International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Kaur A et al. Int J Reprod Contracept Obstet Gynecol. 2026 Jun;15(6):2229-2234
www.ijrcog.org
pISSN 2320-1770 | eISSN 2320-1789

DOI: https://dx.doi.org/10.18203/2320-1770.ijrcog20261636

Case Report

Conservative management of cerebral arteriovenous malformations in pregnancy

Amanjot Kaur, Sumanjot Kaur*, Anil Eragam, Pooja Sikka, Seema Chopra

Department of Obstetrics and Gynaecology, PGIMER, Chandigarh, India

Received: 23 March 2026
Revised: 08 May 2026
Accepted: 11 May 2026

***Correspondence:**
Dr. Sumanjot Kaur,
E-mail: sumanjot83@gmail.com

ABSTRACT

We report two cases of pregnant women diagnosed with unruptured cerebral arteriovenous malformations (AVM), each with distinct clinical presentations. One had history of focal seizures since adolescence. The other woman had history of an unevaluated focal neurological deficit prior to conception. During pregnancy, assessment with neuroimaging revealed an unruptured AVM. In both cases, a multidisciplinary team involving obstetricians, neurologists, neurosurgeons, and anesthesiologists was engaged to formulate the management plan. Considering the stability of the patients, conservative management was chosen and the pregnancy was closely monitored. The patient remained neurologically stable throughout gestation. Delivery planning aimed to minimize maternal hemodynamic stress and the risk of AVM rupture. Both cases underwent Caesarean delivery delivery in controlled conditions. There were no intraoperative, postpartum or neonatal complications.

Keywords: AVM, Neuro-obstetrics, Caesarean delivery, Neuraxial anaesthesia

INTRODUCTION

AVMs are rare vascular anomalies characterized by direct connections between arteries and veins, bypassing capillaries, with a prevalence of 0.01%-0.5% and mean presentation age of 20–40 years.[1] They may be asymptomatic or cause headaches, seizures, stroke, altered consciousness, or focal neurological deficits. AVM rupture is associated with maternal mortality, abortions and intrauterine foetal demise.[2] Grave complication of AVM hemorrhage has 5-12% maternal mortality rate and 17% fetal mortality rate.[1-3] Pregnancy represents a particularly vulnerable period because of the physiological changes in blood volume, cardiac output, and hormonal milieu, which may theoretically increase the risk of AVM rupture. These shunts increase cerebral blood flow and pressure, impairing autoregulation and raising the risk of hemorrhage.[1-4] Evidence on AVM behavior in pregnancy is limited, with unclear impact on rupture risk.[1,2,5] Unruptured aneurysms can reach term without complications, but post-hemorrhage re-bleeding is higher in pregnant women (26%) than non-pregnant women (6%).[1,2,6] AVMs are classified by The Spetzler-Martin AVM grading System according to the size, venous drainage (superficial or deep draining veins) and eloquence (proximity of AVM to structures that control sensory processing, language, communication and movement).[7] It classifies AVMs from grade I to grade V. Grade I AVM have low surgical risk while Grade V AVMs are very high risk AVMs. MRI is the preferred non-invasive modality for initial evaluation. Computed Tomography (CT) is favoured for detecting intracranial hemorrhage in emergent setting, its ability to define angioarchitecture is limited.[1] Digital subtraction angiography (DSA) is the preferred imaging for detailed vascular structure for precise surgical planning. Management is tailored individually, as standardized guidelines are lacking. A conservative approach is

reasonable for small, asymptomatic aneurysms which includes monitoring of vital signs, blood pressure and neurological signs. Surgical management of AVMs encompasses microsurgical resection, endovascular embolization, and stereotactic radiosurgery, selected according to size, site, and clinical status. Endovascular embolization is the preferred minimally invasive option, while resection is suitable for accessible AVMs but may be deferred until after delivery in stable cases. Radiosurgery is reserved for smaller AVMs but is contraindicated in pregnancy due to fetal radiation risk. Ruptured AVMs with neurological deficits are treated irrespective of gestational age with interventions like emergency nidus resection and hematoma removal. Women in first and second trimester undergo neurosurgical management and pregnancy is followed thereafter. For patients having progressive neurological deficits like worsening weakness, sensory loss or visual changes not responding to conservative management, refractory seizures, AVMs causing mass effect or hydrocephalus with viable fetus or in third trimester can be planned for Caesarean delivery delivery followed by neurosurgery. Vaginal delivery is not contraindicated. Clear recommendations or guidelines on surgical timing during pregnancy are lacking.[1] The optimal management of cerebral AVMs in pregnancy is not well established, and decisions must carefully balance maternal safety and foetal outcomes. While surgical or endovascular intervention may be warranted in cases of rupture or neurological deterioration, conservative management may be appropriate in stable, unruptured lesions. We discuss two cases of conservatively managed brain AVM in pregnancy.

CASE REPORTS

Case 1

A primigravida in her late 20s with known case of Spetzler Mortin Grade V Perisylvian AVM presented in second trimester.[7] In her late adolescent years she had symptoms of focal seizures with visual aura, impaired conciousness and headaches, which was gradually progressive since childhood. CT scan done that that time showed AVM in frontotemporal parietal lobe with mass effect and contralateral midline shift. She was offered option of gamma knife surgery but she continued with conservative management with antiepileptic therapy with oral levetiracetam 2 gram per day and oral clobazam 10 mg per day in divided doses.

She was seizure free for interval of 3 years till first trimester of pregnancy when she started having focal seizure. Since onset of pregnancy patient has been non-compliant to antiepileptic therapy following which, she had multiple episodes of focal seizures with visual aura during first trimester, was again started on oral levetiracetam 2 gram per day and rest of the antenatal period was uneventful. She had no history of smoking, alcohol or drug abuse. Her family history was insignificant. Her general physical, obstetric and neurological examination was unremarkable. During evaluation cerebral infections, malignancies, electrolyte imbalance and other psychogenic causes were ruled out. Electroencephalogram was normal. Apart from hypothyroidism, she had no comorbidity; she was supplemented with 25 micrograms levothyroxine. She was managed conservatively on antiepileptic therapy with strict watch on blood pressure (every 6th hourly) and pregnancy was continued till term. To avoid valsalva and hypertension she underwent elective Caesarean delivery delivery at 37 weeks gestation. Post operative period was uneventful. There were no focal motor or sensory deficits, no signs of raised intracranial pressure and no seizure activity.

Oral levetiracetam was continued, breastfeeding was allowed with counseling as levetiracetam is considered relatively safe during lactation. Blood pressure control was mainatined. Given high-grade Spetzler-Martin Grade V AVM decision was made to continue conservative management as the AVM was large, eloquent and unsuitable for surgical intervention. Imaging was planned at 6 weeks post-partum to reassess and establish post-pregnancy baseline.

Case 2

A primigravida in her late 20s presented to our hospital at 38+1 weeks period of gestation. She was asymptomatic at presentation and throughout her antenatal period.

She had undergone MRI at her primary health center owing to a prior history of cerebrovascular accident with right-sided hemiparesis as a pre-adolescent, which revealed an AVM. During that initial episode, she had not received medical attention, and her symptoms resolved spontaneously within three months. Her pregnancy had been complicated by gestational diabetes mellitus (well controlled on medical nutritional therapy) and hypothyroidism (supplemented by oral thyroxin 50 mcg/day).

She had no neurological symptoms. She was managed by multidisciplinary team including interventional radiologist and neurosurgeons apart from obstetricians. She was assessed by anaesthesiologist during labor. Figure 1 shows digital subtraction angiography showing large AVM. Figure 2 shows an axial T2-weighted MRI showing multiple flow voids in the right cerebral hemisphere, consistent with AVM.

Figure 3 is an axial MR angiography with contrast enhances sequences showing multiple serpiginous, flow-related hyperintensities. These vessels form a compact nidus with evidence of enlarged feeding arteries and early draining veins. Findings were consistent with a Large AVM in right capsule-thalamic region. Oral Levetiracetam 1 gram per day was initiated. She had spontaneous onset of labour at 38+3 weeks of gestation, and Caesarean

delivery delivery was done. Post-operative period was uneventful and she was discharged in stable condition. She developed no focal deficits or seizures and BP was well controlled. In view of large, deep-seated AVM definitive intervention was deferred and a follow-up MRI was planned at 6 weeks postpartum. Digital subtraction angiography was planned to be done if neurological symptoms developed or intervention was contemplated.

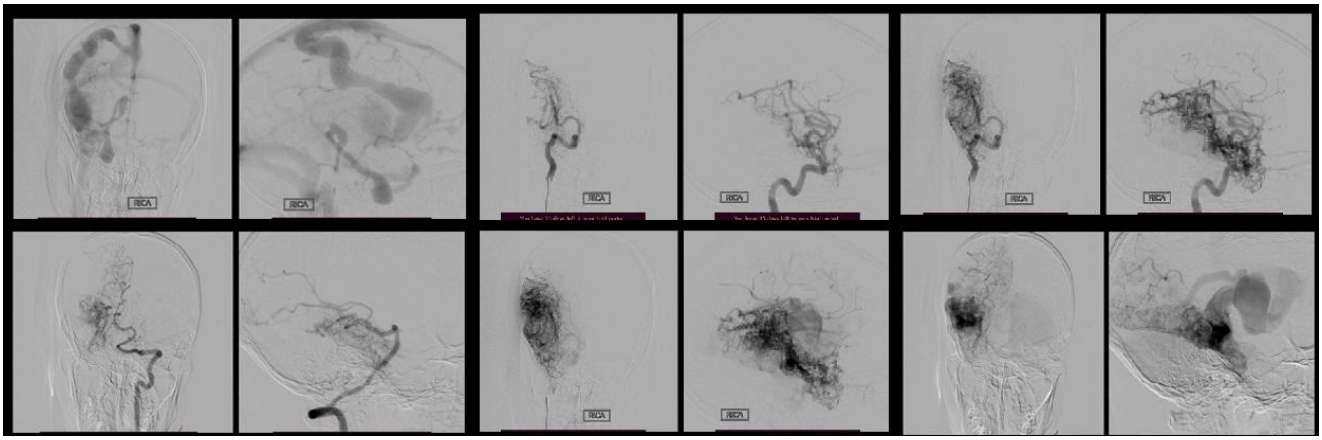

Figure 1: Cerebral DSA showing large cerebral AVM with visualized nidus, feeders, and early venous drainage in AP and lateral views.

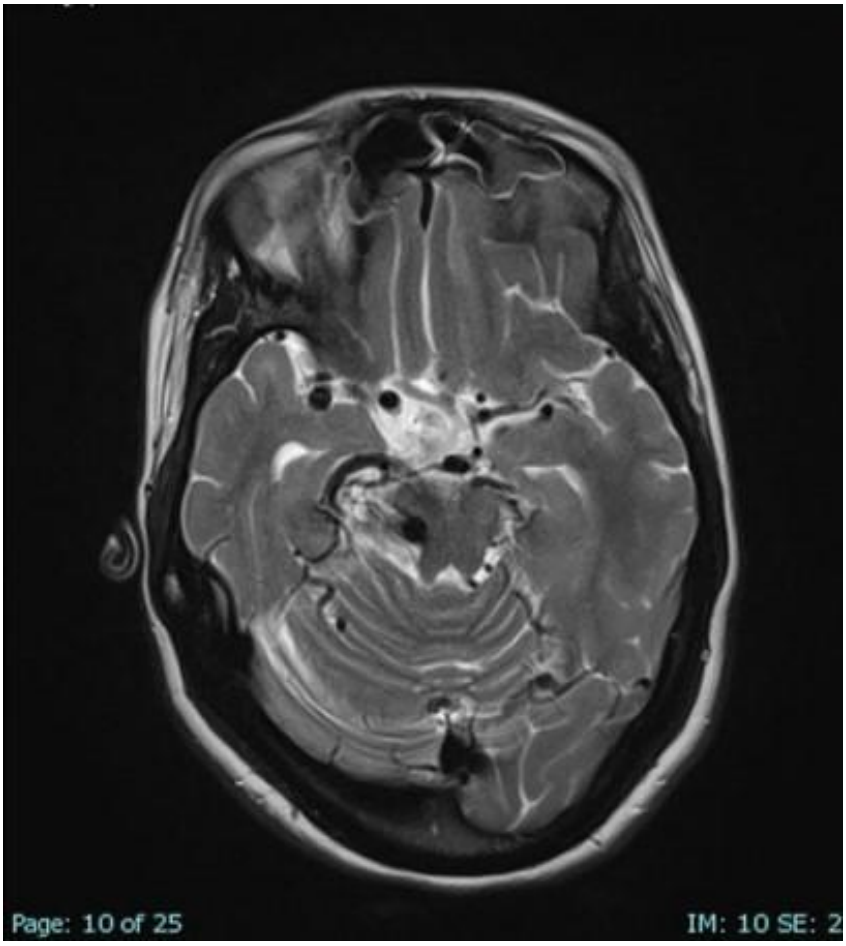

Figure 2: Axial T2-weighted MRI showing multiple flow voids in the right cerebral hemisphere, consistent with abnormal dilated vessels.

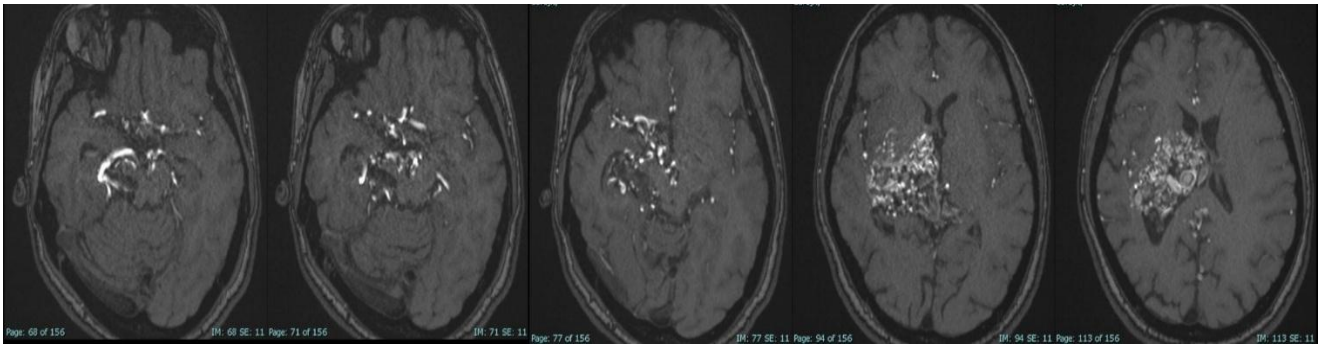

Figure 3: Axial MRI angiography contrast enhances sequences showing multiple serpiginous, flow-related hyperintensities are seen in the right cerebral hemisphere, most prominently in the parietal region. These vessels form a compact nidus with evidence of enlarged feeding arteries and early draining veins.

DISCUSSION

Cerebral AVMs can often exist asymptomatically for years with first identification during pregnancy. Subtle symptoms such as headaches are frequently overlooked, and it is often pregnancy that prompts most women to seek medical evaluation. Seizures are among the most common non-hemorrhagic manifestations and may be the initial symptom prompting neuroimaging. In pregnant women, these signs may be mistakenly attributed to obstetric complications such as eclampsia or migraine, leading to delayed diagnosis.

In one case, a known AVM developed new neurological deficits managed with antiepileptic drugs; in the other case, MRI revealed a previously undiagnosed AVM in a patient with prior focal deficits.

During pregnancy, imaging modality for AVMs is chosen to balance the diagnostic accuracy with fetal safety. MRI without gadolinium contrast is preferred first line modality for initial evaluation and longitudinal follow-up. It provides good visualization of anatomy, associated edema or prior hemorrhage without ionizing radiation, making it safe in pregnancy.

However, it is less detailed than angiography for defining small feeding vessels and exact hemodynamics. Computed Tomography is preferred during emergencies to detect acute intracranial hemorrhage. It involves exposure to ionizing radiation therefore reserved for emergent cases. CT angiography (CTA) offers better vascular detail than non-contrast CT but exposes both mother and fetus to higher radiation and iodinated contrast, so it is usually avoided.

Digital subtraction angiography (DSA) remains the gold standard for detailed AVM characterization and treatment planning, but it is reserved for cases where intervention is being considered or when non-invasive imaging is insufficient as it involves highest radiation exposure and procedural risks. Overall, MRI without contrast is favoured for routine assessment, while CT and angiography are used selectively based on clinical urgency.[8,9]

Both patients received multidisciplinary insight. Management included close hemodynamic and neurological monitoring, continuation of antiepileptics, and Caesarean delivery delivery was planned.

There is no literature supporting or opposing use of prophylactic antiepileptics in cerebral AVMs in pregnancy specifically, although it is not recommended to start prophylactic drugs in intracranial hemorrhage.[10,11]

Antiepileptic drugs were started for both of our patients. As Valsalva during labor increases blood pressure and intracranial pressure which in turn increases the risk of rupture of AVM, Caesarean delivery delivery was chosen and mode of delivery. Additionally, with planned Caesarean delivery delivery, the anesthesiologist can chose techniques that minimize changes in hemodynamics and cerebral autoregulation. Regional anesthesia with controlled hypotension was opted as epidural or combined spinal-epidural anesthesia allows gradual dose titration, maintaining stable hemodynamics and minimizing risk of hypertension and raised intracranial pressure.

It ensures maternal and foetal oxygenation even in emergencies. BP should be maintained close to baseline with MAP 10-15% of baseline and MAP <65 mm Hg should be avoided as recommended in neuroanesthesia and obstetric anesthesia literature.[12-14] Neuraxial anesthesia is appropriate for unruptured AVM, neurologically stable patient, normal coagulation profile with no evidence of acute hemorrhage or no signs of raised intracranial pressure. Patients with neuraxial anesthesia remain awake with allows early detection of deficits.

Moreover, epidural dosing can be titrated slowly ensuring a more physiological response.[15] General anesthesia is reserved for cases where neuraxial techniques are contraindicated, as intubation can trigger sympathetic surges and hypertension.[16] Management must balance maternal safety and foetal well-being; surgical management is effective but poses anesthesia, radiation,

and hemodynamic risks in pregnancy. Consequently, conservative management is often advocated in stable and unruptured AVMs. This approach involves close monitoring of hemodynamic signs, neurological signs and seizure prophylaxis; our patient remained stable throughout pregnancy, supporting the safety of this strategy in selected scenarios.

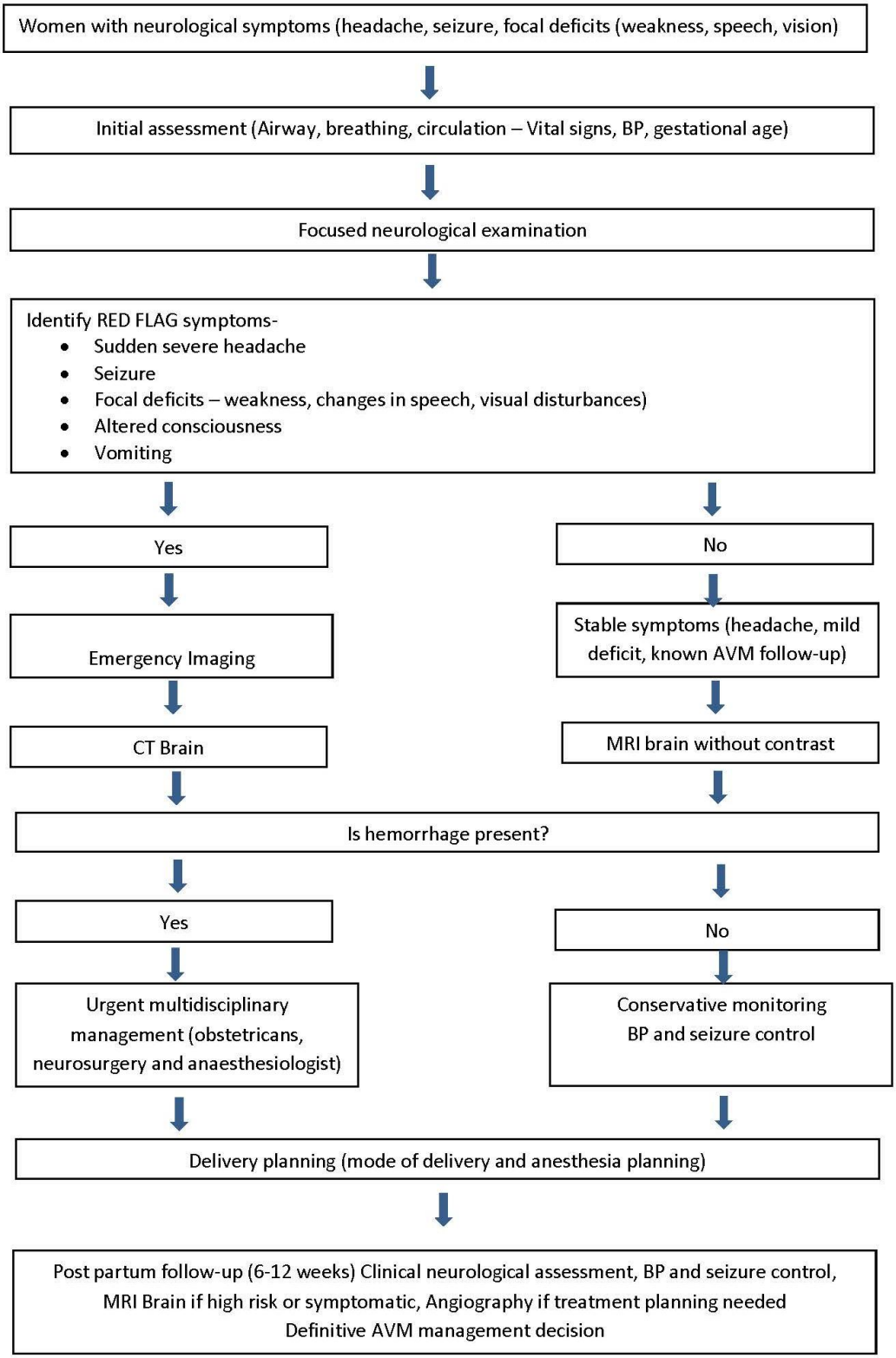

Figure 4: Algorithm for neurological evaluation and management.

A major limitation in guiding management of AVMs during pregnancy is the lack of standardized protocols. Existing evidence is largely derived from retrospective studies, case series, and anecdotal reports, resulting in inconsistent recommendations. Since Caesarean delivery delivery provides a predictable and planned environment for better control of BP and hemodynamics, avoids prolonged Valsalva.

These cases underscore the importance of vigilance and high index of suspicion in pregnant women presenting with neurological symptoms and the need for coordinated and multidisciplinary care and underscores the need for individualized, patient-centered decision-making that incorporates maternal clinical stability, AVM characteristics, gestational age, and patient preferences.

Figure 4 shows an algorithm for neurological evaluation and management. Conservative management can be a safe and effective strategy in selected women with definitive neurosurgical treatment deferred until the postpartum period. Reporting of such cases contributes valuable insight into this uncommon but high-stakes clinical scenario, helping shape future management strategies and standardized protocols

CONCLUSION

Patients presenting with focal neurological symptoms should be critically assessed and investigated with high index of suspicion for sinister pathologies. Pregnancy with unruptured cerebral AVM can be managed conservatively if the patient remains neurologically stable, with close monitoring and multidisciplinary input. Planned early-term cesarean delivery under controlled conditions may help minimize maternal hemodynamic stress and reduce the theoretical risk of AVM rupture, leading to favorable maternal and neonatal outcomes.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Yuan K, Chen Y, Yan D, Li R, Li Z, Zhang H, et al. Re-rupture in ruptured brain arteriovenous malformations: a retrospective cohort study based on a nationwide multicenter prospective registry. J NeuroInterv Surg. 2024;16(11):1145-51.
2. Johnson AC, Cipolla MJ. The cerebral circulation during pregnancy: adapting to preserve normalcy. Physiology (Bethesda). 2015;30(2):139-47.
3. Liu XJ, Wang S, Zhao YL, Teo M, Guo P, Zhang D, et al. Risk of cerebral arteriovenous malformation rupture during pregnancy and puerperium. Neurology. 2014;82(20):1798-803.
4. Lv X, Liu P, Li Y. Pre-existing, incidental and hemorrhagic AVMs in pregnancy and postpartum: gestational age, morbidity and mortality, management and risk to the fetus. Interv Neuroradiol. 2016;22(2):206-11.
5. De Maria L, Serioli S, Fontanella MM. Brain arteriovenous malformations and pregnancy: a systematic review of the literature. World Neurosurg. 2023;177:100-8.
6. Ji Y, Liang Y, Liu B, Wang Y, Li L, Liu Y, et al. Anaesthetic management of cerebral arteriovenous malformation hemorrhage during pregnancy: a case series. Medicine (Baltimore). 2023;102(5):e32753.
7. Spetzler RF, Martin NA. A proposed grading system for arteriovenous malformations. J Neurosurg. 1986;65(4):476-83.
8. American College of Obstetricians and Gynecologists. Guidelines for Diagnostic Imaging During Pregnancy and Lactation. ACOG Committee Opinion No. 723. 2017. Available at: https://www.acog.org/clinical/clinicalguidance/committee-opinion/articles/2017/10/guidelines-for-diagnostic-imaging-during-pregnancy-and-lactation. Accessed on 23 February 2026.
9. Ray JG, Vermeulen MJ, Bharatha A, Montanera WJ, Park AL. Association between MRI exposure during pregnancy and fetal and childhood outcomes. JAMA. 2016;316(9):952-61.
10. Lockney DT, Vaziri S, Walch F, Kubilis P, Neal D, Murad GJ, et al. Prophylactic antiepileptic drug use in patients with brain tumors undergoing craniotomy. World Neurosurg. 2017;98:28-33.
11. Yerram S, Katyal N, Premkumar K, Nattanmai P, Newey CR. Seizure prophylaxis in the neuroscience intensive care unit. J Intensive Care. 2018;6:17.
12. Cottrell JE, Patel PM. Cottrell and Patel's Neuroanesthesia. 6th ed. Philadelphia: Elsevier. 2017;315-30.
13. Albin MS. Textbook of neuroanesthesia with neurosurgical and neuroscience perspectives. New York: McGraw-Hill. 2011;421-35.
14. Chestnut DH, Wong CA, Tsen LC. Chestnut's Obstetric Anesthesia: Principles and Practice. 6th ed. Philadelphia: Elsevier. 2020;681-700.
15. Hebl JR, Horlocker TT, Schroeder DR. Neuraxial anesthesia and analgesia in patients with preexisting central nervous system disorders. Anesth Analg. 2006;103(1):223-8.
16. Coskun D, Mahli A, Yilmaz Z, Cizmeci P. Anesthetic management of Caesarean delivery section of a pregnant woman with cerebral arteriovenous malformation: a case report. Cases J. 2008;1:327.

Cite this article as: Kaur A, Kaur S, Eragam A, Sikka P, Chopra S. Conservative management of cerebral arteriovenous malformations in pregnancy. Int J Reprod Contracept Obstet Gynecol 2026;15:2229-34.