

Microsurgical treatment for spinal tumours

V Hufana, J S H Tan, K K Tan

ABSTRACT

Introduction: Although spinal tumours are amenable to total surgical excision, the factors determining the outcome are diverse. This study re-evaluates aspects of the disease that contribute to their outcome.

Methods: Ninety-three consecutive patients with spinal cord tumours that underwent microsurgical excision between February 1992 and February 2002 were retrospectively studied. All patients underwent magnetic resonance imaging and had histological confirmation of spinal tumours.

Results: There were 44 men and 49 women with a mean age of 49.05 years (range 6 to 83 years). The location of the tumours was cervical in 37 cases, thoracic in 41 cases, lumbosacral in 13 cases, and multilevel in two cases. The mean tumour size was 2.2 cm (range 0.8 to 7cm) and mean duration of symptoms was 10.8 months. Complete excision was achieved in 72 cases and incomplete removal in 15 cases. The mean follow-up period was 21.45 months (range 3 days to 8 years). Immediate post-operative improvement was noted in 40 (43 percent) patients, 24 (25.4 percent) improved within six months, 13 (14 percent) improved after six months, 12 (12.9 percent) had no improvement and four patients died. The duration of symptoms and the completeness of excision were factors that correlated with post-operative improvement (p-value is less than 0.05). Age, gender, size, histological type, presenting symptoms, spinal level affected and axial location of tumour did not correlate with the outcome.

Conclusion: Microsurgical excision of spinal cord tumours is a safe and effective procedure, and post-operative outcome is correlated to duration of symptoms and the extent of tumour resection.

Keywords: primary spinal cord neoplasm, spinal cord neoplasms, spinal neoplasms, spinal surgery

INTRODUCTION

Primary intraspinal tumours comprise 15% of all central nervous system tumours⁽¹⁻³⁾. These tumours are classified into three groups, based on its location, namely: extradural, intradural extramedullary, and intramedullary spinal tumours⁽²⁾. Victor Horsley was credited with the first successful removal of spinal cord tumour in 1887^(1,4). Since then, the rapidly increasing sophistication of imaging and microsurgical techniques have allowed surgery to evolve into today's definitive treatment modality⁽⁵⁾.

Although most tumours are amenable to complete removal, some fail to improve after successful surgery. The diversity of patient profile and presenting symptoms make it even more difficult to pinpoint factors leading to a good post-operative outcome. This study reviews the clinical profile of patients who present with spinal pathology and evaluates the neurological outcome of microsurgical treatment of these spinal tumours. It also determines factors that may have contributed to the treatment outcome.

METHODS

The records of patients who presented to our hospital from February 1992 to February 2002 were retrospectively reviewed. The study included all patients who underwent microsurgical excision of spinal tumours and with histological confirmation of the excised tumour. All patients had preoperative magnetic resonance (MR) imaging and were operated on using standard microsurgical technique. All records and imaging studies were traced but not all data were available. For example, the size of tumour was not clearly stated in 23 patients (24.7%). Histological diagnosis, extent of excision and completeness of excision data were all obtained. Completeness of surgical excision was assessed intra-operatively in all extramedullary tumours. Intramedullary tumours were assessed with post-operative MR imaging within the same admission as per departmental protocol.

Using a uniform database set, clinical charts and outpatient progress notes were reviewed. The patients' neurological functions were assessed preoperatively

Department of
Neurosurgery
National Neuroscience
Institute
11 Jalan Tan
Tock Seng
Singapore 308433

V Hufana, MD
Registrar

J S H Tan, MBBS,
FRCSE, FRCSG
Consultant

K K Tan, MBBS,
FRCSE, FRCSG
Senior Consultant

Correspondence to:
Dr Tan Siah Heng James
Tel: (65) 6256 6011
Fax: (65) 6357 7131
Email: siah_heng_tan@
nni.com.sg

Table I. Characteristics of patients (n=93).

Variable	Number	Percentage
Age (in years)		
<20	7	7.5
20-40	26	28
41-60	34	36.6
>60	26	28
Sex		
Male	45	48.4
Female	48	51.6
Duration of symptoms (in months)		
<1	11	11.8
>1	82	88.2
Presenting symptom(s)		
Pain	13	14
Numbness	4	4.3
Weakness	25	26.9
Pain/ numbness/ weakness	47	50.5
Myelopathy with or without bladder/ bowel problem	3	3.2
Incidental finding	1	1.1
Discharge neurological status		
Improved	58	62.4
Same	30	32.3
Deteriorated	1	1.1
Expired	4	4.3
Surgical complications		
Wound infections	3	3.2
CSF leak	1	1.1
Neuropraxia	1	1.1
Systemic complications		
Pneumonia	2	2.2
Sepsis	2	2.2

CSF: Cerebrospinal fluid

prior to discharge, six months postoperatively and on their latest follow-up. Neurological functions were assigned as improved, the same or deteriorated, compared with their preoperative condition. The onset of the patients' improvement was noted. We chose not to use Frankel grading as it was possible for patient to have an improvement in symptoms (for example, sensation) without improvement in Frankel grading. Neurological improvement was stated as improved if the patient's sensation, power, gait or bladder/bowel function improved post-operatively.

Factors that may have influenced the outcome of the surgical treatment were tested for statistical significance, taken as $p < 0.05$, using SPSS for Windows software version 12.0.1 (Chicago, IL, USA). They include age, gender, location and size of tumour, spinal cord level, presenting symptoms, and their duration, extent of removal and their histological type.

RESULTS

Ninety-three patients with spinal tumours underwent microsurgical excision during the study period. The characteristics of these patients are shown in Table I. The mean age of the patients was 48.05 years (range 6 to 83 years) and they presented with symptoms such as pain (14%), numbness (4.3%) and weakness (26.9%). One-half of them presented with more than one symptom. One patient was diagnosed incidentally (Table I).

The mean duration of symptoms was 8.9 months (range 3 days to 8 years). Their duration varies according to the axial location of the tumour; extradural tumours presented with a mean duration of 7.8 months, intradural extramedullary tumours with a mean of 11.7 months, and intramedullary tumours with a mean of 3.2 months. We found that the duration of symptoms correlated with post-operative improvement. Of those with symptoms of more than one month, 67% improved versus only 27.3% improved for those whose symptoms lasted less than a month. The mean follow-up period was 21.45 months (range 1 month to 96 months) postoperatively.

Most of the excised tumours were intradural and extramedullary in location, with the majority being within the thoracic segment of the spine. Histopathological examination showed that nerve sheath tumours and meningiomas were the most common extramedullary tumours. For intramedullary tumours, ependymoma and astrocytomas had the same level of occurrence (Table II). The post-operative outcomes of the patients are summarised in Table I. Five patients developed postoperative complications. Three had wound infections, one developed cerebrospinal fluid leak and infection, and one had neuropraxia due to surgical positioning. These were addressed appropriately and all recovered with no additional morbidity. Four patients died after surgery; one succumbed to multiple organ failure arising from widespread oesophageal carcinoma, one patient with malignant astrocytoma died of pulmonary embolism, one died from pneumonia (osteosarcoma), and one died from sepsis (meningioma).

The extent of excision either complete excision, incomplete or biopsy was found to positively correlate with post-operative improvement. 58 patients had improved outcome; of these, 49 patients (84.5%) had complete excision and nine patients (15.5%) had incomplete excision or biopsy. 35 patients had no improvement or deterioration of symptoms. 12 patients (34.3%) had only biopsy or incomplete excision. The duration of symptoms ($p < 0.05$) and extent of excision ($p < 0.05$) were shown to have a significant correlation on univariate and multivariate analyses.

Table II. Characteristics of tumours.

Variable	Number	Percentage
Axial location		
Intramedullary	9	9.7
Astrocytoma	4	4.3
Ependymoma	4	4.3
Haemangioma	1	1.1
Intradural extramedullary	74	79.6
Nerve sheath tumours	40	43
Meningioma	21	22.6
Filum ependymoma	0	0
Miscellaneous	13	14
Extradural	10	10.7
Metastasis	5	5.4
Spinal level		
Cervical	37	39.8
Thoracic	41	44.1
Lumbosacral	13	14
Multiple	2	2.2
Size (in cm)		
<1	4	4.3
1-2	28	30.1
>2	12	12.9
Widespread	26	28
Size not recorded	23	24.7
Nature		
Schwannoma/ neurofibroma	40	43
Meningioma	21	22.6
Astrocytoma	4	4.3
Ependymoma	4	4.3
Haemangioma	1	1.1
Metastasis	5	5.4
Others	18	19.4

Table III. Patient's onset of improvement.

Onset of improvement	Number	Percentage
Immediate	40	43
Within 6 months	24	25.8
After 6 months	13	14
No improvement	12	12.9
Expired	4	4.3

DISCUSSION

Spinal tumours are less frequent than tumours involving the brain⁽³⁾. In a series of 8,784 primary tumours of the CNS, only 15% were intraspinal⁽¹⁾. In our study, most of the tumours are intradural extramedullary, and only 10% were intramedullary. Our results are similar to that of McCormick and Stein⁽⁶⁾. One-half of our patients presented with more than one symptom of pain, numbness and

weakness (Table I). The symptoms experienced are a reflection of the tumour location within the spinal axis (intramedullary or extramedullary)^(6,7). It is noteworthy that the mean duration of the symptoms for intramedullary tumours before diagnosis were only 3.2 months, compared with 34 to 35 months in other series^(6,8). This is due to the early destruction of the spinal tracts and hence its early presentation. This would explain the slightly poorer prognosis seen our patients who presented early (<1 month of symptoms). We also showed that those patients with acute onset of symptoms had a poorer prognosis for recovery. We postulate that the more acute symptoms denote more invasive tumours and hence the poorer prognosis.

Filum ependymoma was not seen in our patients and the number of intramedullary tumours was much less compared to Stein and McCormick⁽⁵⁾. The duration of the symptoms and extent of tumour excised showed a direct correlation with outcome. The natural history of spinal tumours is steady progression⁽⁶⁾. The longer the duration of illness, the more severe the symptoms became. Several authors claimed that the most important factor determining the outcome is preoperative neurological status. It has been observed that functional recovery is greater in patients presenting with minor neurological deficit, and that dramatic postoperative improvement was unlikely in patients with severe preoperative neurological deficit⁽⁷⁻¹¹⁾.

The extent of tumour excision correlates directly with a good outcome. This is likely to be attributed to the sites of the tumour in our patients. Generally, extramedullary tumours are more accessible than intramedullary tumours^(12,13). In about 80% of our patients, the tumours were intradural and extramedullary, making them more amenable to complete extirpation. As the tumours are benign, patients can expect excellent prognosis if they are carefully and thoroughly removed^(5,14-16). Other series have shown that the extent of excision of intramedullary tumours depends on how well the tumours are demarcated from surrounding tissue^(17,18).

Postoperative complications include cerebrospinal fluid (CSF) leakage, wound infection, pneumonia, sepsis and neuropraxia. Five (5.4%) of these complications were attributed to surgical complications (wound infection, CSF leak and neuropraxia) and four patients (4.4%) developed systemic complications of pneumonia and sepsis. The mortality rate in our series is slightly higher than that of other series, which ranged from 0% to 3%^(19,20), and this may reflect preoperative surgical selection rather than poor technical considerations. In conclusion, with proper patient selection, microsurgical excision of

spinal tumours is generally safe and effective procedure. The postoperative outcome correlates with the duration of symptoms and extent of tumour excision.

REFERENCES

- Sloof JH, Kernohan JW, MacCarty CS. Primary Intramedullary Tumours of the Spinal Cord and Filum Terminale. Philadelphia: Saunders, 1990.
- Greenberg MS. Handbook of Neurosurgery. 5th ed. New York: Thieme, 2001.
- Adams RD, Victor M, Ropper AH. Principles of Neurology. 6th ed. New York: McGraw-Hill, 1997.
- Stein BM, McCormick PC. Intramedullary neoplasms and vascular malformations. Clin Neurosurg 1992; 39:361-87.
- Stein BM, McCormick PC. Spinal intradural tumours. In: Wilkins RH, Rengachary SS, eds. Neurosurgery. 2nd ed. New York: McGraw-Hill, 1996: 1769-81.
- McCormick PC, Stein BM. Microsurgical approaches to cervical spine. In: Young PH, ed. Microsurgery of the Cervical Spine. New York: Raven Press, 1991: 159-74.
- Epstein FJ, Farmer JP, Freed D. Adult intramedullary astrocytomas of the spinal cord. J Neurosurg 1992; 77:355-9.
- Hoshimaru M, Koyama T, Hashimoto N, Kikuchi H. Results of microsurgical treatment for intramedullary spinal cord ependymomas: analysis of 36 cases. Neurosurgery 1999; 44:264-9.
- Samii M, Klekamp J. Surgical results of 100 intramedullary tumours in relation to accompanying syringomyelia. Neurosurgery 1994; 35:865-73.
- Stein BM. Surgery of intramedullary lesions and escapable pitfalls. In: de Villiers JC, ed. Some Pitfalls and Problems of Neurosurgery. Basel: Karger, 1990: 131-53.
- McCormick PC, Stein BM. Intramedullary tumours in adults. Neurosurg Clin N Am 1990; 1:609-30.
- Cooper PR. Outcome after operative treatment of intramedullary spinal cord tumours in adults: intermediate and long term results in 51 patients. Neurosurgery 1989; 25:855-9.
- DeSousa AL, Kalsbeck JE, Mealey J Jr, Campbell RL, Hockey A. Intraspinal tumours in children. A review of 81 cases. J Neurosurg 1979; 51:437-45.
- Seppala MT, Haltia MJ, Sankila RJ, Jaaskelainen JE, Heiskanen O. Long term outcome after removal of spinal neurofibroma. J Neurosurg 1995; 82:572-7. (Published erratum appears in J Neurosurg 1995; 83:186)
- Levy WJ Jr, Bay J, Dohn D. Spinal cord meningioma. J Neurosurg 1982; 57:804-12.
- Solero CL, Fornari M, Giombini S, Lasio G, Oliveri G, Cimino C, et al. Spinal meningiomas: review of 174 operated cases. Neurosurg 1989; 25:153-60.
- McCormick PC, Stein BM. Spinal cord tumours in adults. In: Youmans JR, ed. Neurosurgical Surgery. Philadelphia: WB Saunders, 1996: 3102-22.
- Rawlings CE III, Giangaspero F, Burger PC, Bullard DE. Ependymomas: a clinicopathologic study. Surg Neurol 1988; 29:271-81.
- Allen JC, Aviner S, Yates AJ, Boyett JM, Cherlow JM, Turski PA, et al. Treatment of high-grade spinal cord astrocytoma of children with "8 in 1" chemotherapy and radiotherapy: a pilot study of CCG-945. Children's Cancer Group. J Neurosurg 1998; 88:215-20.
- Cohen AR, Wisoff JH, Allen JC, Epstein F. Malignant astrocytomas of the spinal cord. J Neurosurg 1989; 70:50-4.
- Costantini S, Miller DC, Allen JC, Rorke LB, Freed D, Epstein JF. Radical excision of intramedullary spinal cord tumours: surgical morbidity and long-term follow-up evaluation in 164 children and young adults. J Neurosurg Spine 2000; 93:183-93.

www.innovmedics.com



at the heart of breathing...

For more information, please contact:

INNOVMEDICS (S) PTE LTD

30 Kaki Bukit Road 3 #07-03/04 Empire Technocentre Singapore 417819

Tel: +65 62844150 • Fax: +65 62844902 • Email: sales@innovmedics.com

Innovmedics
Focuses on Quality Healthcare

