

Original Article

Benefits of spinal meningioma resection

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Abstract

Background: Spinal meningiomas account for approximately 40% of intradural extramedullary tumors. As they are usually slow growing, some patients are often diagnosed late in the clinical course when they have developed myelopathy.

Methods: Here, we retrospectively studied a cohort of 51 patients undergoing surgery for spinal meningiomas. The median follow-up period was 45.9 months (range, 1–168 months). Assessment included evaluation of functional outcomes (e.g., comparison of the pre and postoperative status using the modified McCormick Functional Scale) and identification of prognostic factors.

Results: Seventeen patients with grade IV (McCormick Scale) neurological deficits on admission underwent surgical resection; 4 of 5 grade III (McCormick Scale) and 14 patients (Grade IV) improved within 2.11 months (mean time) postoperatively. There was no surgical mortality and the morbidity rate was 16%.

Conclusion: Patients with advanced neurological deficits/myelopathy (Grades III or IV on the McCormick Scale) improved following surgical resection of spinal meningiomas.

Key Words: Meningioma, rehabilitation, spinal canal, surgery

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INTRODUCTION

Spinal meningiomas account for approximately 40% of intradural extramedullary tumors; in fact, 90% are intradural, 5% are extradural, and 5% are both intradural/extradural. Of interest, 68% are located in the lateral spinal canal, whereas 17% are posterior and 15% are anterior. The typical ratio of female/male patients is 4:1.^[8]

As these are usually slow growing tumors, some patients are diagnosed late in the clinical course with significant myelopathy. Using the McCormick Rating Scale system, this study retrospectively evaluated a prospective cohort of 51 patients with spinal meningiomas, many of whom had McCormick Grade III/IV deficit, who benefited from spinal surgical intervention.

PATIENTS AND METHODS

This retrospective study (1996–2014) involved assessment of a cohort of 51 patients undergoing spinal surgery for meningiomas. There were 40 females and 11 males, averaging 57.6 years of age. Multiple clinical and

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Table 1: Score systems for the evaluation of patients with spinal processes^{a[6]}

Series (ref. no.)	Grade 0	Grade I	Grade II	Grade III	Grade IV
Nurick, 1972	NA	Normal walk; possible clinical spinal irritation	Slight difficulty in walking with normal domestic and working life	Functional disability limiting normal work and domestic activities	Significant weakness making walking impossible without help. Grade 5: Bedridden or wheelchair-bound
Levy <i>et al.</i> , 1982	Normal	Walking with assistance	Strength greater than gravity	Strength less than gravity	Paraplegic (no motor response)
Solero <i>et al.</i> , 1989	NA	Pain only (local, radicular); pain and/or pyramidal signs; pain and/or slight radicular and/or funicular sensorimotor deficits	Slight motor deficit: walks with aid, slight motor deficit and/or radicular and/or funicular sensory deficits, slight motor deficit and/or sphincter disturbance	Severe motor deficit: flexion-extension against gravity, sensory deficit, and/or sphincter disturbances	Very severe motor deficit: flexion-extension without gravity; paraplegia, sensory deficit, sphincter deficits
McCormick <i>et al.</i> , 1990	NA*	Normal; mild focal deficit not significantly affecting function of involved limb; mild spasticity or reflex abnormality; normal gait	Presence of sensorimotor deficit affecting function of involved limb; mild to moderate gait difficulty; severe pain or dysesthetic syndrome impairing patient's quality of life; still functions and walks independently	More severe neurological deficit; requires cane/brace for walking or significant bilateral UE impairment; may or may not function independently	Severe deficit; requires wheelchair or cane/brace with bilateral UE impairment; usually not independent

*NA: Not applicable; UE: Upper extremity. *For the present study patients without symptoms and neurological deficits had a Grade 0

radiological (preoperative magnetic resonance) factors were assessed. In addition, patients were neurologically assessed preoperatively and postoperatively using the McCormick Functional Scale [Table 1]. This study was approved by the Hospital Ethics Committee under an exemption of patient informed consent.

Statistical analysis

Statistical analyses were performed using the IBM-SPSS software, version 21.0. Differences between categorical variables related to the McCormick scale assessments pre and postoperatively were analyzed using the McNemar-Bowker test. Significance was assigned as a *P* value of less than 0.001. The observation time for the improvement of the neurological state was analyzed using the Kaplan-Meier method.

RESULTS

Clinical symptoms

Patients were symptomatic for an average of 20 months (range 3–120 months) preoperatively; 5 were classified as grade III (McCormick Scale, 9.8%) and 17 as grade IV (McCormick Scale, 33.3%). Neurological deficits reflected significant myelopathy in many of these patients: sphincter alteration in 23 patients, ataxia 12 patients, weakness 37 patients, sensory deficit 37 patients, and pain 25 patients [Table 2].

Surgical access and degree of resection

Surgery for 23 (47.1%) patients included a laminectomy, whereas 19 patients (37.3%) underwent laminotomies. Twenty-three (45.1%) patients had Simpson

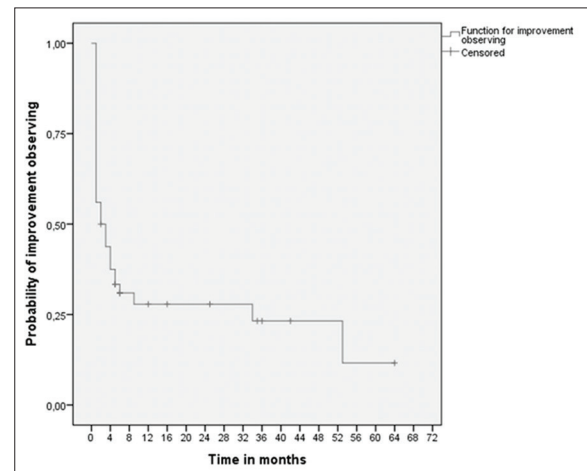


Figure 1: Probability of observing improvement as a function of elapsed time after surgery

Grade 2 [Table 3] resection whereas 21 patients had grade 1.

Functional outcome

Fourteen patients considered McCormick Grade IV improved with surgery as did 4 of the 5 patients considered Grade III (*P* < 0.001). The mean time of the first functional improvement was 2.11 months (range, 1–9 months).

DISCUSSION

In this retrospective study of 51 patients with spinal meningiomas, many patients showed severe

Table 2: Summary of characteristics in 51 patients with spinal meningiomas

Variable	No. of patients (%)	
Sex		
Female	40 (78)	
Male	11 (22)	
Age		
Mean	57.6	
Minimum	14	
Maximum	81	
Manifestation		
Gait ataxia	12 (24)	
Weakness	37 (73)	
Sensory deficit	37 (73)	
Sphincter dysfunction	23 (45)	
Pain	25 (49)	
Histological grade and type		
I		
Transitional	25 (49)	
Psammomatous	17 (33)	
Meningotheliomatous	5 (10)	
Syncytial	1 (2)	
II		
Atypical	3 (6)	
Tumor localization		
Cervical	15 (29)	
Cervicothoracic	4 (8)	
Thoracic	32 (63)	
Simpson resection grade		
I	21 (41)	
II	23 (45)	
III	4 (8)	
IV	3 (6)	
Complication		
Syringomyelia	2 (4)	
Loss of potential neurophysiological	1 (2)	
Cerebrospinal fluid leak	1 (2)	
Coma	1 (2)	
Cerebral thrombosis	1 (2)	
Follow-up (mean months)	45.9	
	Admission (%)	Follow-up (%)
McCormick Grade		
0	3 (6)	14 (28)
I	12 (24)	22 (44)
II	14 (27)	6 (12)
III	5 (10)	4 (8)
IV	17 (33)	4 (8)
Neurological state at the end of follow-up		
Improved		37 (74)
Stable		11 (22)
Deteriorated		2 (4)
Dead		0 (0)

Table 3: Simpson Grading System for removal of meningiomas^[1]

Grade	Definition
I	Macroscopically complete removal of tumor, with excision of its dural attachment and of any abnormal bone. Includes resection of venous sinus if involved.
II	Macroscopically complete removal of tumor and its visible extensions with coagulation of its dural attachment.
III	Macroscopically complete removal of the intradural tumor, without resection or coagulation of its dural attachment or its extradural extensions.
IV	Partial removal, leaving intradural tumor in situ.
V	Simple decompression, with or without biopsy.

^[1]Donald Simpson: The Recurrence of Intracranial Meningiomas After Surgical Treatment. *J Neurol Neurosurg Psychiatry* 1957;20:22-39

myelopathy (McCormick III: 5 patients; McCormick IV: 14 patients), and many improved after surgery [Table 4]. Some studies also showed similar benefits of surgery as in the study by Sacko *et al.*,^[6] where patients over 70 years of age with advanced neurological deficit (grades III and IV) improved despite their Grade III (92%) or Grade IV (96%) preoperative status.

In this study, our patients improved within the first 3 postoperative months (mean interval, 2.11 months) [Figure 1], a finding also reported by Sacko *et al.*^[6]

In a study by Riad *et al.*^[5] among patients with grades II and III deficits (none grade IV), functional improvement was observed after 1 year in 87% of the patients. Furthermore, 67% of the patients with original sphincter changes showed complete resolution of their deficits at 2 postoperative years.

Several other studies have also shown various degrees of neurological improvement after spinal meningiomas were resected for patients with preoperative Grade II–IV status [Table 5].^[1-4,6-8]

CONCLUSION

Here, we performed a retrospective cohort study of 51 patients undergoing surgery for spinal meningiomas, many of whom were severely myelopathic in McCormick Grades III and IV. Even in those who were markedly impaired prior to surgery exhibited partial or total functional recovery following tumor resection.

Acknowledgements

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Table 4: McCormick Grade: Admission versus follow-up^{a,b}

	MacCormick follow-up					Total
	Grade 0	Grade I	Grade II	Grade III	Grade IV	
MacCormick admission						
Grade 0	3 (100%)	-	-	-	-	3 (100%)
Grade I	6 (50%)	5 (42%)	-	-	1 (8%)	12 (100%)
Grade II	3 (21%)	10 (72%)	-	-	1 (7%)	14 (100%)
Grade III	1 (20%)	2 (40%)	1 (20%)	1 (20%)	-	5 (100%)
Grade IV	1 (6%)	5 (31%)	5 (31%)	3 (19%)	2 (13%)	16 (100%)
Total	14 (28%)	22 (44%)	6 (12%)	4 (8%)	4 (8%)	50 (100%)

^aMcNemar-Bowker test, $P < 0.001$. ^bIn a case not possible to assess the McCormick following

Table 5: Functional outcomes after surgery for spinal meningiomas^[3]

Authors and Year	Outcome (%)		
	Improved	Stable	Deteriorated
Levy, <i>et al.</i> , 1982	83	17	0
Solero, <i>et al.</i> , 1989	53	37	10
King, <i>et al.</i> , 1998	95	1	4
Gezen, <i>et al.</i> , 2000	83	14	3
Cohen-Gadol, <i>et al.</i> , 2003	57	39	4
Gottfried, <i>et al.</i> , 2003	92	0	8
Setzer, <i>et al.</i> , 2007	71.3	22.5	5
Sacko, <i>et al.</i> , 2009	91	9	0

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Conflicts of interest

There are no conflicts of interest.

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