be appropriate for small, asymptomatic lesions.

Declarations

Author contribution: Principal author: Öyküm Akıncı, MD; Study concept or design: Emre Kumral MD, Acquisition of data: Celal Çınar, MD; Analysis of data: Ayşe Güler, MD; Study coordination: Emre Kumral, MD.

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Informed consent: Each participating patients or relatives provided informed consent.

Ethical committee approval: Ege University Medical Ethical Committee was approved this study following the principles outlined in the Helsinki Declaration before starting the study (EUMEC 2003/97)

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