Management of Spetzler-Martin Grade IV and V AVMs with Stereotactic Radiosurgery

Ahed H. Kattaa, MD, Kerem Nernekli, MD, Amit R. Persad, MD, Aroosa Zamarud, MD, Paul M. Harary, MS, Amirhossein Akhavan-Sigari, MD, Yusuke S. Hori MD, Louisa Ustrzynski, NP, MBA, Sara C. Emrich, NP, Armine Tayag, NP, David J. Park, MD, PhD, Gary K. Steinberg, MD, Steven D. Chang, MD, MBA

Department of Neurosurgery, Stanford University School of Medicine, Stanford, CA, United States

Stanford MEDICINE Neurosurgery

INTRODUCTION

•Arteriovenous malformations (AVMs) are lesions characterized by an intervening vascular nidus. Management of giant AVMs is complex and relies on multimodal treatment.

•Stereotactic radiosurgery (SRS) has been commonly used, while predictive factors associated with the SRS outcomes have not been well explored.

OBJECTIVES

•This study aims to evaluate the outcomes of SRS for Spetzler-Martin (SM) Grade IV–V Giant AVMs, and determine predictive factors associated with hemorrhage, and degree of nidus eradication.

METHODS

•We performed a retrospective cohort study of all patients with Spetzler-Martin Grade 4-5 AVM and volume > 10 cm^3. Demographic, radiologic, treatment and outcome data were collected. The primary outcomes were AVM obliteration and post-treatment hemorrhage.

•Data were compared by Fisher's exact test for categorical variables and by Mann-Whitney U test for continuous variables. Pearson correlations were examined for relationships between variables.

RESULTS

•We identified 28 Giant AVMs from 28 patient with SM Grade IV (28.6%) or V AVMs (71.43%). A total of 39 SRS treatments were applied, including 13 staged volume (33.3%), and 26 non-staged volume (66.7%) SRS.

•The median age was 17 years at first treatment and 60.71% were male. Pre-SRS embolization was performed in 50%.

•The median AVM volume was 15.6 cm^3. Complete obliteration was achieved in 35.7% with a mean follow-up of 76.9 months.

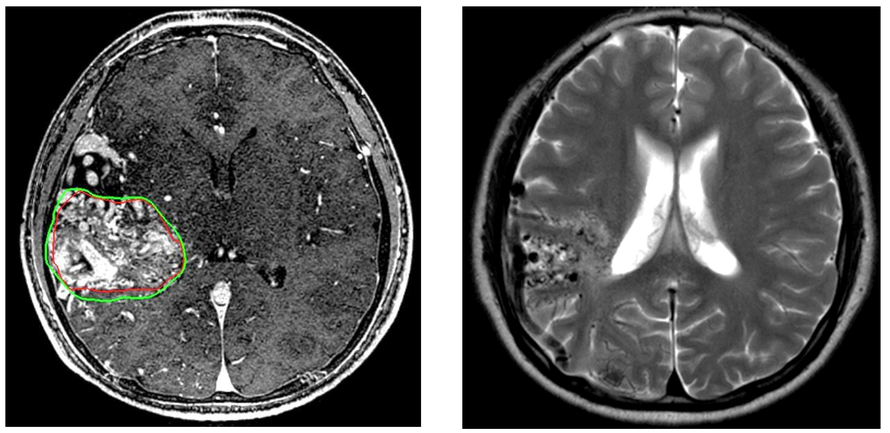

Figure 1. MRI studies from a patient with right parietotemporal, posterior frontal, insular, putamin al, and thalamic arteriovenous malformation with predominant MCA arterial supply and superficia l venous drainage.

A: CyberKnife radiosurgery plan. The AVM volume was 71.86 cc. A marginal dose of 30 Gy, with the maximum dose of 41.21 Gy, was delivered in five fractions to 73% isodose line (AX MFAST Post contrast).

B: MRI studies of 53-month follow-up demonstrates decrease in size of the giant AVM where SRS was delivered (Axial T2).

•High risk features for hemorrhage were detected in 21.4%, including intra-nidal aneurysms and venous stenosis.

•We found association between presence of extra-nidal aneurysms and AVM obliteration (p=0.009). In addition, we found a negative correlation between post-SRS hemorrhage % reduction in AVM volume (p=0.009).

•There was no association of other known factors such as marginal dose, AVM pre-treatment volume or embolization with outcomes.

CONCLUSIONS

In this cohort of giant AVMs treated with mixed SRS methods, we found extranidal aneurysms to be a predictive feature for AVM obliteration, and post-SRS hemorrhage to be associated with less volume reduction.

Table 1. Demographic characteristics of patients, tumors, and CK SRS treatment

Variable	Value
No. of pts	28
Pt Characteristics	
Age at Tx of AVM (yrs.)	
Median	17
IQR	29.5 (10.5-40)
Sex	
Female	11 (39.28%)
Male	17 (60.71%)
AVM Characteristics	
No. of lesions	28
Hemorrhage as initial presentation	4 (14.28 %)
Location sub classifier	
Superficial	7 (25 %)
Deep	6 (21.42 %)
Superficial and deep	15 (53.57 %)
AVM size	
Median	6.85
IQR	1.45 (6-7.45)
Compact AVM	7 (25 %)
Diffuse AVM	21 (75 %)
Aneurysms outside AVM	9 (32.14 %)
Treatment Characteristics	
Vol (cm3)	
Median	15.6
IQR	14.9 (10.9- 25.8)
Marginal dose (GY)	
Median	22
IQR	8 (16-24)
Max dose (GY)	
Median	28.7
IQR	12.8 (20.5-33.3)
Isodose line (%)	
Median	79
IQR	6 (74 -80)
FU period(mos.)	
Mean	80.3
Standard Deviation	54