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Case Presentation

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Giant Serpentine Aneurysm of the Right Middle Cerebral Artery: A Case Report With One-Year Imaging Follow-Up and literature review

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Abstract

Giant serpentine aneurysms are rare, partially thrombosed, fusiform aneurysms exceeding 25 mm in diameter, characterized by tortuous intra-aneurysmal vascular channels. These lesions present with significant morbidity due to mass effect and vascular compromise, posing diagnostic and therapeutic challenges. We report a case of a 22-year-old female presenting with dizziness, headaches, diplopia, and blurred vision. CT imaging revealed a giant serpentine aneurysm of the right middle cerebral artery (MCA) with multiple lobulated sacs and peripheral thrombosis. Endovascular treatment with a flow-diverting stent and coil embolization was performed successfully. Postprocedural imaging confirmed complete exclusion of the aneurysm from circulation with preserved vessel patency. The patient remained neurologically intact with stable imaging findings on six-month follow-up. This case highlights the importance of multimodal imaging and individualized therapeutic strategies, also the efficacy and safety of flow-diverting stents in treating complex giant serpentine aneurysms. For a literature review on their pathogenesis, clinical presentation, imaging characteristics, and management is also provided.

Introduction

The serpentine aneurysm is an infrequent vascular anomaly, representing less than 0.1% of all aneurysms [1,2]. It is defined by a substantial fusiform aneurysm exceeding 25 mm in diameter, frequently exhibiting partial thrombosis and maintaining a serpiginous vascular channel. This condition is associated with high morbidity and mortality rates, presenting considerable therapeutic challenges [3]. Recent advancements in endovascular therapies have transformed the management of serpentine aneurysms, which are now considered the gold standard. These techniques incorporate both reconstructive and obstructive methods, often utilizing parent vessel occlusion testing to achieve

favorable patient. Giant Serpentine Aneurysms (GSAs) are a rare vascular anomaly, comprising less than 0.1% of all intracranial aneurysms [4,5]. They are characterized by a large fusiform dilation exceeding 25 mm in diameter, often partially thrombosed, containing an eccentric tortuous intraluminal vascular channel [4-6]. GSAs most commonly affect the Middle Cerebral Artery (MCA) circulation, followed by the posterior cerebral artery and vertebrobasilar arteries [7,8]. The exact pathogenesis remains unclear; however, repetitive intramural hemorrhage and thrombus formation are considered major contributing factors to their gradual enlargement and unique morphology [9,10].

Clinically, GSAs may present with symptoms related to mass effect, ischemia, or less commonly, subarachnoid hemorrhage [11,12]. Due to their large size and complex morphology, GSAs may mimic neoplastic lesions on imaging studies, presenting as well-circumscribed masses with perilesional edema and midline shift, complicating initial diagnosis [12-14]. Comprehensive imaging with Computed Tomography Angiography (CTA), Magnetic Resonance Imaging (MRI), Digital Subtraction Angiography (DSA), and Functional MRI (fMRI) is essential for accurate diagnosis and preoperative planning. Management of GSAs is challenging due to their size, involvement of eloquent brain areas, and mass effect. Surgical treatment, typically involving aneurysm exclusion and bypass procedures such as Superficial Temporal Artery to Middle Cerebral Artery (STA-MCA) anastomosis, remains the standard of care for many cases (Anson et al., 1996; Amin-Hanjani et al., 2006). Recently, endovascular therapies, including flow-diverting stents, have become increasingly utilized, especially for aneurysms in surgically inaccessible locations, providing minimally invasive exclusion of the aneurysm (van Rooij et al., 2008; Atallah et al., 2025). However, these techniques do not immediately resolve mass effect and require adequate collateral circulation to prevent ischemic complications (Christiano et al., 2009). Due to the complexity and rarity of GSAs, multidisciplinary evaluation involving neurosurgeons, neuroradiologists, and neurophysiologists is critical for individualized treatment planning to optimize outcomes and preserve neurological function (Romano et al., 2023).

Case Presentation

A 22-year-old woman presented at the emergency department complaining of a 2–3-day history of dizziness, severe headache, diplopia, and blurred vision. Two weeks prior, she had experienced transient visual loss in the right eye accompanied by headaches. Her past medical history was unremarkable, and she did not take any regular medication. Neurological examination at admission revealed no focal deficits.

Initial non-contrast and contrast-enhanced MDCT of the brain showed a lobulated, heterodense, expansile lesion with punctate peripheral calcifications in the right Sylvian fissure causing mass effect and perilesional edema. CT angiography revealed ectatic dilatation of the inferior branch of the right MCA with multiple aneurysms: a 12x19 mm aneurysm at the bifurcation, a giant 34x34 mm thrombosed aneurysm distal to it, and a 15x12 mm distal aneurysm with peripheral thrombosis **(Figure 1)**.

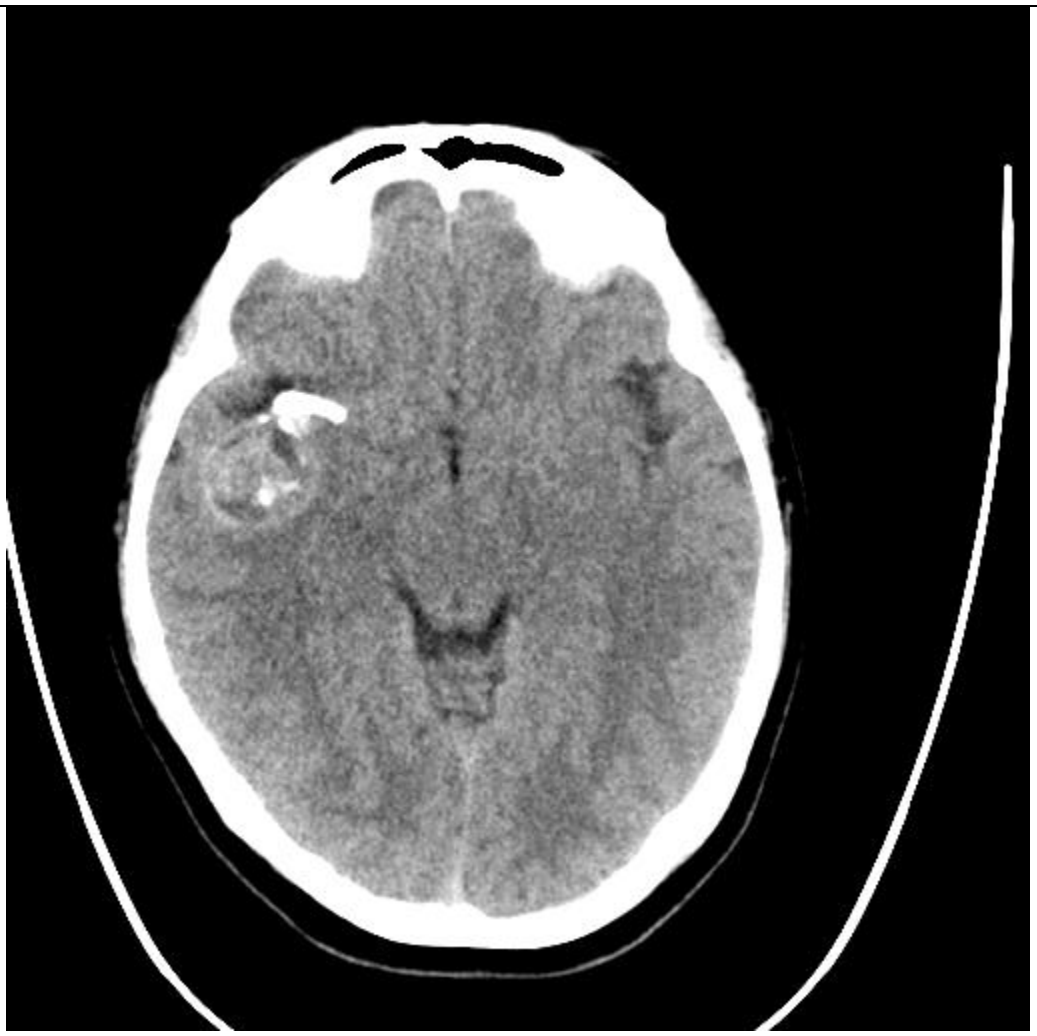

Figure 1: Demonstrates preoperative CT imaging a lobulated, heterodense, expansile lesion with punctate peripheral calcifications in the right Sylvian fissure causing mass effect and perilesional edema.

DSA confirmed a dissecting, largely thrombosed aneurysm at the MCA bifurcation, comprising two sacs connected by a serpentine channel approximately 30 mm in lengths. Branches of the right MCA were displaced laterally and superiorly. The morphology of the vascular course within the aneurysm was snake-like and serpiginous. A diagnosis of a giant aneurysm was made. The patient was presented at the Neurovascular Multidisciplinary Team Meeting, and endovascular treatment was recommended.

Treatment

Under general anesthesia, right femoral artery access was obtained. A flow-diverting Pipeline embolization device (2.75x18 mm) was deployed via microcatheter across the neck of the proximal aneurysm sac, extending from the M1 segment into the superior M2 branch, achieving flow diversion across both aneurysm sacs. Coil embolization with platinum microcoils was also performed. Postprocedural angiography showed preserved patency of parent vessels and successful aneurysm exclusion.

Dual antiplatelet therapy with aspirin (100 mg daily) and clopidogrel (75 mg daily) was prescribed for six months, followed by aspirin monotherapy for an additional six months **(Figure 2)**.

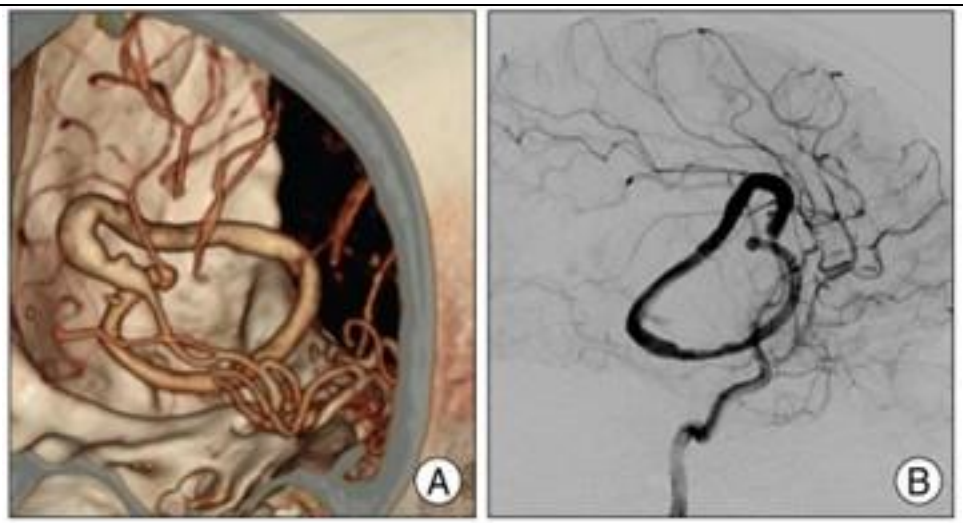

Figure 2A–B: Postoperative CT and DSA angiography.

Follow-up and Outcome

The patient remained neurologically intact post-procedure without new deficits. A twelve-month follow-up brain MRI and MRA demonstrated stable exclusion of the aneurysm with no residual filling. Imaging showed a lobulated lesion in the right insular and temporal regions consistent with the treated aneurysm and small chronic microangiopathic changes in the right parietal white matter without edema or enhancement.

No new aneurysms or vascular stenoses were detected. The ventricular system and subarachnoid spaces were normal **(Figure 3-8)**.

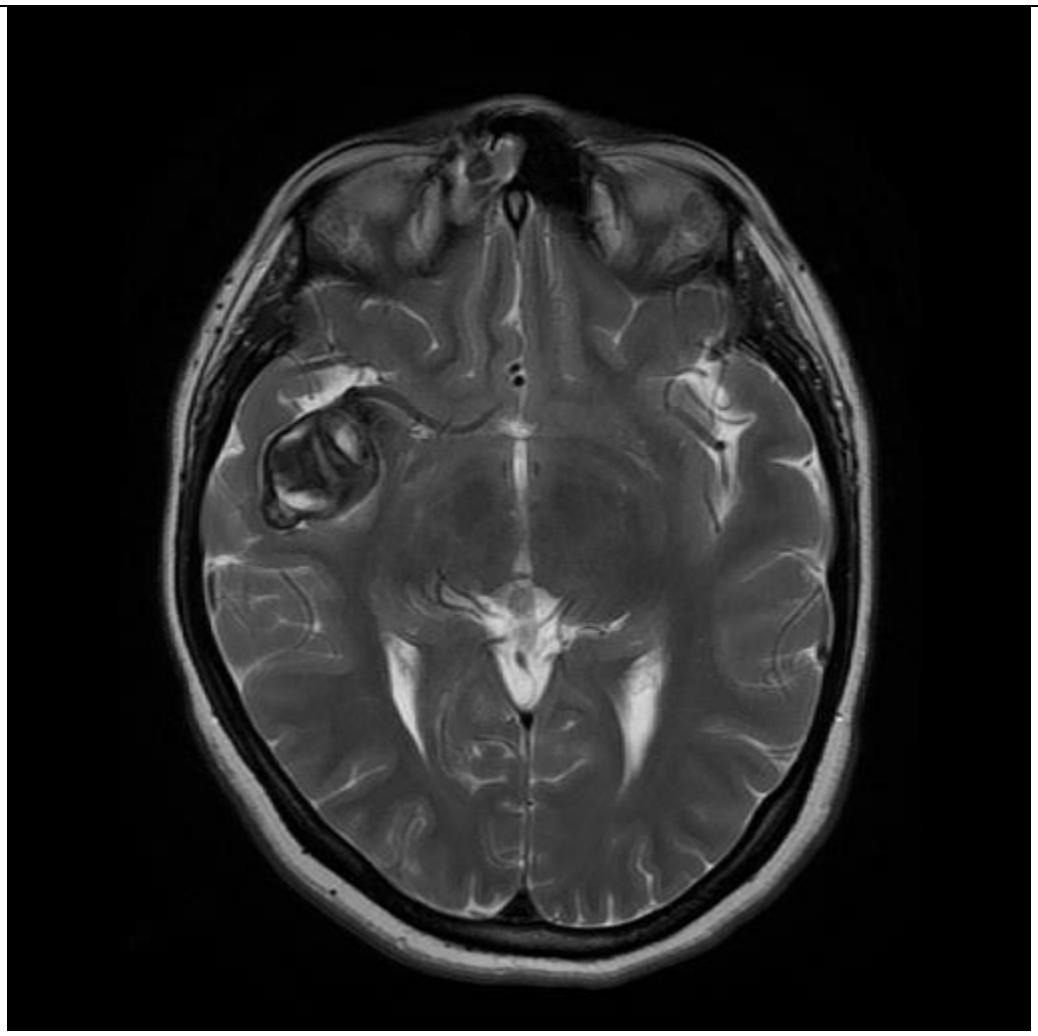

Figure 3: FLAIR axial.

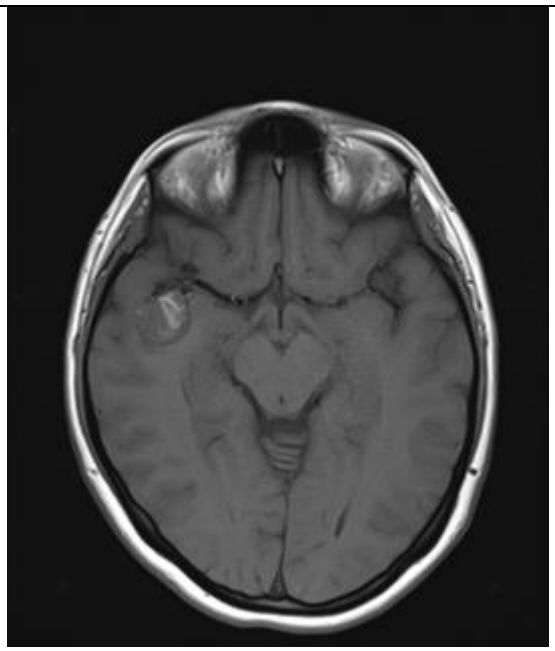

Figure 4: T1W axial.

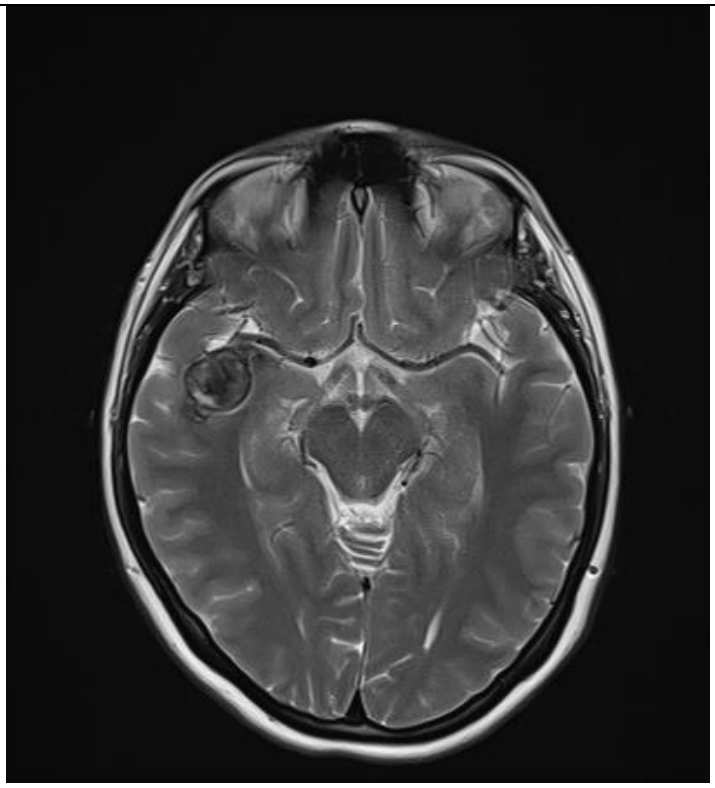

Figure 5: T2W.

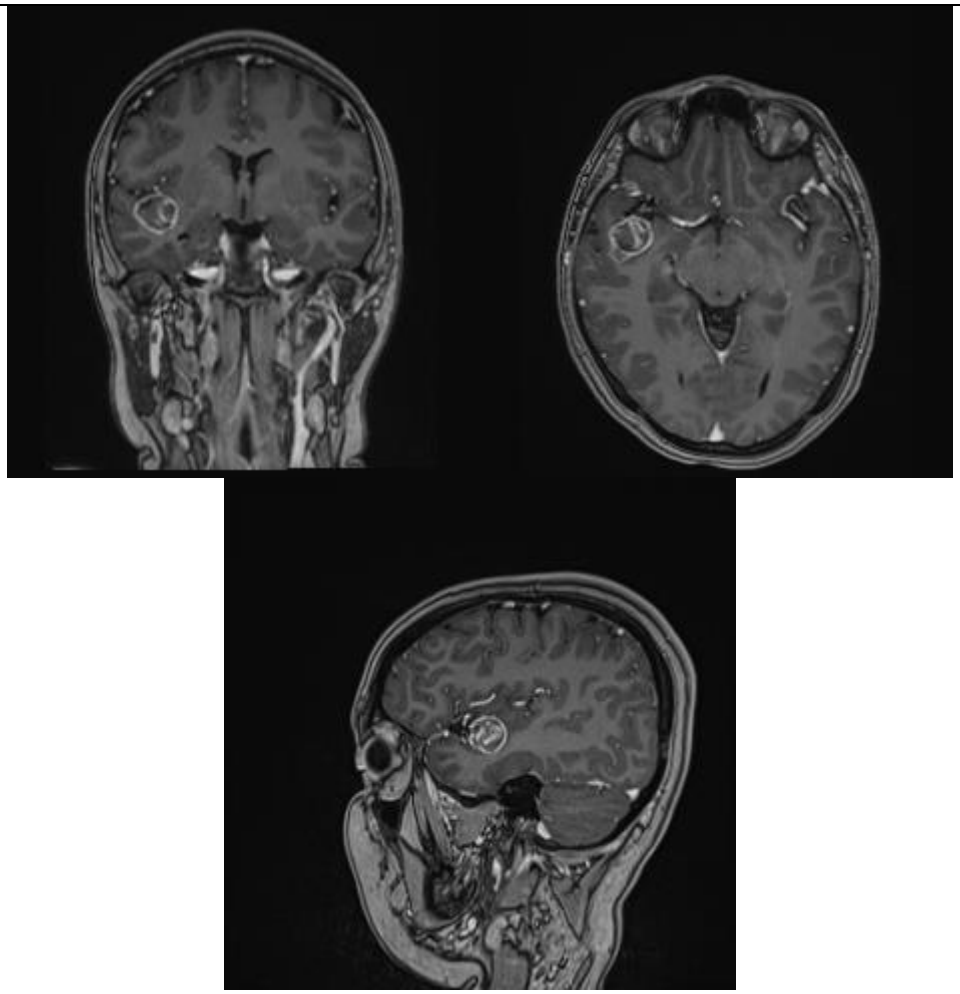

Figure 6: Coronal, axial and sagittal T1w postcontrast.

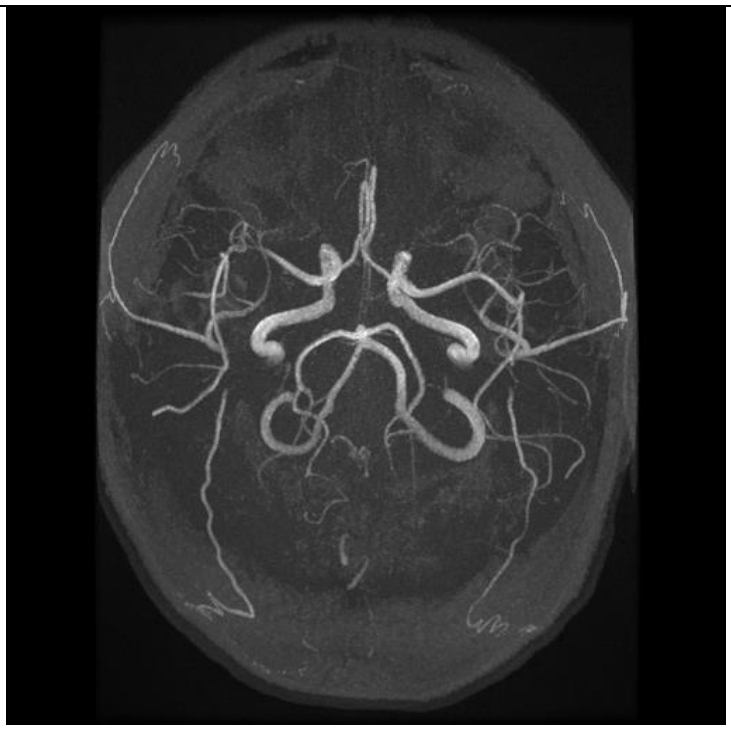

Figure 7: MR angiography.

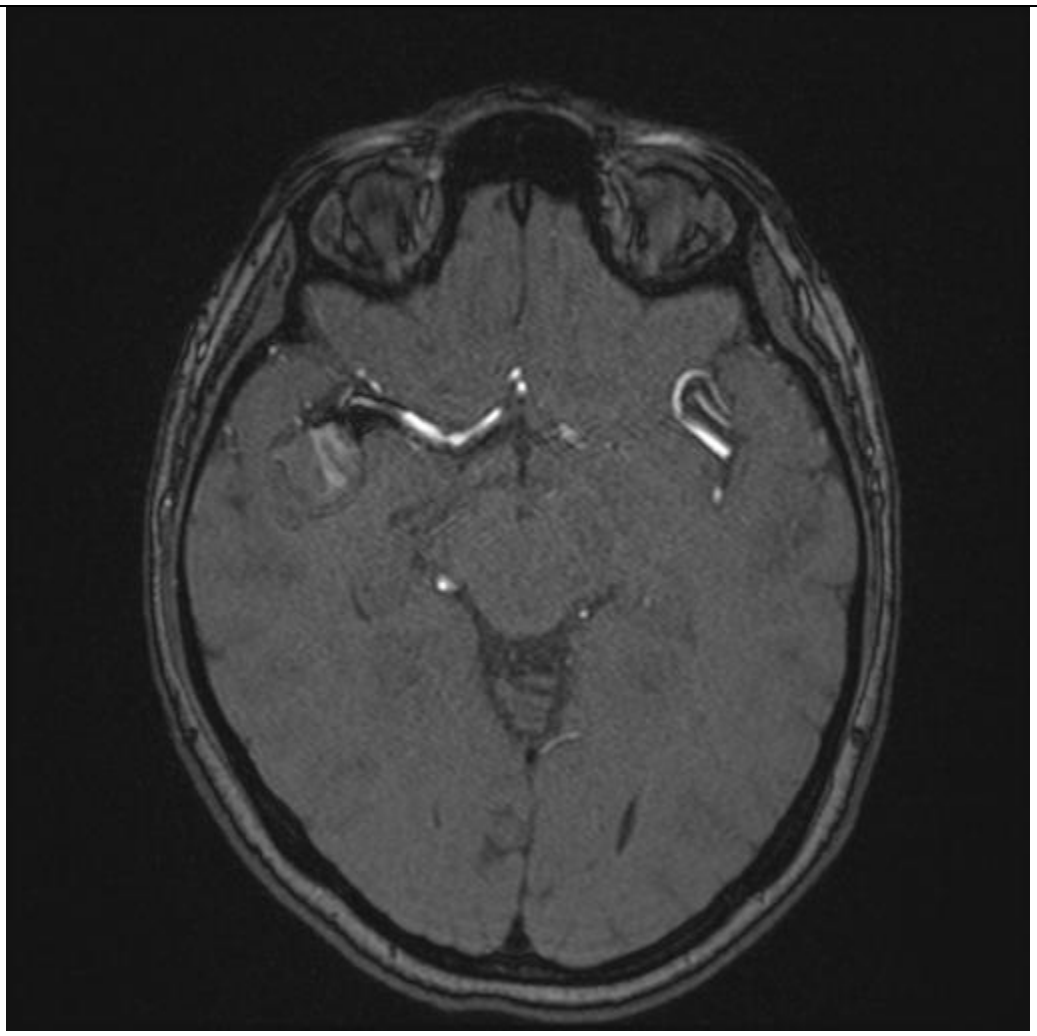

Figure 8: TOF angiography.

Discussion

The origin and pathogenesis of giant serpentine aneurysms remain incompletely understood. These lesions may represent the progressive expansion of fusiform aneurysms accompanied by partial thrombosis and repeated intramural hemorrhages through weakened segments of the arterial wall [1]. Christiano et al. reported that giant serpentine aneurysms most commonly occur in the Middle Cerebral Artery (MCA) circulation (50%), followed by the Posterior Cerebral Artery (PCA) circulation (18%) and vertebrobasilar artery (15%) [8]. The MCA circulation lacks structural barriers such as dural or bony elements that could limit aneurysm growth, a feature thought to favor serpentine aneurysm development. Fanning et al. suggested that the lower jet flow force in the MCA causes flow stagnation within the aneurysm, promoting thrombus formation [6]. Additionally, giant serpentine aneurysms possess eccentric vascular channels that result in the Coanda effect, where jet blood flow forces are stronger along the deflected aneurysm wall rather than centrally, and facilitating thrombus deposition in the aneurysm core. On Computed Tomography (CT), giant serpentine aneurysms may

mimic brain tumors due to their well-circumscribed mass appearance, associated edema, and midline shift, often leading to initial misdiagnosis [4]. Contrast-enhanced CT typically shows a heterogeneously enhancing mass with peripheral calcifications and thick, wavy vessels within the lesion, indicative of chronic thrombus formation over time [5]. MRI findings are variable and reflect the coexistence of thrombi in different stages within the aneurysm [1]. The natural history of giant serpentine aneurysms is not well established, largely due to their rarity. The few published reports include limited case numbers. Some authors documented spontaneous aneurysm occlusion [3], but most reported rapid neurological deterioration leading to death after ischemic stroke or aneurysm recanalization following thrombosis [2,7,11]. Suzuki et al. followed 39 cases, observing angiographic enlargement in 12 patients during follow-up, attributing it to repetitive intramural hemorrhage and thrombus accumulation [1]. Cases of spontaneous, complete thrombosis have also been reported [3]. Mahadevan et al. described rapid neurological deterioration and death resulting from ischemic stroke due to parent vessel compression or acute occlusion caused by thrombosis [2]. Lee et al. reported aneurysm recanalization after spontaneous occlusion, emphasizing the need for ongoing monitoring and treatment consideration [7]. While subarachnoid hemorrhage is not a common presentation, Suzuki et al. reported it in 28% of giant serpentine aneurysm cases [1].

Surgical treatment remains the primary option for most giant serpentine aneurysms. Suzuki et al. demonstrated better neurological outcomes and preservation of distal cortical blood flow in surgically treated patients compared to conservative management [1]. Important surgical considerations include aneurysm accessibility, morphology, and the presence of perforating arteries. Earlier methods such as carotid artery ligation were associated with poor outcomes and ischemic stroke rates up to 33% [2]. Wrapping or coating techniques resulted in significant mortality in some series [1]. Horowitz et al. reported that occlusion of the distal outflow alone might be effective but requires further validation [6]. Prior to the development of bypass surgery, aneurysm surgery carried morbidity and mortality rates of 30–35% [4]. Since the outflow of giant serpentine aneurysms supplies distal cortical vessels, occlusion or narrowing may cause ischemic stroke [6]. Bypass surgery, such as Superficial Temporal Artery to MCA (STA-MCA) bypass combined with proximal MCA clipping, offers an effective way to preserve distal blood flow and avoid ischemic complications. Amin-Hanjani et al. reported a patient treated with STA-MCA bypass and proximal MCA clipping who remained neurologically intact with a patent bypass 13 years later [2]. Endovascular treatments have gained traction recently, especially for aneurysms in surgically inaccessible locations, with promising results [7,16]. However, endovascular approaches do not immediately relieve mass effect and are contraindicated when collateral distal blood flow is insufficient. In the present case, severe mass effect caused headache and ipsilateral trigeminal neuropathy, making immediate mass effect relief a key therapeutic goal. Preoperative assessment of distal vessel patency and language dominance was essential, especially given the patient's left-handedness. Functional MRI and Wada testing provided critical information for preserving eloquent cortex during surgery. When performing STA-MCA bypass, locating an appropriate recipient vessel at the brain surface is easier than deep within the sylvian

fissure. However, identifying the correct cortical branch may be difficult due to complex vascular anatomy. Cerebral angiography alone often fails to localize the optimal target vessel for bypass. Intraoperative microvascular Doppler ultrasound can aid identification by detecting arterial flow changes after temporary clipping of the MCA distal to the aneurysm. Following successful bypass, aneurysm excision and sacrifice of perforators feeding non-functional insular cortex can be performed safely.

Serpentine giant aneurysms are complex vascular lesions that require individualized management. Endovascular flow diversion allows reconstruction of the parent artery and promotes thrombosis within the aneurysm while preserving distal flow. Our case illustrates successful treatment with flow diversion and coil embolization, leading to symptom resolution and aneurysm occlusion **[5].** The origin and pathogenesis of giant serpentine aneurysms remain incompletely understood. These lesions are thought to represent the progressive expansion of fusiform aneurysms accompanied by partial thrombosis and recurrent intramural hemorrhages through weakened segments of the arterial wall **[6].** The anatomical characteristics of the MCA circulation, which lacks structural barriers such as dura or bone that could limit aneurysm growth, are believed to facilitate the development of serpentine aneurysms **[7].** These aneurysms can mimic tumors on CT, may cause mass effect, and require advanced endovascular or surgical techniques for treatment **[8].** Careful assessment of collateral circulation, use of parent vessel occlusion testing, and individualized planning are critical. Our case confirms that flow diversion and coiling is a viable strategy with durable outcomes **[9].** Giant serpentine aneurysms represent a distinct clinical entity with unique angiographic and pathophysiological features. Their natural history is poorly defined due to limited case numbers, but progressive neurological deterioration is common without treatment (Atallah et al., 2025; Suzuki et al., 2009). The serpentine vascular channel within the aneurysm sac, often partially thrombosed, contributes to mass effect and distal cerebral ischemia by altering normal blood flow dynamics (Christiano et al., 2009; Kandemirli et al., 2018). Surgical management focuses on aneurysm exclusion while preserving distal blood flow, commonly achieved via bypass procedures such as STA-MCA anastomosis (Amin-Hanjani et al., 2006). Preoperative functional testing including balloon test occlusion and fMRI is essential to assess collateral circulation and identify eloquent cortex to reduce postoperative neurological deficits (Romano et al., 2023; Atallah et al., 2025). Notably, functional mapping is critical in cases with atypical language dominance, such as in left-handed patients (Romano et al., 2023). Endovascular treatments, particularly flow-diverting stent placement, have shown efficacy in promoting aneurysm thrombosis and parent vessel remodeling, providing a less invasive alternative especially for aneurysms located in surgically challenging sites (van Rooij et al., 2008; Atallah et al., 2025). However, these procedures do not provide immediate relief of the mass effect and require adequate collateral supply to prevent ischemia (Christiano et al., 2009).

Conclusion

The serpentine aneurysm is a rare entity, yet it possesses specific angiographic characteristics that are essential for appropriate management. Generally, these pathologies are technically challenging, and each case must be considered individually. Endovascular treatment using flow-diverting stents

combined with coil embolization is an effective and safe option for managing giant serpentine MCA aneurysms. Careful imaging follow-up is essential to monitor treatment durability and vessel patency. In conclusion, management of giant serpentine aneurysms requires a multidisciplinary approach, balancing aneurysm exclusion, preservation of neurological function, and alleviation of mass effect. Surgical resection with bypass remains the mainstay in many cases, while endovascular techniques continue to evolve as important therapeutic options.

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