

# Vascular Related Intracranial Hemorrhage in Women: A Literature Review

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## Introduction

Vascular intracranial hemorrhage comprises a significant portion of the neurosurgical patient population. Female patients appear to have unique risk factors and hormonally related pathophysiology differences, especially during pregnancy. This is prevalent throughout the literature. However, females may benefit from prevention measures and specialized management protocols to maximize optimal outcomes.

# **Methods**

Review of the literature.

### Results

Aneurysm

Female gender is a known risk factor for aneurysmal SAH. However, studies have shown equitable morbidity and mortality. These women have hormonal related risk factors that lend towards an overall estrogen- deficient state and elevate one's risk of hemorrhage from aneurysmal rupture, ie, post-menopausal state, peri-menstrual cycle and smoking. Additionally, factors that offer hormonal stability offer reduced risk, such as the post-menopausal state with hormone replacement and oral contraceptive therapy.

# Figure I Personal supposes a suppose suppose

Aneurysmal subarachnoid hemorrhage is associated with a estrogen-deficient state.

**AVM** 

It is known that AVMs have intracranial hemorrhage risk of 2-4% per year. Male gender is a risk for hemorrhage. However, in pregnant females the data appears to be conflicting. Some studies show 10 fold increase in risk while others show no difference. Nevertheless, rupture tends to occur late in pregnancy and is associated with high degree of fetal complications.

Cavernous Malformation
Literature supports an
increase risk of recurrent
hemorrhage in women in the
first 5 years after a
hemorrhage.

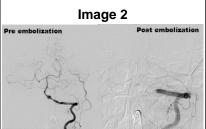
This has been hypothesized to be explained by physiological differences between women, and added risk factors of hormone contraceptive therapy and pregnancy.

Pregnancy

Intracranial hemorrhage in pregnancy is rare but has high mortality rate of 5-12% of all maternal deaths. The etiology of hemorrhage includes, aneurysmal rupture, AVM hemorrhage and others (eclampsia, RCVS, CVT, and cerebral angiopathy). The incidence of vascular related intracranial hemorrhage tends to increase with gestational age. Aneurysmal rupture is responsible for the majority of hemorrhages and arteriovenous malformations are is second. Studies have shown that hemorrhage often occurs around 30 weeks of gestation when cardiac output increases by 60%. This compliments the idea that hemodynamic and physiologic changes in pregnancy may play a role in vascular instability. Additionally, delivery mode; cesarean section versus vaginal delivery does not appear to alter maternal or fetal outcome.

Image I

YM is a 36 yo F who presented with a seizure due to subarachnoid hemorrhage after delivering a premature infant at 29 weeks gestation. She was found to a dissecting left vertebral artery aneurysm and was treated with coil occlusion of left vertebral artery and dissecting aneurysm.



Post-operatively, she suffered a right middle cerebral artery infarct due to spasm. Additionally, she developed CHF due to stress cardiomyopathy and MI associated with SAH. She went on to develop heart failure requiring temporary left ventricular assist device. Long term she suffered from significant hemiplegia and required tracheostomy and gastrostomy placement.

# Conclusions

Sex hormones levels, especially relative reduction in baseline levels appear to relate to an increased risk of subarachnoid hemorrhage and data suggests that it may play a role in other vascular related intracranial hemorrhages such as cavernous malformation hemorrhages. Pregnancy does not appear to statistically increase one's chance of vascular related intracranial hemorrhage. However, hemodynamic and physiologic changes of pregnancy complicate management and may result in poorer outcomes. Further studies are needed to investigate whether reducing risk factors or altering management techniques improves outcome for women affected by vascular related intracranial hemorrhage.