

Gamma Knife Surgery For Pediatric/Adolescent Arteriovenous Malformations: A Comparison Of Posttreatment Complications And Outcomes With Adults

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Introduction

Cerebral AVMs carry significant risk of morbidity and mortality related to intracerebral hemorrhage. The annual rate of hemorrhage ranges from 2% to 4%. Some have suggested that the yearly risk of hemorrhage from AVMs maybe higher in the pediatric population. Many believe that AVM vessels in children have less mature morphology. The fact that AVMs treated in childhood have the capacity in rare instances to reoccur has been touted as evidence of the dynamic character of these lesions in childhood. All these, give rise to the question of whether different characteristics of cAVMs in children/adolescents and adults could lead to different radiosurgical outcomes. In the present study, we are going to expand our experience with treating cAVMs in children/adolescents and adults specifically with focus on differences in posttreatment complications and functional outcomes (obliteration interval and obliteration rate) after stereotactic radiosurgery (SRS).

Methods

This will be a retrospective comparative study. The cohort was selected for the two age groups 1) patients up to and including 18 years of age at treatment and 2) patients

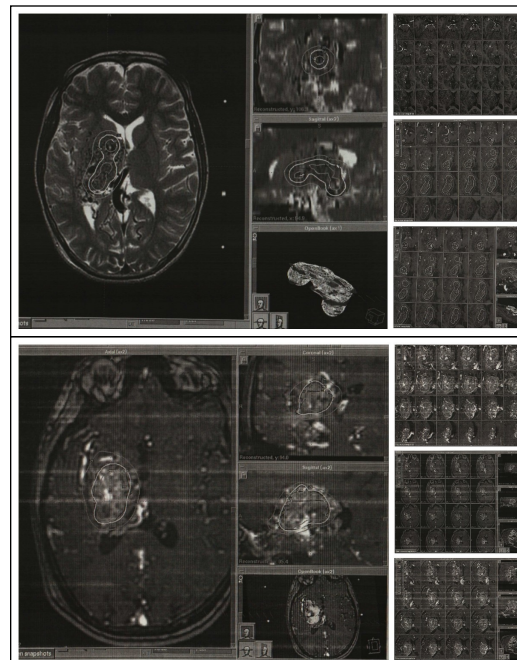
more than 18 years with brain AVMs who treated with SRS from 2003 and had been observed for 3 years. In the final analysis, obliteration data will refer to the cases who had at least 3 years follow up (or less if obliteration was angiographically documented within 36 months of SRS), while all other aspects, including complications, refer to the whole patient cohort. The data relevant to this study were collected from the case notes of each patient.

Results

Statistical comparisons between obliteration rate and obliteration interval in children/adolescents and adults are based on the Fisher exact two-tailed test (OR) and the Wilcoxon rank-sum test (OI). Annual hemorrhage rates are calculated based on years of follow-up and the total number of hemorrhages. We consider p values less than 0.05 to be significant.

Complications	
New neurological deficits (permanent/temporary)	By neurologic evaluations in attending physicians outpatient clinic usually at 6-, 12-, 24-, and 36-month intervals to assess vascular response.
Adverse radiation effect	New areas of high T2 signal surrounding the irradiated AVM nidus
radionecrosis	Typically a mass with rim or nodular enhancement on T1-weighted images in the irradiation field and a high signal surrounding oedema on T2-weighted images
Persistent edema	
Seizure*	Within 24 hours after SRS as an immediate complication, or seizure worsening (increased seizure frequency), or de novo seizure
Headaches	Immediate within 24 hours after SRS. Or headache worsening (increased episodes per month or duration or de novo headache.
Hemorrhage rate**	

* Seizure outcome are assessed based on Engel Epilepsy Surgery Outcome Scale



Preradiosurgical imagings of our 13 yrs. female patient with a history of head trauma following car accident 4 years ago. Then she gradually developed Lt. upper extremity course tremor and after that lower extremity tremor, seizure, Lt. hemiparesia, Lt. side diplopia, 6 and 11 nerve paresis. Imaging showed a Rt. temporoparietal AVM which treated with 22 Gy. dose (nidus size 6.9 cc). During three years follow up, the patient completely recovered from tremor, hemiparesis exacerbated and she developed paresthesia and numbness in Lt. side limbs. She scheduled for repeat radiosurgery with 22 Gy. dose and a nidus size of 15.1 cc. After two years follow up nidus size reduced by 50%. Presthesia and hemiparesis improved and patient remained seizure free with using sodium valproate.

Conclusions

Many authors believe that AVMs are not static congenital lesions but have the ability to grow, regress, disappear and even reappear after total surgical excision or radiosurgery. The relatively large nidus diameters seen

in children > 10 years of age may indicate relatively rapid AVM enlargement after the initial lesion has emerged. Whether the possibility of fast AVM growth is limited to young patients or may also occur in adults remains to be determined. The results will reveal whether SRS has similar success rates in pediatric/adolescents and adult patients in the treatment of cAVMs.

Learning objectives

- 1) To demonstrate how much different pediatric cAVMs behave from those in adults after SRS.
- 2) To understand the effect of radiation on the developing brain in children compared with adult patients.
- 3) To assist in better understanding of the claims of higher obliteration rates with SRS in pediatric/adolescent patients in existing literature.

References

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