

Predictors of Hemorrhagic Presentation for Pediatric Brain Arteriovenous Malformations: An International Multicenter Study

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Introduction

Brain arteriovenous malformations (AVM) are the most common etiology of spontaneous intracranial hemorrhage in pediatric patients (age <18 years). Since the cumulative lifetime risk of AVM hemorrhage is considerable in children, an improved understanding of the risk factors influencing hemorrhagic presentation may aid in the management of pediatric AVMs. The aims of this first of a two-part multicenter, retrospective cohort study are to evaluate the incidence and determine the predictors of hemorrhagic presentation in pediatric AVM patients.

Methods

We analyzed and pooled AVM radiosurgery data from seven institutions participating in the International Gamma Knife Research Foundation (IGKRF). Patients <18 years of age at the time of radiosurgery and who had =12 months of follow-up were included in the study cohort. Patient and AVM characteristics were compared between unruptured and ruptured pediatric AVMs.

Results

A total of 357 pediatric patients were eligible for analysis, comprised of 112 patients in the unruptured and 245 patients in the ruptured AVM cohorts (69% incidence of hemorrhagic presentation). The annual hemorrhage rate prior to radiosurgery was 6.3%. Hemorrhagic presentation was significantly more common in deep (basal ganglia, thalamus, and brainstem) than cortical (frontal, temporal, parietal, and occipital lobes) locations (76% vs. 62%; $P=0.006$).

Among the factors found to be significantly associated with hemorrhagic presentation in the multivariate logistic regression analysis, deep venous drainage (OR 3.2; $P<0.001$) was the strongest independent predictor, followed by female gender (OR 1.7; $P=0.042$) and smaller AVM volume (OR 1.1; $P<0.001$).

Conclusions

Unruptured and ruptured pediatric AVMs have significantly different patient and nidus features. Pediatric AVM patients who possess one or more of these high-risk features may be candidates for relatively more aggressive management strategies.

Learning Objectives

By the conclusion of this session, participants should be able to 1) Describe the importance of hemorrhagic presentation in pediatric patients with brain AVMs, 2) Discuss, in small groups, characteristics of ruptured and unruptured pediatric AVMs, and 3) Identify predictors of hemorrhagic presentation for pediatric AVMs.

References

1. Ding D, Starke RM, Kano H, Mathieu D, Huang PP, Feliciano C, Rodriguez-Mercado R, Almodovar L, Grills IS, Silva D, Abbassy M, Missios S, Kondziolka D, Barnett GH, Lunsford LD, Sheehan JP. International Multicenter Cohort Study of Pediatric Brain Arteriovenous Malformations, Part 1: Predictors of Hemorrhagic Presentation. *J Neurosurg Pediatr.* 2016 Dec 2. [Epub ahead of print]. [PMID: 27911248.](https://pubmed.ncbi.nlm.nih.gov/27911248/)