SVOA Neurology

e-ISSN 2753-9180

Case Report

Microsurgical Resection of a Ruptured Left Pre-Rolandic Brain Arteriovenous Malformation: A Case Report and Review of Management Strategies

W Bennabi[1*], MD, PhD; A Boudjadja[1], MD; M Laidani[1], MD; T Beldjebli[1], MD; R Hamdane[1], MD; S Khider[1], MD, PhD; M Djaafer[1], MD, PhD

[1]Department of Neurosurgery, Mustapha University Hospital Center, Algiers, Algeria.

***Corresponding Author:** Bennabi Walid, Neurosurgery Department, Mustapha Pacha University Hospital, Algiers, Algeria.

DOI: https://doi.org/10.58624/SVOANE.2026.07.012

Received: April 23, 2026

Published: May 11, 2026

Citation: Bennabi W, Boudjadja A, Laidani M, Beldjebli T, Hamdane R, Khider S, Djaafer M. Microsurgical Resection of a Ruptured Left Pre-Rolandic Brain Arteriovenous Malformation: A Case Report and Review of Management Strategies. *SVOA Neurology* 2026, 7:3, 74-79. doi.org/10.58624/SVOANE.2026.07.012

Abstract

Brain arteriovenous malformations (AVMs) are rare cerebrovascular lesions characterized by abnormal direct arteriovenous shunting without an intervening capillary bed. Although many AVMs remain asymptomatic, they may present with seizures, headaches, focal neurological deficits, or life-threatening intracranial hemorrhage. Hemorrhage remains the most severe complication, contributing significantly to morbidity and mortality. The annual risk of rupture is estimated at 2–4%, increasing substantially after an initial hemorrhage. Management strategies are individualized and multidisciplinary, combining microsurgical resection, endovascular embolization, and stereotactic radiosurgery. The Spetzler–Martin grading system remains essential for surgical risk assessment. We report the case of a 39-year-old man with a ruptured left pre-rolandic AVM (Spetzler–Martin Grade II) successfully treated with complete microsurgical resection. We also review current diagnostic and therapeutic strategies.

Keywords: *Brain AVM, Intracerebral Hemorrhage, Cerebral Angiography, Eloquent Cortex, Microsurgery*

Introduction

Brain arteriovenous malformations (AVMs) are developmental vascular abnormalities consisting of direct arterial-to-venous shunts without an intervening capillary network [1]. First described in the 19th century, they remain clinically relevant due to their unpredictable natural history and potential for catastrophic hemorrhage.

The prevalence of AVMs is estimated at 10–18 per 100,000 individuals [2]. While many lesions are incidentally diagnosed, up to half of symptomatic cases present with intracerebral hemorrhage, which remains the most clinically significant complication [3,4].

The annual hemorrhage risk varies between 2% and 4%, increasing substantially after initial rupture [5]. Management remains controversial, particularly in unruptured lesions, as highlighted by the ARUBA trial [6], which emphasized the complexity of balancing intervention risks against natural history.

Current guidelines recommend individualized, multidisciplinary decision-making integrating microsurgery, endovascular embolization, and radiosurgery [7].

Case Presentation

A 39-year-old man with no significant medical history presented to the emergency department with sudden onset of altered consciousness. On admission, he was drowsy with a Glasgow Coma Scale score of 13.

Neurological examination revealed aphasia and mild right-sided hemiparesis (muscle strength 4/5, MRC scale). Reflexes were brisk on the right side with a positive Babinski sign. Sensory and cranial nerve examinations were normal.

Brain MRI demonstrated a serpiginous vascular lesion in the left pre-rolandic region with strong contrast enhancement, suggestive of an AVM (Figure 1).

Cerebral angiography confirmed a high-flow AVM with a nidus measuring approximately 42*13.5*19 mm. Arterial supply arose primarily from frontal ascendant branches of the left middle cerebral artery, with additional supply from the anterior cerebral artery. Venous drainage occurred via dilated cortical veins into the superior sagittal sinus (Figure 2).

Based on these findings, the lesion was classified as Spetzler–Martin Grade II and supplemented Spetzler-Martin grade 4. Following multidisciplinary discussion, microsurgical resection was recommended.

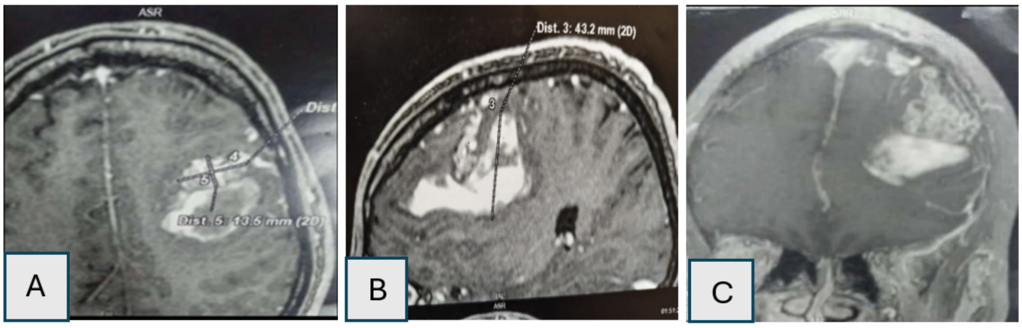

Figure 1. Preoperative MRI. axial (A), sagittal(B), and coronal(C) images showing the AVM nidus with intracranial hemorrhage.

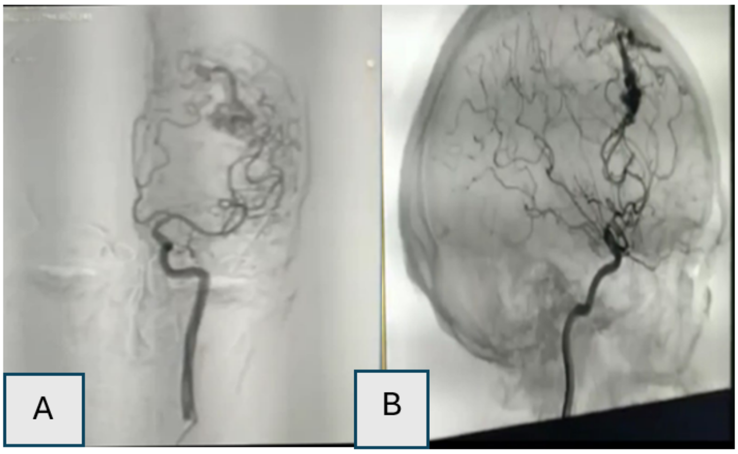

Figure 2. Preoperative angiography. (A) Frontal view showing arterial feeders from the left middle and anterior cerebral arteries. (B) Lateral view highlighting venous drainage into the superior sagittal sinus

A left frontal craniotomy was performed under general anesthesia. The dura was opened, revealing a prominent cortical draining vein characteristic of high-flow AVMs.

A meticulous circumferential dissection was carried out. Feeding arteries were progressively identified, coagulated, and divided while preserving normal vasculature. The draining vein was maintained until complete devascularization of the nidus.

After total isolation, the draining vein collapsed, confirming cessation of abnormal shunting. The AVM was completely excised. Hemostasis was achieved, and closure was performed in standard fashion.

The intraoperative images (Figure 3) highlight critical stages of the intervention, capturing the complexity of the AVM's high-flow dynamics and the precision required to navigate its proximity to eloquent cortical regions. These photographs serve to illustrate the methodical progression of the resection, from initial exposure and vascular dissection to the successful removal of the nidus.

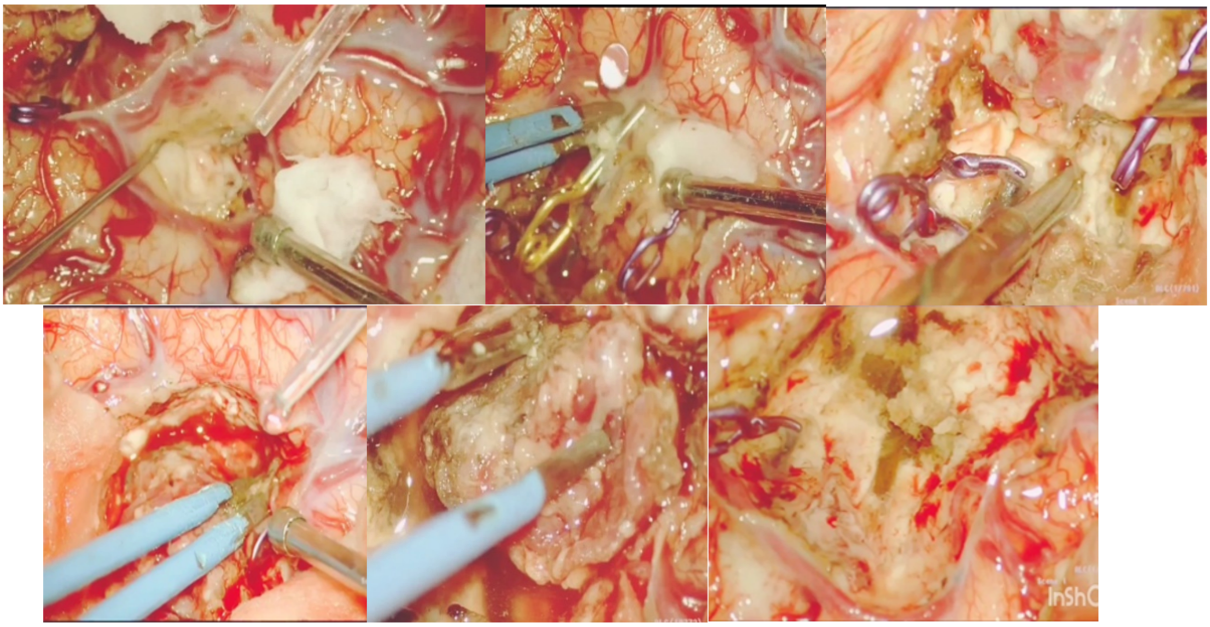

Figure 3. Intraoperative observations of AVM resection.

Postoperative recovery was favorable. Three-month follow-up angiography confirmed complete obliteration of the AVM (Figure 4).

Neurological deficits, including aphasia and hemiparesis, resolved completely within three months. At two-year follow-up, the patient remained neurologically intact with no recurrence.

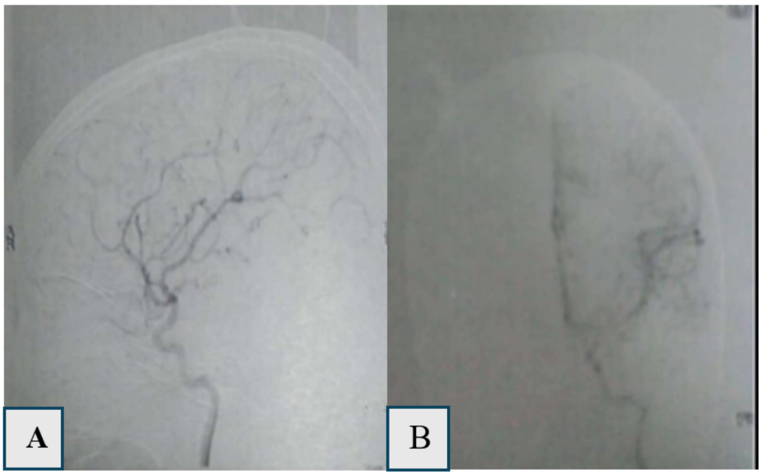

Figure 4 (A and B): Postoperative DSA; Sagittal view (A) and Frontal view (B)confirmed complete resection of the AVM with no evidence of residual nidus or abnormal vascular structures.

Discussion

Ruptured AVMs represent a neurosurgical emergency requiring prompt stabilization and multidisciplinary evaluation. In the present case, clinical presentation was consistent with acute intracerebral hemorrhage secondary to AVM rupture.

Ruptured brain arteriovenous malformations (AVMs) pose a significant treatment challenge, with options including microsurgical resection, endovascular embolization, radiosurgery, or combination between these modalities.

1- Imaging:

Accurate characterization of AVMs relies heavily on multimodal imaging. In our case, MRI provided the initial identification of the lesion and its hemorrhagic component, whereas cerebral angiography enabled a comprehensive understanding of the vascular architecture, including arterial feeders, nidus configuration, and venous drainage. Despite advances in noninvasive imaging, angiography remains indispensable for therapeutic planning due to its superior spatial and temporal resolution [9]. More recently, adjunct techniques such as functional MRI and perfusion imaging have gained importance, particularly when lesions are located in eloquent brain regions. These tools allow for a more refined assessment of functional anatomy and hemodynamic stress, thereby contributing to safer surgical strategies [14].

Long-term follow-up with angiographic imaging is essential to confirm complete obliteration of the nidus and to rule out recurrence, even in cases where surgical resection appears complete intraoperatively [9].

2- Surgery

Several factors need to be considered when deciding to treat a brain AVM. Its rupture, leading to ICH, constitutes a neurosurgical emergency and necessitates prompt stabilization and a multidisciplinary approach to optimize clinical outcomes. Studies show that, Microsurgical resection remains the treatment of choice for low-grade AVMs, offering immediate and definitive cure when complete excision is feasible [9]. However, treatment strategy must be individualized based on lesion angioarchitecture, eloquence, and clinical status [7]. The Spetzler-Martin grading system is integral for stratifying surgical risk and guiding treatment decisions [8]. In this case the patient's AVM, classified as Grade II, indicated moderate surgical complexity. Surgery was done with a meticulous dissection of the nidus and feeding arteries, combined with preservation of cortical draining veins until the nidus was completely excised, highlights the precision required for successful AVM resection. Complete resection minimizes the risk of rebleeding and ensures long-term obliteration, with evidence supporting its efficacy in preventing recurrence [9,10]. Advances in imaging and intraoperative tools, such as neuronavigation and intraoperative neuromonitoring, awake surgery have improved safety and offered additional potential for enhancing surgical precision and outcomes in AVM resection especially in eloquent zone [14].

Postoperative neurological recovery is strongly influenced by early rehabilitation strategies. Early mobilization and structured physiotherapy are associated with improved functional outcomes following intracerebral hemorrhage. Vigilant monitoring is equally important to detect and manage potential complications, including infection, hydrocephalus, or recurrent hemorrhage.

3- AVMs in Eloquent Brain Regions:

Lesions located within eloquent cortex, such as the pre-rolandic motor area in this case, present unique surgical challenges. The risk of postoperative neurological deficit is inherently higher due to the functional importance of these regions.

Evidence suggests that AVMs involving sensorimotor cortex are associated with less favorable early outcomes compared to lesions in non-eloquent areas [14]. However, neurological deficits may improve over time, likely due to cortical plasticity and rehabilitation.

In our patient, the presence of preoperative deficits followed by complete recovery supports the concept that carefully executed surgery can achieve good functional outcomes even in eloquent locations.

4- Possibility of Adjunctive Therapies

The management of AVMs increasingly relies on a multimodal approach. Endovascular embolization is frequently used as an adjunct to surgery, aiming to reduce nidus vascularity and intraoperative bleeding. Embolic agents such as Onyx have significantly improved the safety and efficacy of this technique [10,13].

However, embolization is not without limitations, including the risk of incomplete occlusion and procedure-related complications. Therefore, its use should be tailored to individual cases.

Stereotactic radiosurgery provides an alternative for small or surgically inaccessible AVMs. While it offers a noninvasive treatment option, its delayed therapeutic effect and lower obliteration rates compared to microsurgery limit its role in ruptured, accessible lesions [11,15].

5- Timing of Intervention

The optimal timing of surgical intervention following AVM rupture remains a subject of ongoing debate. Early surgery may be necessary in cases of significant mass effect or neurological deterioration. Conversely, delayed intervention can allow for hematoma resolution and improved delineation of anatomical planes.

In this case, a delayed surgical approach was chosen, enabling safer resection under more favorable conditions. This highlights the importance of individualized decision-making rather than adherence to a rigid treatment timeline.

Conclusion

Brain AVMs remain complex lesions requiring individualized management. Treatment decisions should consider patient characteristics, lesion features, and available expertise.

This case illustrates that microsurgical resection remains a highly effective treatment for ruptured low-grade AVMs, even when located in eloquent brain regions. Successful outcomes depend on careful preoperative planning, precise surgical execution, and appropriate use of adjunctive therapies.

Conflict of Interest Statement

The authors declare no conflict of interest.

References

1. Fleetwood IG, Steinberg GK. Arteriovenous malformations. *The Lancet*. 2002;359(9309):863–873. https://doi.org/10.1016/S0140-6736(02)07953-2

2. Stapf C, Mast H, Sciacca RR, et al. The New York Islands AVM Study: design, study progress, and initial results. *Stroke*. 2003;34(5):1181–1187. https://doi.org/10.1161/01.STR.0000068308.81774.8C

3. Brown RD Jr, Wiebers DO, Torner JC, O'Fallon WM. Incidence and prevalence of intracranial vascular malformations in a defined population. *Journal of Neurosurgery*. 1996;85(1):29–32. https://doi.org/10.3171/jns.1996.85.1.0029

4. Gross BA, Du R. Natural history of cerebral arteriovenous malformations: a meta-analysis. *Journal of Neurosurgery*. 2013;118(2):437–443. https://doi.org/10.3171/2012.10.JNS121280

5. Al-Shahi Salman R, Hall JM, Horne MA, et al. Untreated clinical course of brain arteriovenous malformations: a prospective cohort study. *The Lancet Neurology*. 2014;13(6):569–577. https://doi.org/10.1016/S1474-4422(14)70045-9

6. Mohr JP, Parides MK, Stapf C, et al. Medical management with or without interventional therapy for unruptured brain arteriovenous malformations (ARUBA). *The Lancet*. 2014;383(9917):614–621.

7. Derdeyn CP, Zipfel GJ, Albuquerque FC, et al. Management of brain arteriovenous malformations: a scientific statement for healthcare professionals. *Stroke*. 2017;48(8):e200–e224.

8. Samaniego EA, Dabus G, Meyers PM, et al. ARISE consensus on brain arteriovenous malformation management. *Stroke*. 2024;55(5):1449–1463. https://doi.org/10.1161/STROKEAHA.124.046725

9. Spetzler RF, Martin NA. A proposed grading system for arteriovenous malformations. *Journal of Neurosurgery*. 1986;65(4):476–483. https://doi.org/10.3171/jns.1986.65.4.0476

10. Saatci I, Geyik S, Yavuz K, et al. Endovascular treatment of brain arteriovenous malformations with Onyx: long-term results. *American Journal of Neuroradiology*. 2011;32(2):332–338. https://doi.org/10.3174/ajnr.A2298

11. Starke RM, Yen CP, Ding D, et al. Stereotactic radiosurgery for cerebral arteriovenous malformations: long-term outcomes. *Neurosurgery*. 2013;72(4):620–631. https://doi.org/10.1227/NEU.0b013e318283c3b3

12. Langhorne P, Bernhardt J, Kwakkel G. Stroke rehabilitation. *The Lancet*. 2011;377(9778):1693–1702. https://doi.org/10.1016/S0140-6736(11)60325-5

13. Pierot L, Wakhloo AK. Endovascular treatment of intracranial arteriovenous malformations: current status. *Journal of Neuroradiology*. 2013;40(5):300–313. https://doi.org/10.1016/j.neurad.2013.03.001

14. Chen CJ, Ding D, Starke RM, et al. Microsurgical resection of arteriovenous malformations in eloquent cortex: outcomes and predictors. *Neurosurgery*. 2014;74(1):34–45. https://doi.org/10.1227/NEU.0000000000000178

15. Friedman WA, Bova FJ, Mendenhall WM. Linear accelerator radiosurgery for arteriovenous malformations: relationship of size to outcome. *Journal of Neurosurgery*. 2001;94(2):241–252. https://doi.org/10.3171/jns.2001.94.2.0241

16. Lawton MT, Kim H, McCulloch CE, et al. *The supplementary grading system for arteriovenous malformations: a proposed supplement to Spetzler–Martin grade.*Journal of Neurosurgery**.** 2010;113(3):371–379. DOI: https://doi.org/10.3171/2009.11.JNS091074