Journal of Clinical Neuroscience 19 (2012) 262–266

Contents lists available at SciVerse ScienceDirect

Journal of Clinical Neuroscience

journal homepage: www.elsevier.com/locate/jocn

Clinical Study

Clinical presentation and outcome of patients with intradural spinal cord tumours

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ARTICLE INFO

Article history:
Received 27 March 2011
Accepted 10 May 2011

Keywords:
Intradural
Outcome
Presentation
Spinal cord
Surgery
Tumour

ABSTRACT

We aimed to retrospectively investigate the clinical presentation and outcome of surgical intervention of patients with intradural spinal cord tumours (IDSCT), and to assess the predictors of surgical outcome. A total of 109 patients with IDSCT (57 males and 52 females) (130 admissions; mean age, 45.9 years; range, 14–89 years) underwent surgery between 1 January 1994 and 30 June 2009 at The Royal Melbourne Hospital. Ninety per cent of tumours were classified as low grade. Pain was the most common symptom at presentation (60%) and the mean duration of symptoms was 37.8 weeks (0–4 years). Total resection was achieved in 72.3% of patients with IDSCT. An extramedullary location was the strongest predictor of greater extent of tumour resection (odds ratio [OR] = 4.367, 95% confidence interval [CI] = 1.876–10.204, $p = 0.001$), whereas a rostral location was also a significant predictor of greater resection (OR = 1.393, 95% CI = 1.014–1.908, $p = 0.040$). The surgical mortality rate was 0.92%. A good pre-operative clinical grade was the strongest predictor of a positive post-operative neurological status at discharge for IDSCT (OR = 7.382, 95% CI = 4.575–11.912, $p < 0.001$). The mean follow-up was 37.9 months (16 days–165 months). A good post-operative clinical grade was the most significant predictor of a positive neurological outcome at short-term follow-up (OR = 9.953, 95% CI = 4.941–20.051, $p < 0.001$), while a good pre-morbid clinical grade was the most significant predictor of a positive outcome at long-term follow-up (OR = 9.498, 95% CI = 2.780–32.451, $p < 0.001$). We concluded that surgical outcome was influenced by pre-morbid, pre-operative and post-operative clinical grades, the extent of resection, tumour grade and tumour location with respect to the spinal parenchyma. Surgical intervention has a high success rate for tumour control and we recommend total resection where possible.

1. Introduction

Intradural spinal cord tumours (IDSCT) can be classified as being either extramedullary (EMSCT) or intramedullary (IMSCT), with IMSCT accounting for 16% to 20% of IDSCT.[1,2] IMSCT exist within the spinal parenchyma, while EMSCT are outside the parenchyma but within the dural sheath.

In June 1887, Mr (later Sir) Victor Horsley performed the first resection of an IDSCT, successfully excising a benign extramedullary fibromyxoma.[3] This pioneering procedure established surgery as a primary mode of treatment for this rare condition. Since then, advancements in surgical techniques and equipment, such as the bipolar cautery and ultrasonic aspirator, have continued to change management and improve the post-operative outcome in patients.

This study investigates the clinical presentation of patients with IDSCT, and assesses the predictors of neurological outcome after surgical intervention.

2. Methods

2.1. Study design

This retrospective study was carried out at The Royal Melbourne Hospital, a tertiary metropolitan hospital that is a major referral centre for patients with IDSCT in Victoria. The records of 109 patients (130 admissions) who had undergone surgery for IDSCT between 1 January 1994 and 30 June 2009 were studied to investigate the clinical presentation and outcome of patients after surgery.

2.2. Patient selection

Patients who had undergone surgery for IDSCT were identified from the hospital and neurosurgery department databases. Patients who had been treated surgically for cavernous haemangiomas, arteriovenous fistulas and arteriovenous malformations were excluded.

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doi:10.1016/j.jocn.2011.05.021

Table 1
Clinical/functional classification scheme of neurological function[a]

McCormick grade	Description*
I	Neurologically normal; mild focal deficit not significantly affecting function of involved limb; mild spasticity or reflex abnormality; normal gait
II	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 ambulates independently
III	More severe neurological deficit; requires cane/brace for ambulation or significant bilateral upper extremity impairment; may or may not function independently
IV	Severe deficit; requires wheelchair or cane/brace with bilateral upper extremity impairment; usually not independent

* In our study, patients who were completely neurologically normal with no deficits were classified as grade 0, rather than grade 1.

[a] Table reprinted with the kind permission of the American Association of Neurosurgeons, from McCormick PC, Torres R, Post KD, Stein BM. Intramedullary ependymoma of the spinal cord. *J Neurosurg* 1990;**72**:523–32.

2.3. Data collection

Patient records were studied retrospectively to collect information regarding patient admission, pre-morbid status, symptoms at presentation, tumour resection score (biopsy, partial, subtotal or total), and surgical outcomes. According to the World Health Organisation (WHO) classification of CNS tumours,[4] grade 1 and 2 tumours were considered as low-grade, while grade 3 and 4 tumours were high-grade. Each recorded admission involved surgery for the IDSCT. Primary tumours were those not preceded by neoplasms of the same histopathological subtype. Secondary tumours represented a recurrence, seeding or metastasis. A recurrence has been defined as a secondary tumour that re-occurs in the same location as the primary tumour, or the further growth of an IDSCT after surgery, while seeding involves the spread of a tumour through the cerebrospinal fluid (CSF) from the cranial to the spinal region, or from one spinal region to another.

Only symptoms that were directly attributable to the IDSCT were classified as presenting symptoms. In patients with recurrences, only new or worsening symptoms were classified as presenting symptoms for the next admission.

The McCormick grade[5] of neurological function (Table 1) was used to determine the pre-morbid and pre-operative status as well as outcome at discharge (post-operative), short-term and long-term follow-up after discharge. Short-term follow-up was defined as 0–12 months after discharge, while long-term follow-up referred to 12–36 months after discharge.

After surgery, an improvement in status was defined as a decrease of at least one McCormick grade, whereas deterioration was represented by an increase of at least one grade. Recovery referred to a McCormick grade of 0 after surgery, and implies that the pre-operative status was not 0.

Surgical mortality referred to death from any cause within 30 days of surgery, whereas the IDSCT mortality rate referred to patients who had died as a result of IDSCT progression.

2.4. Statistical analysis

A univariate analysis was used to help identify variables for multivariate analysis. Backward stepwise logistic regression and ordinal logistic regression were used for multivariate analyses of dichotomous and ordinal variables respectively.

Table 2
Histopathology and medullary location of intradural spinal cord tumours for 130 admissions (109 patients)

Histopathology	IMSCT	EMSCT	Total
Astrocytoma	6	–	6
Ependymoma	23	11	34
Haemangioblastoma	2	3	5
Haemangiopericytoma	–	2	2
Intraneural perineuroma	–	1	1
Meningioma	–	45	45
Metastasis	2	1	3
Neurofibroma	–	9	9
Oligoastrocytoma	–	1	1
Paraganglioma	1	–	1
Schwannoma	–	22	22
PNET	–	1	1
Total	34	96	130

EMSCT = extramedullary spinal cord tumour, IMSCT = intradural spinal cord tumour, PNET = primitive neuroectodermal tumour.

3. Results

3.1. Study population

A total of 109 patients (57 male, 52.3%; 52 female, 47.7%), who comprised 130 admissions (96 for EMSCT resections, 73.8%; 34 for IMSCT, 26.2%) were included. The overall mean age at admission was 45.9 years (range, 14–89 years).

3.2. Histopathology

Tumour histopathology and location with respect to the spinal parenchyma is detailed in Table 2. Meningiomas (34.6%), ependymomas (26.2%) and nerve sheath tumours (NST – schwannomas and neurofibromas) (23.8%) were the most prevalent histopathological subtypes. Furthermore, tumours such as ependymomas, haemangioblastomas and tumour metastases presented as either EMSCT or IMSCT (Fig. 1).

The tumour grade for each tumour subtype is included in Table 3. Most (90%) of the tumours were low grade, while one patient had an astrocytoma of unknown grade. The three metastatic tumours were from lung, melanoma and rectal primary malignancies.

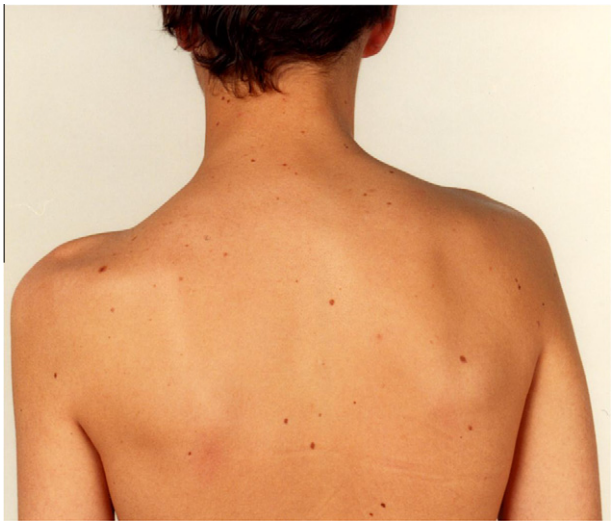

Fig. 1. A photograph of a 15-year-old male showing muscle atrophy as a result of a C1–C3 tancytic ependymoma. (This figure is available in colour at www.sciencedirect.com.)