



## Spetzler Martin Grading As A Predictor For Surgical Risk in Patients of Supratentorial Cerebral Arteriovenous Malformations

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### ABSTRACT

**Background:** Arteriovenous malformations (AVM) of brain are a rare cause of all hemorrhagic strokes with detection rate of approximately 1/100 000 person-years. But as AVMs affect more of young and healthy adults; they pose significant neurological problems for the community. Spetzler and Martin grading system was designed for prediction of the risk of morbidity and death from operative treatment, according to particular characteristics of a brain AVM. In this study we analysed Spetzler Martin grading as a predictor for surgical risk in patients of supratentorial cerebral arteriovenous malformations.

**Material methods:** This was a prospective observational study conducted on consecutive patients of supratentorial cerebral arteriovenous malformations presenting at Bangur Institute of Neurosciences and IPGMER, Kolkata during study period from August 2011 to December 2013. A total 24 cases of supratentorial AVMs, diagnosed angiographically and fulfilling the said inclusion criteria were considered in the study. 7 patients underwent surgical procedure were analysed.

**Results:** Out of 3 operated Spetzler and Martin Grade I patients 2 (66.6%) recovered with no neurodeficit, while one patient (33.3%) died. Out of 4 operated Spetzler and Martin Grade III patients 2 (55.0%) recovered with no neurodeficit, while 2 patients (50.0%) died.

**Conclusion:** Spetzler Martin grading is good predictor of surgical risks in supra tentorial AVMs but Better patient selection utilizing supplementary grading system proposed by Lawton and colleagues, especially for Spetzler Martin grade III patients can further help in predicting the outcome.

**KEYWORDS:** Spetzler Martin grading, supratentorial, cerebral arteriovenous malformations.

### Introduction:

Arteriovenous malformations (AVM) of the brain are congenital vascular lesions that account for approximately 2% of all hemorrhagic strokes<sup>1,2</sup>. Despite the relative rarity of the disease (with an estimated current detection rate of approximately 1/100 000 person-years) the availability of non invasive imaging has rapidly increased the detection of incidental AVMs. The complex cerebrovascular anatomy of AVMs makes them a challenge to treat, and the treatment itself carries significant risks. To evaluate the possible benefit of a risky treatment, one needs to understand the natural history and prognosis of the disease. The decision for no treatment or for a single or multimodality treatment, it also involves being familiar with the outcomes and risks of each treatment modality—microvascular resection, endovascular embolization, and stereotactic radiosurgery.

Spetzler and Martin<sup>3</sup> grading system was designed for the prediction of the risk of morbidity and death from operative treatment, according to particular characteristics of a brain AVM [1986]. It is simple (grade I for a <3-cm nidus, grade II for 3 to 6 cm, grade III for >6 cm,) with a point added for deep venous drainage and a point added if located in or adjacent to one of the following: sensorimotor cortex, language cortex, visual cortex, thalamus, hypothalamus, internal capsule, brainstem, cerebellar peduncles, or deep cerebellar nuclei.

This grading system has been widely accepted for its simplicity and practicality. In our study we aimed to study Spetzler Martin grading in predicting surgical risk in patients of supratentorial cerebral arteriovenous malformations.

### Material methods:

This was a non randomized prospective study conducted at Bangur Institute of Neurosciences at Institute of Post Graduate Medical Education and Research (IPGME & R) Kolkata from August 2011 to December 2013. Consecutive patients attending Bangur Institute of Neurosciences OPD and admitting in B.I.N. Hospital wards, of all ages, any sex with radiological diagnosis of supratentorial cerebral arteriovenous malformation were included. Patients of other cerebrovascular malformations (venous angioma, cavernous malformations, capillary telengectasia and direct fistula), spinal & infratentorial cerebral arteriovenous malformation. Uncontrolled comorbid condition and History of significant head trauma were excluded. Patients demographic profile, clinical presentation, natural history were noted and radiological features (NCCT / Contrast CT Scan Brain, CT Angiography, MRI Brain (Plain And Contrast), MR Angiography, 4 Vessel Cerebral Digital Subtractions Angiography (DSA).) were reviewed.

### Results:

The total 22 patients analyzed in the study were of the age ranging from 11 years to 55 years and mean age of patients was 28.14 years.

Out of 8 patients of SM Grade I, 7 presented with hemorrhage and 1 with seizures, 3 had history of chronic headaches and 1 had history of previous rupture. Of 4 patients of SM Grade II, 2 presented with hemorrhage and 2 with chronic headache, 1 patient had seizure at presentation and 1 patient had focal deficit. There were total 8 patients of SM Grade III, 4 presented with seizures, 2 with chronic headache and 2 with history of previous rupture. 3 patients had history of seizures and 3 had focal deficits at presentation. There was 1 patient of SM Grade IV who was diagnosed incidentally due to CT scan done for unrelated reasons. One patient was of SM Grade V who presented with seizures and focal deficit in the form of right hemiparesis. 3 (43%) of the total (n=7) operated patients were Spetzler and Martin Grade I AVMs, while 4 (57%) were Grade III AVMs.

Out of 3 operated Spetzler and Martin Grade I patients 2 (66.6%) recovered with no neurodeficit, while one patient (33.3%) died. Out of 4 operated Spetzler and Martin Grade III patients 2 (55.0%) recovered with no neurodeficit, while 2 patients (50.0%) died.

### Discussion:

Patients age ranging from 11 to 55 years were part of this study, of total 22 patients, 6 (27%) patients were aged less than 20 years, 12 patients that is 55% were aged between 20 to 40 years and 4 (18%) patients were more than 40 year old at the time of the presentation.

Average age of diagnosis in patients presented in this study was 28.14 years with majority of patients in the age group of 20 to 40 years. Ondra et al.<sup>4</sup> outlined the natural history of AVMs among 160 patients who presented with symptomatic AVMs and were followed for a mean follow-up of 23.7 years. The mean age at presentation was 33 years.

One patient in our study was diagnosed incidentally from a CT scan head done for mild head injury at a peripheral centre and patient was subsequently referred to our centre. As per the reported literature the proportion of incidentally diagnose AVMs has increased due to better availability of diagnostic modalities<sup>5</sup>.

In present study we utilized standard Spetzler Martin grading system<sup>3</sup> with this criteria the incidence of AVMs in various grades was for grade I, 8 (36.4%); grade II, 4 (18.2%); grade III, 8 (36.4%); grade IV, 1

(4.5%); and for grade V, 1 (4.5%). In a large Finnish series of 623 AVMs accrued over 55 years (1951 to 2005), 13% were grade I, 29% were grade II, 32% were grade III, 19% were grade IV and 4% were grade V AVMs.<sup>6</sup>

In present study 7 (29.2%) patients underwent microsurgical treatment. Of the operated patients 3(43%) were grade I and 4(57%) were grade III. 3 grade I patient who underwent microsurgery 2 (66.6%) recovered with no postoperative neurodeficit, 1 (33.3%) patient died in follow up due to surgery related complications and out of 4 grade III patients undergoing microsurgery 2 (50%) died in follow up due to surgery related complications while 2(50%) recovered without neuro-deficit.

In present series there was no significant morbidity in recovered patients and mortality of 42.8% is noted in operated patients. In 1998 Schaller and colleagues<sup>7</sup> reported following rates of late permanent neurologic major and minor deficits in 150 patients: for grade I, 3% ; grade II, 0 ; grade III, 23% ; grade IV, 38% ; and grade V, 50%. In 2010 Lawton and colleagues<sup>8</sup> reported the following rates of "worse, dead" outcomes in 300 patients treated between 2000 and 2007: for grade I, 9%; grade II, 24%; grade III, 30%; grade IV, 31%; and grade V, 100%. Heros and colleagues in 2011 reported following rates of "fair, poor or dead" outcomes in 578 patients treated between 1981 and 2008: for grade I, 3%; grade II, 7%; grade III, 22%; grade IV, 29%; and grade V, 67%.<sup>9</sup>

After microsurgical resection favorable outcome can be expected in most of the grade I and grade II AVMs (91%-97% and 76%-100% respectively), in many grade III AVMs (70%-89%), but only a reduced proportion of grade IV and particularly grade V AVMs (62%-71% and 0%-85% respectively)<sup>10</sup>.

In present study there was no significant morbidity but relatively high mortality (66.7% mortality was seen in Grade III AVMs) which represents early institutional experience.

### Conclusion :

Supra tentorial AVMs are complex pathological conditions which needs individualized treatment approach. Better patient selection utilizing supplementary grading system along with the Spetzler Martin grade for stratification of surgical risk as proposed by Lawton and colleagues<sup>52</sup>, especially for Spetzler Martin grade III patients which constitutes a heterogeneous group regarding complexity of AVMs and surgical risks, is very important.

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