

Introduction

Grade 3 AVMs are a unique group encompassing 4 different types of AVMs according to their size, location in eloquent cortex and venous drainage, with potentially different management and outcome for the subgroups. Most of these AVMs are treated, though the significance of the different types of grade 3 AVMs is not clear in context of multimodality management. Previously De Oliveira et al.(1) and Lawton(2) sub-classified this group of AVMs based on their outcome, however, both these were mainly surgical series. We present our experience with multimodality treatment of grade 3 AVMs.

Methods

100 patients with grade 3 AVMs were treated from 1986 to 2009. AVMs were categorized as follows: Type 1, S1E1V1, Type 2 S2E1V0, Type 3 S2E0V1 and Type 4 S3E0V0. The occurrence of new deficit, functional status (mRS) at discharge and follow-up, and radiological obliteration were correlated with demographic and morphologic characteristics.

Fig. 1(a): Grade 3 AVM (type 1): Anteroposterior digital subtraction angiogram. Pre-embolization: shows a prominent right posterior cerebral artery feeder

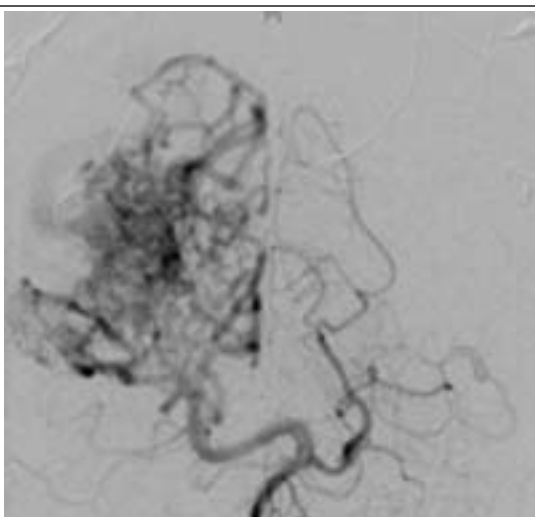
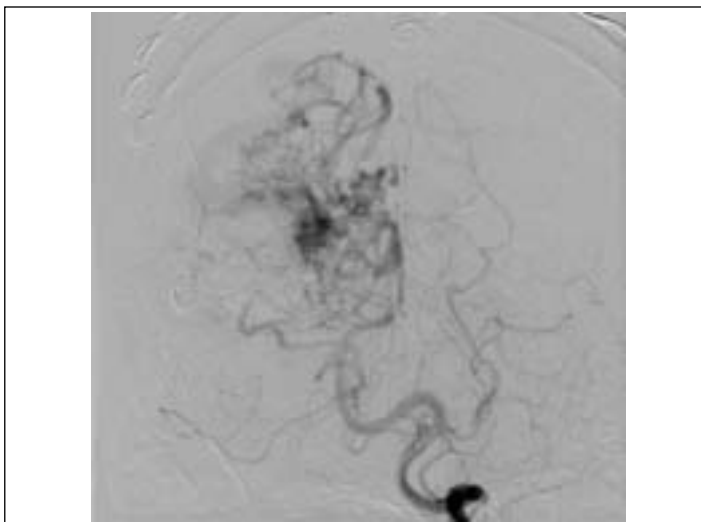


Fig. 1(b): Grade 3 AVM (type 1): Anteroposterior digital subtraction angiogram-Post-embolization: 30% reduction



Results

100 patients (49f, 51 m, 5-68 years, mean 35.8 years) were evaluated. Size of AVMs were <3cm (28), 3-6 cm (71) and >6 cm (1); 86 AVMs were in eloquent cortex, and 38 had central drainage. The AVMs were type 1 (28), type 2 (60), type 3 (11) and type 4 (1). Embolization was performed in 77 patients (175 procedures), surgery in 64 patients (74 surgeries), and radiosurgery in 49 patients (44 primary, 5 postoperative). Mortality following the management of these AVMs was 1%. Fourteen patients (14%) had new deficits, with 5 (5%) disabling (mRS >2), and 9 (9%) non-disabling (mRS < 2) events. Patients with type 1 AVM (small AVMs) had the best outcome, with 1/28 (3.6%) having a new deficit as compared to larger AVMs (13/72, 16.7%, $p < 0.002$). Older age (>40 years), size >3cm, and non-hemorrhagic presentation predicted occurrence of new deficits ($p < 0.002$).

Eighty-nine patients were included in the obliteration analysis. AVM was obliterated in 78 patients (87.6%). There was no difference between obliteration rates between types of AVMs, Size, eloquence and drainage or clinical presentation.

Conclusions

Grade III AVMs are a diverse group of lesions with varied presentations. Overall in this 24-year series we had an 87.6% obliteration rate, but a 14% rate of treatment related new neurologic deficits, and 5% major complications including 1% mortality. Multimodality management of Grade III AVMs results in a high rate of obliteration which isn't influenced by size, venous drainage or eloquent location. However, the development of new neurologic deficits did correlate with size, while eloquence and venous drainage did not influence this. We propose sub-classifying the grade III AVMs according to their size (<3 cm and >3 cm) to account for treatment risk.

References

1. de Oliveira E, Tedeschi H, Raso J. Comprehensive management of arteriovenous malformations. *Neurol. Res.* 1998;20(8):673-683.
2. Lawton MT. Spetzler-Martin Grade III arteriovenous malformations: surgical results and a modification of the grading scale. *Neurosurgery.* 2003;52(4):740-748; discussion 748-749.

Fig. 1(b): Grade 3 AVM (type 1): Anteroposterior digital subtraction angiogram-Post-operative: no residual AVM

