



# Multimodality Treatment of Arteriovenous Malformations (AVMs) of Basal Ganglia and Thalamus: Factors Affecting Outcome and Obliteration

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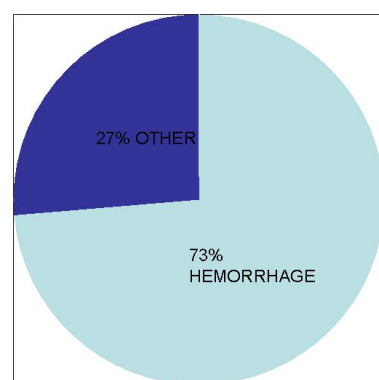
## Introduction

Arteriovenous malformations (AVMs) of basal ganglia and thalamus account for 3-13 % of malformations in various surgical series (1-4). Due to the critical location, hemorrhage has potentially devastating neurological consequences. Radiosurgery has been accepted as the primary management modality, though the obliteration rates are reported to be lower than superficial AVMs. Many authors have also reported good results after microsurgery for some selected AVMs in basal ganglia and thalamus.2,5-7. Embolization of these AVMs can be performed with low risk; however, they are rarely curative and often used as adjuncts before radiosurgery or microsurgery. We describe our experience with multimodality treatment of these AVMs.

## Methods

116 patients were treated, 6 patients without radiological follow-up were excluded. Patients were analyzed with respect to presentation, hemorrhage rates, management, outcome and obliteration.

Proportion of patients ( n=110) presenting with Hemorrhage



## Results

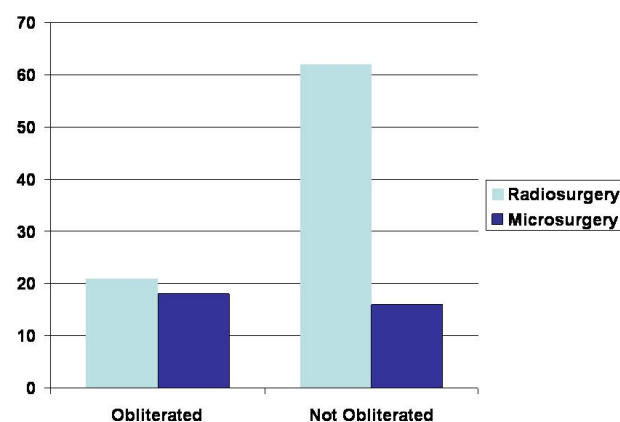
The annual risk of hemorrhage before treatment was 10.3% per patient-year, while it was 5.7% after the start of treatment till obliteration/last follow-up. The maximum size of the nidus ranged from 0.8-8 cm (mean 3.4 cm).

Follow-up ranged from 3 months-18 years (mean 5.2 years). Seventy-four patients (67.3%) had good mRS (0-2). Ten patients (9.1%) expired during follow-up (9 due to hemorrhage from AVM, 1 unrelated cause).

Good preoperative mRS ( $p < 0.001$ ), AVM  $< 3$  cm ( $p < 0.001$ ), grade 2 and 3 ( $p < 0.001$ ), females ( $p = 0.04$ ), and absence of repeat hemorrhage ( $p < 0.001$ ) predicted good long-term outcome.

Obliteration status was evaluated for 98 patients. 54 patients (55.1%) had obliteration of AVM. AVM size  $< 3$  cm and S-M grade 2 and 3 predicted obliteration on univariate analysis.

Obliteration rate in patients treated with microsurgery ( 53%) compared to radiosurgery (25%)



## Subgroup analysis-Grade 4 and 5 AVMS

There were 54 AVMs that were Spetzler-Martin Gr. 4 or 5. For grade 4 and 5 AVMs, the hemorrhage rate pre-treatment was 10.4% and post-treatment was 7.8%. 23 patients (42.6%) had good outcome at follow-up, AVM was obliterated in 40.4% patients.

## Conclusions

Basal ganglia and thalamic AVMs can be managed with multimodality treatment with acceptable morbidity and mortality. The hemorrhage rates following treatment are lower than the natural history of the disease. Though radiosurgery is the mainstay of treatment of the central AVMs, judicious use of embolization and surgery lead to better outcomes and obliteration rates.

## References

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