Supplementary Spetzler-Martin AVM grading scale

In 2010, Michael T. Lawton et. al introduced the Supplementary Spetzler-Martin AVM grading system. The Supplemented Spetzler-Martin grading scale also included rupture status, age of the patient, and nidal architecture (diffuse versus focal). In the 300 patients in Lawton's 2010 study, the supplemental Spetzler-Martin grading scale demonstrated a stronger correlation with surgical outcomes than the initial Spetzler-Martin AVM grading system (ROC 0.78 vs 0.66) [1].

This arteriovenous malformation (AVM) grading system supplements rather than replaces the well-established Spetzler-Martin AVM grading system and is a better predictor of neurologic outcomes after AVM surgery. The supplementary grading scale has high predictive accuracy on its own and stratifies surgical risk more evenly. The supplementary grading system is easily applicable at the bedside, where it is intended to improve preoperative risk prediction and patient selection for surgery [2].

Spetzler-Martin Grading	Points	Supplementary Grading
Size, cm		Age, y
<3	1	<20
3-6	2	20-40
>6	3	>40
Venous drainage		Bleeding
Superficial	0	Yes
Deep	1	No
Eloquence		Compactness
No	0	Yes
Yes	1	No
Total	5	

	Total	Improved/ Unchanged		Worse/ Dead	
	N	*N*	%	*N*	%
Spetzler-Martin grade					
I	56	51	91	5	9
II	123	93	76	30	24
III	90	63	70	27	30
IV	29	20	69	9	31
V	2	0	0	2	100
Supplementary grade					
I	27	26	96	1	4
II	67	59	88	8	12
III	113	88	78	25	22
IV	79	47	59	32	41
V	14	7	50	7	50
Supplemented Spetzler-Martin grade					
1	0	0	0	0	0
2	7	7	100	0	0
3	21	21	100	0	0
4	55	50	91	5	9
5	90	71	79	19	21
6	70	51	73	19	27
7	44	20	45	24	55
8	8	4	50	4	50
9	5	3	60	2	40
10	0	0	0	0	0

A retrospective study was conducted on 200 patients admitted to the Helsinki University Hospital between 2000 and 2014. The validity of the Supp-SM and SM grading systems was compared using the area under the receiver operating characteristic (AUROC) curves, with respect to the change between preoperative and early (3-4 mo) as well as final postoperative modified Rankin Scale (mRS) scores.

The performance of the Supp-SM was superior to that of the SM grading scale in the early follow-up (3-4 mo): AUROC = 0.57 (95% confidence interval [CI]: 0.49-0.65) for SM and AUROC = 0.67 (95% CI: 0.60-0.75) for Supp-SM. The Supp-SM performance continued improving over SM at the late follow-up: AUROC = 0.63 (95% CI: 0.55-0.71) for SM and AUROC = 0.70 (95% CI: 0.62-0.77) for Supp-SM. The perforating artery supply, which is not part of either grading system, plays an important role in the early follow-up outcome (P = .008; odds ratio: 2.95; 95% CI: 1.32-6.55) and in the late follow-up

outcome (P < .001; odds ratio: 5.89; 95% CI: 2.49-13.91).

The Supp-SM grading system improves the outcome prediction accuracy and is a feasible alternative to the SMS, even for series with higher proportion of high-grade AVMs. However, perforators play important role on the outcome [3].

Data collected from 1009 AVM patients who underwent AVM resection were used to compare predictive powers of Spetzler-Martin AVM grading systems(SM) and supplemented Spetzler-Martin grades (SM-Supp). Patients included the original 300 patients plus those treated thereafter (N=117), and an additional 592 patients from three other centers.

In the combined cohort, the SM-Supp system performed better than SM system alone: AUROC=0.75 (95% CI: 0.71 - 0.78) for SM-Supp and AUROC=0.69 (95% CI: 0.65 - 0.73) for SM (p< 0.001). Stratified analysis fitting models within three different follow-up groupings (<6 months, 6 months - 2 years, and >2 years) demonstrated that the SM-Supp system performed better than SM system for both medium (AUROC=0.71 vs. 0.62, p=0.003) and long follow-up (AUROC=0.69 vs. 0.58, p=0.001). Patients with SM-Supp grades ≤ 6 had acceptably low surgical risks (0 - 24%), with a significant increase in risk for grades above 6 (39% - 63%).

The study of Kim et al., validates the predictive accuracy of the supplementary grading system in a multicenter cohort. SM-Supp grade of 6 is a cut-off or boundary for AVM operability. Supplemented grading is currently the best method of estimating neurological outcomes after AVM surgery, and recommended as a starting point in the evaluation of AVM operability [4].

References

1)
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