

Case Report

Preservation of Important Medial Veins in Deep Parieto-Occipital Arteriovenous Malformation (AVM) with Intracerebral Hemorrhage

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Abstract

Background:

Deep parieto-occipital arteriovenous malformations (AVMs) represent a significant surgical challenge because of their complex angioarchitecture and close relationship with critical deep venous drainage pathways. Hemorrhage from these lesions further distorts normal anatomy, increasing the risk of venous injury and postoperative neurological deficits. Preservation of major medial veins, particularly the internal cerebral vein and the basal vein of Rosenthal, is essential to prevent venous infarction and ensure favorable outcomes.

Case Presentation:

A 24-year-old male presented with sudden severe headache, confusion, and left homonymous hemianopia. Neuroimaging revealed a right parieto-occipital intracerebral hemorrhage caused by a Spetzler-Martin Grade III AVM. Digital subtraction angiography demonstrated arterial supply from branches of the anterior, middle, and posterior cerebral arteries with deep venous drainage into the internal cerebral vein and basal vein of Rosenthal. The patient underwent urgent right parieto-occipital craniotomy. Following hematoma evacuation, meticulous microsurgical dissection allowed stepwise disconnection of arterial feeders while carefully preserving the major medial venous structures. The AVM nidus was completely excised without compromising venous drainage.

Results:

Postoperative CT angiography confirmed complete obliteration of the AVM with preservation of deep venous pathways. The patient showed progressive neurological recovery with improvement of visual deficits. At three months, functional status improved significantly, and by ten months follow-up the patient achieved full functional recovery without new neurological deficits.

Conclusion:

Microsurgical resection of deep parieto-occipital AVMs with hemorrhage can be performed safely when meticulous attention is paid to the preservation of critical medial veins. Careful operative planning, stepwise arterial disconnection, and protection of deep venous drainage are key factors for achieving complete resection and favorable neurological outcomes.

Keywords: Arteriovenous malformation, parieto-occipital AVM, intracerebral hemorrhage, venous preservation, basal vein of Rosenthal, microsurgical resection.

Introduction:

Deep parieto-occipital arteriovenous malformations (AVMs) present a significant surgical challenge due to their intricate vascular anatomy and critical venous drainage pathways (1). Hemorrhage within an AVM can further complicate management by increasing mass effect, altering normal venous flow, and elevating the risk of catastrophic neurological deficits (2). Preserving prominent medial veins, including Rosenthal's internal cerebral and basal

vein of Rosenthal, is crucial to preventing venous infarction and optimizing patient outcomes (3). Here, we report a case of a deep parieto-occipital AVM with intracerebral hemorrhage (ICH) where meticulous surgical planning allowed for successful AVM resection while preserving critical venous drainage.

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Case Presentation

A 24-year-old male presented with sudden-onset severe headache, left-sided hemianopia, and mild confusion. There was no history of trauma or prior neurological symptoms. The patient was obtunded on examination but had impaired visual field function on the left side.

An emergency non-contrast CT scan revealed a hyperdense lesion in the right parieto-occipital region, consistent with an acute intraparenchymal hemorrhage. Subsequent MRI and digital subtraction angiography (DSA) confirmed a Spetzler-Martin Grade III deep parieto-occipital AVM with active bleeding (figure 1), primarily fed by branches from the anterior, middle and posterior cerebral arteries and draining into the internal cerebral vein and basal vein of Rosenthal. Due to the presence of hemorrhage, mass effect, and symptomatic deterioration, urgent surgical intervention was planned.

Surgical Management.

A right parieto-occipital craniotomy was performed in Holy Family Red Crescent Medical College Hospital according to preoperative findings. This surgery was intended to do a life-saving procedure where a loop was used with a magnification of 4.5 X. Upon dural opening, careful cortical dissection was carried out to access the hemorrhagic cavity while minimizing disruption to the surrounding eloquent cortex and venous structures. The hematoma was evacuated to decompress the brain and improve visualization of the AVM nidus. Arterial feeders were temporarily clipped from ACA, MCA, and PCA close to Nidus. Dissection was carried out with observation of AVM nidus; all the arterial feeders, including smaller ones, were coagulated and cut. Special attention was given to preserving the internal cerebral vein and basal vein of Rosenthal, which were at risk due to the hemorrhage-induced displacement of venous structures. The AVM nidus was carefully dissected circumferentially while safeguarding these critical veins. After controlled disconnection of arterial feeders, the AVM was successfully excised while maintaining venous drainage integrity.

Postoperative Outcome

The patient recovered well postoperatively, with a gradual improvement in visual function. Postoperative CT angiogram of the brain confirmed complete AVM resection with preserved venous structures (figure 2). At a three-month follow-up (figure 3: mRS 4-1), the patient had no new neurological deficits, and his visual field deficits had partially improved. At 10 months follow-up, the patient's functional recovery was complete (figure 4)

Discussion

Hemorrhagic deep parieto-occipital AVMs pose an increased risk of intraoperative complications due to hematoma-induced venous congestion and altered vascular anatomy (4). Preserving key medial veins is essential to preventing secondary venous infarction and optimizing neurological recovery (5). This case signifies the importance of meticulous surgical technique, intraoperative decision-making, and a stepwise approach to achieving complete AVM resection while maintaining critical venous drainage.

Furthermore, publications detail the growing role of endovascular embolization in managing complex AVMs, either as a standalone treatment or as a preoperative adjunct to microsurgery (6,7). The decision to employ a staged approach, which was not used in this case because of hemorrhage, is also supported by literature highlighting the benefits of reducing AVM volume and flow before definitive surgical resection (8,9,10).

By their very nature, deep-seated AVMs are situated in areas of the brain that are difficult to access, increasing the risks associated with conventional surgical intervention (11). While open surgery can provide immediate AVM removal, it carries the potential for significant neurological deficits due to the disruption of surrounding critical brain structures. Conversely, Gamma Knife radiosurgery or SRS offers a non-invasive approach, delivering focused radiation to the AVM nidus. However, it requires a latency period, often several years, for complete obliteration, during which the risk of hemorrhage persists (12,13). Furthermore, radiosurgery carries the risk of radiation-induced complications, such as edema.

The decision between these treatment modalities is highly individualized, depending on factors such as the AVM's size, location, and the patient's overall health, and often requires a multidisciplinary approach (14,15).

By contextualizing our case within the broader framework of published research, we reinforce the significance of careful surgical planning and execution in achieving favorable patient outcomes.

Conclusion

Surgical management of deep parieto-occipital AVMs with hemorrhage requires a delicate balance between hematoma evacuation, AVM excision, and venous preservation. This case highlights the feasibility of complete resection while safeguarding major venous pathways, ultimately leading to favorable functional outcomes.

Figure 1: Preoperative CT scan and CT angiogram showing right Parieto-occipital AVM with haemorrhage

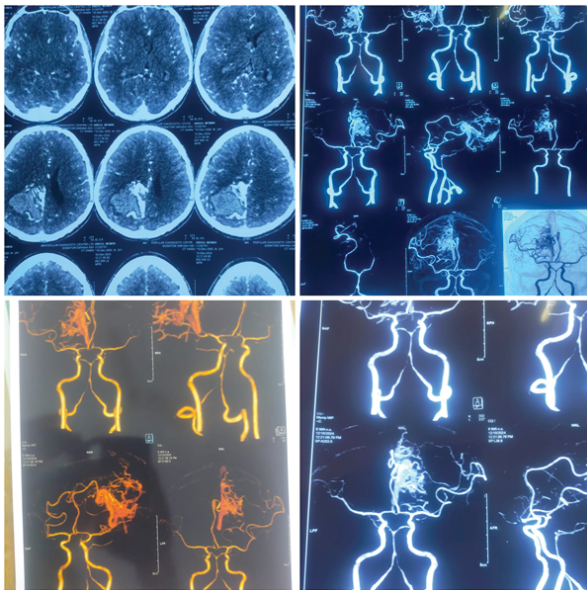


Figure 2: Postoperative CT angiogram showing obliteration of AVM

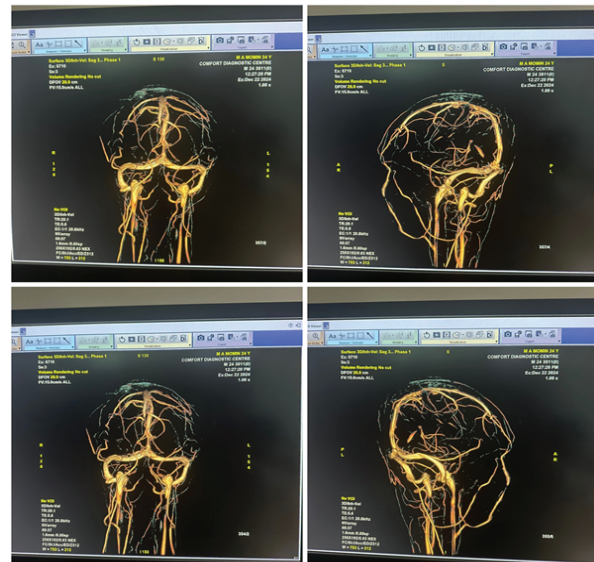


Figure 3: Surgical outcome using Modified Rankin Scale

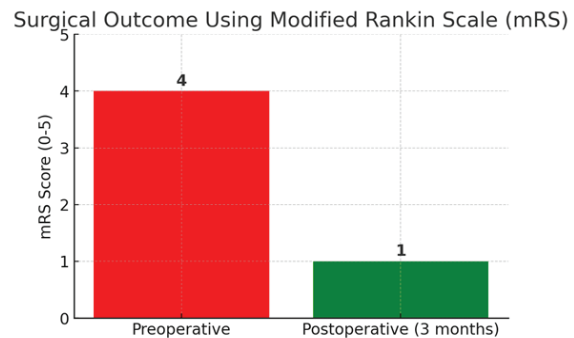
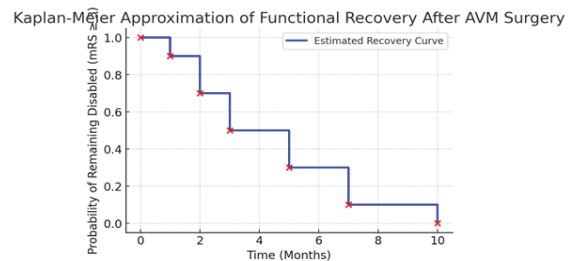


Figure 4: Kaplan-Meier Functional Recovery after surgery



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