



ORIGINAL RESEARCH PAPER

Obstetrics & Gynaecology

CEREBRAL ARTERIO-VEINUS MALFORMATION IN PREGNANCY

KEY WORDS: AVM, Pregnancy, Haemorrhage

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ABSTRACT

Objective: It is difficult to outline the natural history of cerebral AVM (Arterio-venous malformation) in pregnant women due to less number of cases. There is controversy regarding the issue if pregnancy increases the risk of haemorrhage from intracranial AVM or not. This review was performed to search the answers in different relevant published literatures.

Methods: A Pub Med and Google search using the terms "cerebral arteriovenous malformation, pregnancy and treatment" was performed from the year 2006-2017. Clinical data regarding maternal age, parity, Gestational age, presenting symptoms at admission, obstetric management, postoperative complications, follow-up and maternal outcome were recorded from relevant abstracts and full article.

Results: Result summarized in Table Format. (Table- 1)

Conclusion: Hemorrhagic presentation of cerebral AVM was significantly associated with poor maternal outcome and surgical intervention in these cases can prevent rebleed. In case of unruptured case we counsel the patient regarding risk and we continue with the conservative management if risk factors (Increasing age, Deep location, Deep Venous drainage and previous haemorrhage). Pregnancy is not the risk factor for the haemorrhage in a woman without previous haemorrhage.

Introduction

The prevalence rate of cerebral arteriovenous malformation (AVM) is approximately 0.01%–0.5% and generally presents in 2nd and 3rd decade of life, most commonly at 30 years of age and affects men and women equally^{1,2}. Haemorrhage due to AVM is a rare but it stands as a grave complication of pregnancy and is responsible for 5%–12% of all maternal deaths during pregnancy and 17% fetal mortality^{3,7}. Pregnancy coexisting with AVM is a complex situation and may involve pre-existing pathology, incidental finding or haemorrhage prior to or during pregnancy. Once the diagnosis is established, the management is mainly based on neurosurgical consideration rather than obstetric consideration.

Presentation in different journals- Discussed in Table-1

Discussion

Age range of 18 year to 40 year was studied as this is child bearing age in females.

Most cerebral haemorrhage occurred between 20 weeks of pregnancy and post partum 6 weeks, which coincide with maternal hemodynamic change¹⁸. Pregnancy increase cardiac output by 30%-60% which increase rapidly after 1st Trimester. Cardiac output reach at peak at end of 2nd trimester become normal after few weeks of postpartum. The blood volume and Blood pressure also reach at peak during late pregnancy. Patient with cerebral AVM have decreased ability to adjust blood flow due to vascular abnormality. It increases the shear stress in wall of AVM which can cause AVM rupture and bleeding¹. The time of onset of AVM rupture may be related to this hemodynamic and hormonal change¹⁹. Findings in experimental studies suggest that angiogenic activity of AVM tissues may increase during late pregnancy; so physicians should inform pregnant patients with AVM of the potential risk²⁰. Couldwell et al. described a rare case of spontaneous regression of an AVM, noted in the postpartum period in this case, suggesting the particular significance of hormonal factors in the dynamics of growth and rupture of an AVM²¹. Pre-existing AVMs play a significant role in pregnancy-associated hemorrhagic stroke, and most remain undiagnosed until stroke onset. The possibility of AVM should be considered in any pregnant patients with neurological symptoms, and a full investigation should be conducted.

Investigation

Magnetic resonance imaging examination is helpful to distinguish the eclampsia, pre-eclampsia and intracranial haemorrhage. Pregnant female can present as eclampsia in case of cerebral haemorrhage. For head computed tomography (CT) examination, good shielding must be done for pregnant uterus. After

intracranial haemorrhage, cerebral angiography should be performed for pregnant. The fetus is rarely affected by radiation and iodine contrast if shielding done properly. We can find the risk factors^{5,7} as in our study, for the haemorrhage after looking at the angio-architecture of the AVM²² and grading according to the Spetzler-Martin classification²³.

Management

Advances in noninvasive fetal monitoring, neuroanaesthesia, and microsurgical techniques permit safe neurosurgical management of brain lesions during pregnancy^{24,27}. Corticosteroids are very effective in the treatment of severe brain edema perioperatively and in the peripartum period. They may accelerate fetal maturity by stimulating the lecithin-sphingomyelin index, which is a marker for lung maturation; however, long-term use of corticosteroids, particularly during the third trimester, may result in fetal adrenal suppression and neonatal hypoadrenalism. The usual regimen is a divided dose of 2–4 mg dexamethasone every six hours, tapered slowly over a few weeks^{5,7,27,28}. Hemodynamic stability is important for maintaining maternal cerebral perfusion as well as prevention of uterine hypoperfusion and fetal hypoxia²⁹. Administration of mannitol should be cautious and reserved only for acute emergency because it crosses the placenta and affects the fetus and may cause redistribution of water from the fetus to the mother leading to fetal hypovolemia and dehydration. Furosemide may be a better alternative to mannitol²¹. Maternal hydration should be maintained to prevent fetal hypovolemia.

Prompt control of repeated seizures during pregnancy should be done. Folic acid should be given. Patients who have new-onset seizures during pregnancy should be investigated³¹. Antiepileptic drugs should be prescribed (preferably monotherapy) to all gravid patients with AVMs and their levels should be monitored closely during pregnancy and puerperium and the dose adjusted accordingly²⁵. Patients with seizures should be maintained on folic acid from early pregnancy and should receive supplemental vitamin K₁ three weeks before and during confinement to minimize the risk of drug-induced neural tube defects or blood dyscrasias.

Intracranial haemorrhage from an AVM in pregnancy is quite rare and could lead to exceedingly high maternal and fetal morbidity and mortality^{28,31}. In this review we found that AVM ruptures associated with rapidly escalating neurologic deficit caused by raised intracranial pressure were treated before delivery, irrespective of the stage of pregnancy, and the method of treatment were decided primarily on neurosurgical grounds. Patients near full term (at mean of 35.8 weeks' gestation (range from 26 to 40 weeks' gestation)) with rapidly escalating neurologic deficit caused by raised intracranial pressure had an emergency

caesarean section (CS) followed by the neurosurgical operation in the same session. Patients in the first, second and early third trimester had the neurosurgical procedure performed first and pregnancy was completed. At full term, obstetrician decided the method of delivery (Vaginal Delivery (VD) or CS)³¹. We found that all cases of unruptured AVMs continued pregnancy to full term without endangering the mother or fetus.

Urgent interventions (emergent nidus resection, ventricular drainage, and hematoma removal) are reserved for patients with a ruptured AVM, active hydrocephalus requiring shunting, associated with signs of impending herniation, progressive neurological deficit or both. Therefore, AVM evaluation and treatment may be undertaken without regard for the pregnancy and the pregnancy should progress without concern for AVM⁵.

Endovascular technique

Recent advances in **endovascular technology** have increased the potential for successful treatment of previously inoperable high-grade AVMs^{2, 32, 33, 34}. By doing angiography we can better understand the anatomy of the AVM, including number and orientation of the feeding arteries and draining veins, to find the associated prenidial and intranidal aneurysm. AVM can be partially embolized through accessible feeders to facilitate surgical

resection and minimize blood loss and surgical morbidity⁵. Extensive endovascular Onyx embolization is feasible in the setting of a ruptured high-grade AVM during pregnancy². Preoperative endovascular embolization can be included when considering surgical excision³¹. The rationale for proceeding with treatment should be presence of risk factors for haemorrhage as it increases the maternal morbidity and mortality rate in case of AVM haemorrhage.

Stereotactic radiosurgery

In those patients with small deeply seated AVMs, which are a high operative risk, or inoperable lesions, stereotactic radiosurgery can be used as an alternative treatment to microsurgery even in pregnant patients³⁶.

Conclusion

Haemorrhagic presentation of AVM was significantly associated with poor maternal outcome and surgical intervention in these cases can prevent rebleed. In case of unruptured case we counsel the patient regarding risk and we continue with the conservative management if risk factors (Increasing age, Deep location, Deep Venous drainage and previous haemorrhage). Pregnancy is not the risk factor for the haemorrhage in a woman without previous haemorrhage.

JOURNAL	No of patients/ Pt. Year follow up/ Annual haemorrhage rate/RISK FACTORS for haemorrhage/ Conclusion				
Stapf C et al 11 (2006)	622 patients were analyzed		Follow up 829 days (median-102 days)	RISK FACTORS · Haemorrhagic AVM at presentation · Deep location · Deep venous drainage · Increasing age	Conclusion AVM haemorrhage presentation was associated with poor Maternal outcome. Gestational Age was Not associated with poor Maternal Outcome.
Gross BA et al 12 (2012)	54 women with AVM reviewed	2461.3 patient year follow up	1.1% - Annual haemorrhage rate	Conclusion Early Intervention- if Ruptured. Unruptured- counselling /Continue without intervention	
Gross BA et al 13 (2013)	3923 patients	18,423 patient year follow up	3.0 % annual rupture risk- overall Unruptured cases annual risk 2.2% Ruptured cases 4.5%	Prior haem. 95% CI-2.1%-4.3% Deep location (95% CI- 1.4%-3.4%) Deep venous drainage (95% CI- 1.1-3.8)	Conclusion Prior haemorrhage deep Location, Deep venous Drainage and associated Aneurysm has greater Risk of Haemorrhage.
Liu XJ et al 1 (2014)	979 females with AVM	25,578 patient years follow up		3.11% Annual haemorrhage rate	Conclusion No increased risk in Pt. With AVM in Pregnancy and Puerperium
Xing-ju Liu et al 14 (2014)	979	25, 578 patient years follow up		3.11% Annual haemorrhage rate	Conclusion No increased risk Of haemorrhage in Pregnancy and Puerperium
Xianli L et al 15 (2015)	Conclusion Unruptured- To be managed Conservatively Ruptured- Treatment on Neurosurgical Indication				
Rispoli R et al 16 (2015)	1 case report 23year 27 wk pregnancy	Complain- Severe headache with Nausea and vomiting Management- CS Craniotomy- Discharged POD-2			Conclusion Surgical Intervention- In ruptured Cases Can prevent Re-bleed
Xianli Lv et al 17 (2016)	54 (83.1%) AVM Rupture during pregnancy and post partum	6 (11.1%) 1 st Tri. 24 (44.4%) 2 nd Tri. 22 (40.7%) 3 rd Tri. 2(3.7%) Post partum	16-45 years Mean 28+/-4.9	Maternal Death- 3 Case Mortality- 4.6% 42 case – LSCS 10 case – Vaginal Delivery	AVM Haemorrhage presentation – Associated with poor outcome

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