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Resection of Spinal Cord Cavernous Malformations Improves Long-term Outcomes for Patients with Poor **Pre-operative Frankel Grade**

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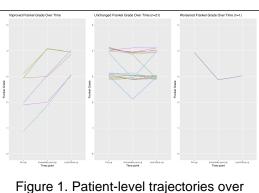
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Introduction

Intramedullary spinal cord cavernous malformations (CMs) account for 5% of all CMs in the CNS and 5–12% of all spinal cord vascular lesions. The optimal management of spinal cord CMs continues to be controversial. We sought to identify factors associated with improved long-term functional outcome in patients with this rare cerebrovascular pathology.

Methods

Retrospective observational cohort study of 32 patients who underwent surgical resection for spinal CM from 1996–2017 at a single-institution. We evaluated immediate postoperative and long-term outcomes against pre-operative baseline status, as determined by Frankel and Aminoff-Logue Disability grades. Mean follow-up length was 40.9 months (SEM, 8.9).



time by Frankel grades

Figure 2. Patient-level trajectories over time by Aminoff grades

Variable	Long-term improvement (n = 6)	Long-term stable or worsened (n = 20)	P value
Mean age at presentation	37.8 (7.2)	48.4 (3.2)	0.38
Female sex	2 (33.3)	14 (70.0)	0.25
Spinal level	2 (0.41)	1.5 (0.13)	0.29
Mean Lesion Size (mm)	6.3 (1.2)	6.9 (0.75)	0.60
Cerebral cavernous malformation	2 (33.3)	6 (30.0)	
Family history	1 (16.7)	4 (20.0)	1.00
Clinical course			0.64
Acute, stepwise	3 (50.0)	13 (65.0)	
Progressive	3 (50.0)	7 (35.0)	
Presenting symptoms			
motor	4 (66.7)	9 (45.0)	0.64
sensory	3 (50.0)	18 (90.0)	0.06
pain	3 (50.0)	9 (45.0)	1.00
bladder/bowel	1 (16.7)	3 (15.0)	1.00
Duration of symptoms (days)	36 (6.1)	25.4 (9.4)	0.57
Preoperative Frankel Grade			0.004
A	0 (0)	0 (0)	
В	1 (16.7)	0 (0)	
c	2 (33.3)	0 (0)	
D	3 (50.0)	10 (50.0)	
E	0 (0)	10 (50.0)	
Preoperative Aminoff Grade			0.06
I	2 (33.3)	17 (85.0)	
п	1 (16.7)	3 (15.0)	
ш	0 (0)	0 (0)	
IV	1 (16.7)	0 (0)	
Use of CO2 Laser	1 (16.7)	11 (55.0)	0.17
IONM change	1 (16.7)	10 (50.0)	0.33
proved Frankel Grade Immediate Post-op	4 (66.7)	0 (0)	0.001

Table 2. Predictors of long term improvement in patients with > 6 months of follow up

Results

The mean age at presentation was 44.2 (range, 0.5-77 yrs). Symptoms included sensory deficits (n = 26, 81%), loss of strength/coordination (n = 16, 50%), pain (n = 16, 50%), and bladder/bowel dysfunction (n = 6, 19%). Thoracic (n = 16, 50%) and cervical CMs (n = 16, 50%) were equally common, with mean size of 7.1 mm (range, 1-20 mm).

Intra-operative neuromonitoring changes were associated with worsened Frankel grade (P = 0.03) but not with worsened Aminoff-Loque grade (P = 0.18), while use of a CO2 laser was associated with improved Frankel grade (P = 0.02), but not with improved Aminoff-Logue grade (P = 0.48) immediately following resection.

Long-term functional outcomes were improved in 6 (23%), unchanged in 19 (73%), and worsened in 1 (4%) patients. Poor pre-operative Frankel grade (P = 0.006) and improved Frankel grade immediately following resection (P = 0.001) were strongly associated with improvement from baseline at long-term follow up (Table 2).

Conclusions

Gross total resection of symptomatic spinal cord CMs can prevent further functional decline and may improve functional status for patients with poor pre-operative Frankel grades. Our experience suggests resection of spinal cord CMs can be achieved with excellent long-term outcomes and minimal surgical morbidity.

Learning Objectives

- · Gross total resection of symptomatic spinal cord CMs can prevent further functional decline.
- Resection of spinal cord CMs may improve functional status for patients with poor pre-operative Frankel grades.

References

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