

Case Report

Management Options and Outcome of Cerebral Arteriovenous Malformation in Pregnancy: Case Series

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Abstract

Cerebral arteriovenous malformation (AVM) is a rare entity with an estimated prevalence of 0.01-0.05% in the general population. We reviewed hospital obstetric records during 2010-2017 and reported a case series of six patients with cerebral AVM in pregnancy, of which five patients had successful pregnancy, and one maternal mortality.

Keywords: Cerebral arteriovenous malformation, Management, Outcome, Pregnancy

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Introduction

Cerebral arteriovenous malformation (AVM) is a rare entity with estimated prevalence of 0.01%–0.05% in the general population.¹ It affects men and women equally and commonly presents in patients aged 20–40 years old. AVMs are formed from a complex vascular mass or nidus that shunt blood between arterial-venous circulations without an intervening capillary bed.² Although patients are usually asymptomatic, they are at increased risk of rupture. This results in management dilemma for obstetricians.

Case Reports

We reviewed the hospital obstetric records during 2010–2017 and reported a case series of six patients with cerebral AVM in pregnancy, of which five patients had successful pregnancy, and one maternal mortality.

Patient 1

A 28-year-old G1P0 with known cerebral AVM was referred at 14 weeks of gestation. She was diagnosed at the age of 19 and was partially treated with clipping. Throughout the pregnancy, she remained asymptomatic and was co-managed by an obstetrician and neurosurgeon. She underwent an uncomplicated elective caesarean section (CS) at 38 weeks of gestation under spinal anesthesia. There was no absolute contraindication for subsequent pregnancy as she remained asymptomatic. She used the calendar method to space out her pregnancy for two

years. Her second pregnancy progressed well and elective repeat CS was performed at 38 weeks of gestation without complication.

Patient 2

A 27-year-old G3P1+1 with history of left cerebral AVM was referred at 16 weeks of gestation. She underwent craniotomy and complete excision of the AVM two years ago. During the pregnancy, she was co-managed by obstetrician and neurosurgeon with 2 to 3 weekly follow-ups. She remained asymptomatic and successfully delivered a baby girl via spontaneous vertex delivery without complications at 40 weeks of gestation. However, she defaulted her neurosurgical follow-up as she remained asymptomatic. Two years later, she was referred back to an obstetrician at 32 weeks during her fourth pregnancy. Her pregnancy had been uneventful and she delivered a baby girl via normal vaginal delivery at 39 weeks of gestation.

Patient 3

A 32-year-old G1P0 presented with persistent headache associated with vomiting at 14 weeks of gestation. Magnetic resonance imaging (MRI) of brain and cerebral angiogram confirmed basal ganglia AVM with nidus measuring 3.2 × 1.5 cm and no evidence of acute hemorrhage. She had persistent vomiting and headache and required embolization at 19 weeks of gestation. Unfortunately, she developed intraventricular and extradural hemorrhages that required multiple craniotomies and the management

of this case was challenging with unsuccessful pregnancy outcome. The patient died.

Patient 4

A 33-year-old G3P1+1 presented with occipital headache associated with nausea and vomiting at 14 weeks of gestation. She had no neurological deficit. MRI brain revealed AVM with intraventricular haemorrhage. Cerebral angiogram showed left parasagittal AVM measuring 2.0x0.8cm with multiple intranidal and feeding arteries (Figure 1a). A discussion on pregnancy termination was held between the obstetrician, neurosurgeon, intervention radiologist and the patient. The patient decided to continue with the pregnancy. She had persistent headache and required embolization at 22 weeks of gestation, where 60% of the nidus was successfully occluded. Post-procedure, she developed premature contraction which resolved after treatment. She was co-managed by an obstetrician and neurosurgeon every 2 weeks. Her pregnancy progressed well and she delivered a baby boy without complication via elective CS at 37 weeks. She was planned to have repeat embolization post-partum but defaulted the appointments. Unfortunately, without proper contraception, she conceived again a year later and presented to us at 7 weeks of gestation. In view of persistent AVM and history of rupture in the previous pregnancy, embolization was performed at 21 weeks despite patient being asymptomatic. Post-embolization angiogram showed residual AVM with reduction in flow (Figure 1b). She remained asymptomatic and her pregnancy progressed well. She had an uncomplicated elective repeat CS with bilateral tubal ligation at 37 weeks of gestation.

Patient 5

A 25-year-old previously healthy G1P0 was referred for further management of suspected ruptured cerebral AVM at 24 weeks of gestation. She presented with persistent headache without neurological deficit at 18 weeks of gestation. Brain MRI revealed right temporal AVM with previous hemorrhage. Cerebral angiogram at 24 weeks of gestation showed a nidus measuring 2.2 cm without

active hemorrhage. She was managed conservatively under supervision of a multi-disciplinary team (obstetrician, neurosurgeon and intervention radiologist). Her pregnancy progressed well and she had an uncomplicated elective CS at 38 weeks of gestation. She used intra-uterine device as contraception while awaiting corrective surgery for AVM.

Patient 6

A 36-year-old G7P1+5 with a 3-year history of cerebral AVM presented with persistent headache at 22 weeks of gestation. She refused surgical intervention at time of diagnosis and was managed conservatively with yearly MRI surveillance. She had a spontaneous vertex delivery 6 years ago and unexplained recurrent miscarriages. MRI at 14 weeks of gestation showed occipital AVM measuring 2.2 × 2.3 × 3.3 cm, unchanged from previous imaging. Detail scan of the fetus showed presence of transposition of great arteries (TGA) and she was managed together with a maternal-fetal-medicine specialist. Throughout the pregnancy, she presented multiple times with headache and photophobia. She was managed conservatively as there was no evidence of AVM rupture. She delivered a baby girl via an uncomplicated elective CS at 37 weeks of gestation. Her baby was referred to a neonatologist for further management of TGA.

Discussion

It is postulated that increase in cardiac output during pregnancy and intra-partum may cause AVM to rupture. Most AVM hemorrhages occur between 18 to 20 weeks of gestation and within 6 weeks post-partum. However, there are contradictory results among investigators regarding the risk of AVM rupture during pregnancy. A previous study highlighted a four times increased risk of AVM rupture during pregnancy compared to the general population.³ Meanwhile, Horton et al. found that risk of AVM bleed during pregnancy was 3.5%, similar to the general population (3.1%).⁴ However, the risk of second bleeding increased to 6% within a year if untreated after the first bleeding in pregnancy.⁵ A recent study also did not find an increased risk of AVM rupture during pregnancy

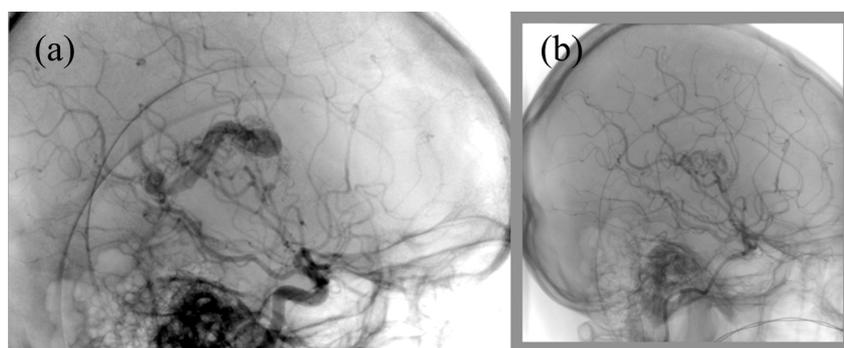


Figure 1. (a) Pre-embolization Cerebral Angiogram. (b) Post-embolization Angiogram.

among Chinese women aged between 18 to 40 years.⁶ Nevertheless, AVM hemorrhage caused 28% maternal mortality and 14% neonatal mortality.⁷

Role of imaging and treatment are different in every pregnant woman with AVM. They may have incidental AVM, preexisting ruptured or unruptured AVM or ruptured AVM in pregnancy. CT brain is useful to diagnose intracranial hemorrhage and MRI has the advantage of identifying the cause of bleeding.⁸ Good abdominal shield is mandatory during CT brain to reduce radiation to the developing fetus. Cerebral angiography is necessary to demonstrate characteristics of AVM, such as feeding vessels, the size of nidus, location of AVM, flow rate and coexisting aneurysm.⁷ It has been reported in literatures^{9,10} to be safe for fetal development. In our case series, 4 patients (patient 3 to 6) had brain MRI and 3 patients underwent cerebral angiogram (patient 3 to 5). For asymptomatic patient with preexisting AVM (patient 1 & 2), the role of imaging during pregnancy is limited unless intracranial bleeding is suspected or new neurological deficit develops.

For asymptomatic patients with no evidence of hemorrhage (patient 1 and 2), we managed the patients conservatively with frequent surveillance and monitoring every 2 to 3 weeks. Blood pressure monitoring is essential as a sudden increase may indicate the possibility of AVM bleeding.¹¹ Multi-disciplinary care involving an obstetrician and neurosurgeon is important to ensure good pregnancy outcome. Interestingly, both patients had two successful pregnancies without surgical intervention for AVM during their pregnancies. For patient 5, whether to correct the AVM surgically or not remained a dilemma to the treating doctors. She was at increased risk of further hemorrhage following an asymptomatic bleeding at 18 weeks of gestation. A consensus was reached between the patient, obstetrician, neurosurgeon and intervention radiologist to treat conservatively after evaluating benefits and risks. Nevertheless, we recommended proper and frequent communication between doctors and patient during the process of expectant monitoring to avoid unwanted complications.

For patients with no evidence of hemorrhage but symptomatic (persistent headache), we implemented two different approaches. Patient 3 was treated with embolization but developed complications and unfortunately died. Expectant monitoring and vigilant surveillance with weekly follow-ups were done to manage patient 6 with a successful pregnancy outcome. Embolization has been reported to be associated with bleeding complications especially in large AVM.¹² Proper evaluation of patient before implementation of treatment is important to ensure good outcome. Endovascular embolization is another option for woman with bleeding AVM during pregnancy with reported good outcomes for both mother and fetus.^{13,14} Patient 4 was treated

with embolizations during her two pregnancies without complications. One major consideration in embolization is the risk of radiation to fetus. The risk of fetal harm varies depending on the gestational age and radiation dosage. The safety threshold for radiation dose is 120 mGy at 15 weeks of gestation.¹⁰

Surgical resection is necessary for ruptured AVM in pregnancy. If fetus is mature, emergency CS should be considered. Literature has suggested that surgical excision of AVM can be performed during pregnancy in selected cases to improve mother's prognosis.^{13,15} Surgical resection of AVM during pregnancy may cause bleeding and hence compromise utero-placenta circulation. Generally, it is recommended that corrective surgical resection should be performed post-partum in an elective list. Corrective surgery risk should be graded according to the Spetzler–Martin classification to ensure good prognosis.¹¹

There is no evidence that normal vaginal delivery will increase risk of AVM hemorrhage.¹¹ Majority of the literature suggested elective CS as the preferred delivery method.^{16,17} If AVM has been completely resected, such as in patient 2, vaginal delivery can be considered unless obstetrically contraindicated. Precautions such as epidural analgesia for better pain control and instrumentation assisted vaginal delivery to shorten duration of second stage are strongly recommended.¹⁸ We prefer elective CS in favor of feasibility in controlling hemodynamic stability, timing and duration of delivery.

Counselling regarding future pregnancy remains the most challenging task. To date, there is no solid evidence to discourage women with unruptured or complete resection of AVM to not have children. Choice of contraception and risk of AVM rupture should be properly advised. Evidence has suggested that women with history of AVM rupture should be treated before embarking on pregnancy.

In conclusion, treatment of cerebral AVM in pregnancy should be in accord with patient's presentation. Each patient requires a tailored and individualized management plan to ensure good pregnancy outcome

Authors' Contribution

CKT, NIB, AKAK, MAA, and MFA are all involved in manuscript writing and management of patients. EYH, and RZ are involved in writing radiological report and providing image of Figure 1 in this manuscript. JaT, and AAB providing expert opinion to manage these case series and also involving in manuscript writing. NAAG and NAMI involved in final manuscript writing and correction.

Conflict of Interest Disclosures

On behalf of all authors, the corresponding author states that there is no conflict of interest. All authors are responsible for the content and writing of this paper.

Ethical Statement

As this is a case series manuscript, ethical approval from our institute is not required. Informed verbal consent was obtained from all individual included in this manuscript.

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