RESULTS OF EXCISION OF DORSAL SPINAL MENINGIOMA WITH SEVERE NEURO DEFICITS

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Summary

Although being a slow growing tumor, spinal meningiomas are often diagnosed late and presents with features of significant cord compression that essentially warrants surgical management. To assess the clinical and functional outcome of excision of dorsal spinal meningioma. Within the period of July 2003 to June 2012, retrospective review of the records of 23 patients (Male:07, Female:26, age range, 34-68 years) with postoperative histological confirmation of meningioma were evaluated. Pre- and postoperative neurological state was classified according to the Frankel scale and functional outcome was assessed according to Levy Score. Chi-squared test and z-test was used for statistical analysis using SPSS. The mean age was 48.30±03.50 years with significant female predominance. The posterior and postero-lateral position was significant causing significant neuro-deficit. Satisfactory surgical results were achieved in 78.90% cases (Levy Score) and 82.82% cases (Frankel grading). Surgical resection of spinal meningiomas is a safe and effective procedure even with severe neurological deficits.

Key words

Spinal meningioma; neurodeficit; surgical excision.

Introduction

The annual incidence of primary intra-spinal neoplasm is about 5/1,000,000 for females and 3/1,000,000 for males [1]. However, Spinal intra-dural extra-medullary tumors account for 2/3rd of all intra-spinal neoplasms and among them spinal meningiomas alone account for 25-46% of all the primaries [2, 3]. They most frequently occur in the thoracic region in middle- aged women, and typically located in the intra-dural extra-medullary space [4]. They grow slow and spread laterally in the subarachnoid space and therefore lead to symptoms only after reaching a distinct size causing significant spinal cord compression. Initially, local pain is one of the leading symptoms; however, in a considerable number of patients diagnosis is suspected not until neurological deficits (e.g. sensory loss, weakness, and sphincter disturbances) or gait disturbances are present. Advances in radiological devices have resulted in earlier diagnosis but the prognosis in patients with spinal meningiomas is excellent even with a poor preoperative neurological status [4,5]. Considering all the aspects of spinal meningiomas, we conducted a retrospective study of our clinical cases to evaluate the results of the surgical management of spinal meningiomas associated with severe preoperative neurological deficits.

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Materials & methods

Forty three patients with spinal meningiomas (histologically confirmed) were operated in the department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka between July 2003 and June 2012. Among these, 33 patients (age range 34-68 years) suffered from severe preoperative neurological deficits and were rated grade III (n=24, 73.73%) or IV (n=09, 27.27%) according to the Levy scoring system (Table 1) [6]. The patients with Levy grade-I and II, cervical and lumbar spinal meningiomas, and patients with multiple level tumors were excluded from the study to exclude the possibility of bias in outcome assessment. We retrospectively reviewed age, gender, duration of symptoms and radiological assessment of intra-spinal location as well as the anterior–posterior distribution of the meningiomas. Magnetic Resonance imaging (MRI) with Gadolinium Contrast enhancement was done for the radiological assessment of the lesion [Fig 1 (a) (b) (c)]. Post-operative Levy score was assessed on 3, 6 and 12 months follow up and considered satisfactory with Grade-I and II and unsatisfactory when Grade-III and IV. The outcome was considered to be total recovery when the recovery rate was 100%. The patient's pre and postoperative neurological state was

classified according to the Frankel scale (Table I) in order to achieve a grading of functional disturbance of daily life activities and gait disturbances. According to the Frankel grade outcome was classified as poor (A + B) fair (C) and good (D + E) [7].

All the patients underwent a postoperative follow-up at least 12 months after the operation, with a mean of 30.7 months. Statistical analysis was performed using SPSS software. The chi-square was used with the level of significance 0.05.

Operative technique: All patients were operated on in the prone position via a posterior approach using laminectomy which was marked preoperatively by using the C-arm. the dura mater was exposed and a yellow discoloration was noted. The dura was incised at the midline, exposing an extra-medullary mass compressing and displacing the spinal cord. A plane was developed between the normal spinal cord and tumor by performing sharp dissection [Fig1 (d)]. Micro-scissors and bipolar cauterization were used to debulk the tumor centrally to achieve decompression. Using the micro-scissors and micro-dissector, the tumor and its dural attachments were removed from the spinal cord. The dural attachment was thoroughly coagulated using bipolar cauterization. A gross-total resection was achieved. The dura was closed in all patients and when necessary, dural defects were repaired with fascia (01 case).

Pathological examination: The entire excised tumor specimen was sent for histopathological examination that revealed the lesion as meningioma [Fig 1 (e)]. Microscopic evaluation demonstrated nests of tumor cells with abundant cytoplasm and bland oval nuclei. There were occasional psammoma bodies. The findings were consistent with spinal meningioma.

Postoperative course: The patients remained supine for 48 hours after surgery. Postoperative MRI revealed no evidence of residual tumor. Prior to discharge from the hospital on postoperative Day 4, they were ambulated with a walking aid.

Results

The patients ranged from 34 to 68 years of age (mean age, 48.30 years) with two thirds of them aged below 50. There was a predominance of females (79.79%) with a female to male ratio of 3.7:1. The mean duration of symptoms until surgery was 13.7 months (range, 3-36 months). One case was located extra-durally and the other meningiomas were strictly intra-dural. Meningiomas were posterior to the spinal cord in 15(45.45%) cases, postero-lateral in 09(27.27%) cases, lateral in 06(18.18%) cases, antero-lateral in 01(03.03%) case and anterior in 02(06.06%) cases. Female patients, <50 years (75.75%) of age and posterior and posterolateral position (72.72%) of the tumors were found to be significant [chi squared test, $p<0.05$]. Paraparesis was significant [chi squared test, $p<0.05$] and was present in 21(63.64%) patients. Hypesthesia was the predominant symptom in 17(51.52%) patients. Bladder and sphincter disturbances were found in 13(39.39%) patients [Table II]. The mean duration of the development of symptoms prior to surgery was 13.70 months among which pain was the predominant symptom in 11(33.33%) cases. Surgical resection led to significant alleviation of pre-operative symptoms. Histological type was psammomatous in 07(21.21%), fibrous in 04(12.12%), meningothelial in 14(42.42%) transitional and mixed type in 03(09.09%), and malignant meningioma in 02(06.06%) patients.

Surgical results showed improvement in 29(78.90%) cases, no change in 03(09.09%) cases, and deterioration in 01(03.03%) case due to the surgery induced syrinx formation. According to Levy Score 29(78.90%) cases and according to the Frankel grading 27(82.82%) cases had satisfactory results [Table-III]. There were 02(06.06%) cases of postoperative CSF leakage which was improved clinically by prolonged rest in prone reversed trendelenburg position. No patients had died of progression of malignant meningioma.

Table I: The clinical and functional assessment tools.

Neurological Disability assessment by Levy Score

Classification	Symptoms and Signs
Grade-0	Normal
Grade-I	Walking with assistance
Grade-II	Strength greater than gravity
Grade-III	Strength less than gravity
Grade-IV	Paraplegic (No motor response)

Neurological assessment by Frankels Grading

Grade		Criteria
Frankel-A	Complete	No motor or sensory function
Frankel-B	Sensory only	No motor function, preservation of sensory function
Frankel-C	Motor useless	Some motor function present but not useful
Frankel-D	Motor useful	Motor function present but somewhat weak
Frankel-E	Intact	Normal sensory and motor function

Table II : Demographic variables. (n=23).

	Traits	No	Percent(%)	Traits	No	Percent(%)
Age	30-39	11	33.33%	Sex	Male	07	21.21%
	40-49	14	42.42%		Female	26	79.79%
	50-59	06	18.18%	Duration of	1-12 months	15	45.45%
	60-69	02	06.06%	Symptoms	12-24 months	18	64.55%
Neurological Involvement	Pain	11	33.33%	Location of Meningioma	Pure Ventral	02	06.06%
	Sensory	17	51.52%		Pure Dorsal	15	45.45%
	Motor	21	63.64%		Ventro-Lateral	01	03.03%
	Reflex	13	39.39%		Dorso-Lateral	09	27.27%
	Gait	18	64.55%		Lateral	06	18.18%

Table III : Outcome variables. (n=23).

The Levy Score					Frankel`s Grade					
Preop Score	Post-Operative Score				Preop Grade	Post-Operative Grade				
	I	II	III	IV		A	B	C	D	E
III	14	02	01	01	B	00	03	01	04	02
IV	06	07	01	01	C	01	00	00	03	07
Total	20	09	02	02	D	00	00	01	00	11
	Satisfactory		Unsatisfactory		Total	01	03	02	07	20
						Poor		Fair	Good	

Fig 1 (a)

Fig 1 (b)

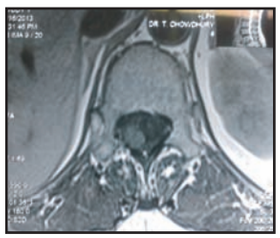

Fig 1 (c)

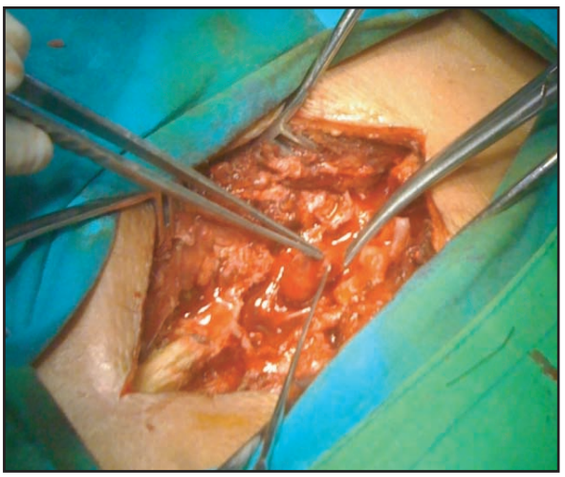

Fig 1 (d)

Fig 1 (e)

Fig 1 (a, b, c, d, e) :
Preoperative MRI showing the tumor at the level of $D_{10/11}$.

The T1 and T2 weighted image in sagittal section showing intradural lesion (a), (b) and axial section showing the dorso-lateral position(c). intraoperative image showing the tumor excision after lsminectomy D_{10} (d), which was later send for tissue diagnosis and was confirmed as meningioma.

Discussion

Meningiomas are benign tumours arising from arachnoid cells and mostly located in the intracranial compartment. Spinal meningiomas are rare and account about 1.2% of all meningiomas and 25% of all spinal cord tumours [8]. The primary goal of surgery is to achieve complete tumour removal and to avoid additional neurological damage. The aim of our study was to review our patients operated on a spinal meningioma with severe neurological deficit

in order to analyze their postoperative outcome and to compare them with other literatures. Although we could not assess the recurrence rates and the role of radiotherapy due to short duration of follow up and less number of study subjects, the overall clinical outcome was found to be significantly satisfactory even in patients with severe neurological involvement.

Many investigators have reported a higher proportion of women in their series [2,9]. In their series, the female to- male ratios in patients with spinal meningioma ranged from 3 and 4.2 to 1, and the ages of the people who were affected ranged mostly <50 years. In our series, the female-to-male ratio is 4.3 to 1. It has been suggested that spinal meningioma occurs more frequently in fertile women because of the possible dependency of these tumors on sex steroid hormones [8,9]. Although the theory is controversial, hormonal studies have shown the existence of various receptors that may contribute to meningioma formation [9]. In the current series with the thoracic region meningiomas, the incidence of the same location was reported to be 79.5% by Roux, 75% by Levy and 66% by Namer [1, 6, 10]. The site of dural attachment in our series was not consistent at all with any of the different other series. Because of the different criteria in describing the relationship of the tumor to the spinal cord, the distribution of the site of tumor origin was heterogeneous in the reviewed studies [5,11].

Pain is the commonest symptom in most series, but paraparesis (63.64%) was predominant in our series, probably due to lack of diagnostic facilities in the rural areas of our country that made the delay in presentation and advancement of neural involvement [1,2,6,8]. The similar features were also reported by Pena [12]. Unspecific symptoms as local pain are often misinterpreted, not until the existence of progressive neurological deficits and gait disturbances. Delay of diagnosis as the result of failure to consider a slow growing spinal tumour responsible for longstanding back pain or neurological deficits was already observed. Therefore, in the current series, demographic, anatomical and clinical data are close to those previously reported in the pertinent literature.

Recent clinical studies have confirmed that in acute spinal cord compression, whatever the cause, prognosis for recovery depends mainly on two factors: the severity of the neurological deficit and the duration of the deficit before decompression [13]. However, as the degree of compression increases, there is a rapid reduction of spinal cord blood flow leading to ischemia resulting in irreversible changes, (e.g flattening of anterior horn, disappearance and necrosis of anterior horn cells, demyelination and axonal degeneration of white matter) [14,15]. Meningiomas are usually slow-growing, well-delineated, and exhibit benign biological behaviour and assumed to exert a predominantly compressive action. In our patients with severe preoperative neurological deficits, by the end of 12 months, all of them had improved clinically. Few of the previous reports considered profound preoperative neurological deficits to be detrimental to recovery but In 1988, Ciappetta specifically reported the functional outcome with severe paraparesis was relatively favourable [16,17,18]. Some authors have stressed that even paraplegic patients have a chance of recovering ambulation if given adequate time [6,8]. Our series showed no statistically significant difference in recovery rate between patients rated grade III or grade IV but the recovery rate was significantly favorable in all the patients. We presume that the significant clinical recovery is due to complete excision of the tumor which is also reported in other literarures [1,6,8]. However, radical surgery may result in higher morbidity particularly for anteriorly located and en plaque meningiomas due to the peculiar configurations of feeding vessels and the presence of intratumoral calcifications [1,4,19]. There were some technical difficulties of ventral tumor resectioning, although even in those cases, resectioning of the tumor was performed using a careful microsurgical technique.

Although we could not assess the rate of recurrences due to time constraints, only a few long-term studies have reported the rate of late recurrence to be 4% by Levy and 1.3% by Solero Mirimanoff reported that, after a total resection, the recurrence-free rates at 5, 10, and 15 years, were 93%, 80% and 68%, respectively, whereas, after a subtotal resection, the progression-free rates were only 63%, 45% and 9%, respectively, during the same periods [6,8,20]. So, the acceptable treatment method for spinal meningioma is total removal of the tumor, Mirimanoff also suggested that radiotherapy should be considered as an adjunctive treatment after subtotal excision or recurrent meningioma. We did not consider radiotherapy because of the indolent nature of the disease and potential damage caused by radiation [20]. Moreover, we had macroscopically removed the entire tumor and there were no cases dealt with recurrences in our short series with minimum 1 year follow up.

Conclusion

Despite the retrospective character of this study and its limitations we can conclude that resection of spinal meningiomas is a safe and effective procedure even with severe neurological deficits.

Disclosure

All the authors declared no competing interest.

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