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Primary Spinal Malignant Schwannomas: Clinical and Prognostic Remarks

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Summary

Malignant peripheral nerve sheath spinal tumours are relatively rare. A primary spinal location at onset from the nerve roots is rarely reported in the literature, thus the clinical features and therapeutic results of these spinal malignant tumours are not defined.

Six cases of malignant primary spinal schwannomas, 2% of 293 spinal schwannomas operated on in a 38 year period, are reported.

Based on an analysis of a limited number of cases, ours and those collected from the literature (21 patients), some suggestions are possible:

a) pre-operative clinical presentation and imaging studies are not predictive of malignancy;

b) postoperative outcome is poor, especially in patients with von Recklinghausen's disease and after partial removal of the tumour;

c) local recurrence and metastases are possible, even after radical surgery and radiotherapy.

Keywords: Spinal tumour; malignant schwannoma.

Introduction

Malignant schwannoma is an unusual neoplasm of peripheral nerves sheaths. Paravertebral regions are frequent sites of onset of these tumours [2, 4, 15]. Thus schwannomas of the thoracic or abdominal cavity not infrequently show secondary invasion of the vertebral canal. On the other hand, nerve root malignant tumours primarily localized within the spinal canal are rare [6, 12–15].

Because the clinical aspects and the prognosis of these spinal malignant tumours are not clearly defined, it seems appropriate to report our small series of 6 malignant schwannomas, all related to a nerve root and completely or mainly intraspinal, treated in a 38 year period, and add our experience to that of the other scattered communications in the literature on this topic.

Clinical Material (Table 1)

Between 1955 and 1993, 293 patients with spinal schwannoma underwent surgical treatment in the Neurosurgical Division of "La Sapienza" University of Rome; in six of these patients (2%) the tumour was histologically clearly malignant (grade IV WHO) [9].

Table 1. *Summary of Our Cases*

	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
Age/Sex	52/F	68/F	43/M	36/F	22/F	30/M
Neurofibromatosis	no	no	no	no	yes	no
Duration of symptoms (mos)	8	9	3	5	24	72
Symptoms, signs	pain motor	pain motor	pain	pain	pain, motor sphincter	pain motor
Site	D2	L4	L3	D11	C2	D7
Relation to dura	ID	ID	ID–ED	ID-ED	ID	ID
Dimension	1 cm	2 cm	1 cm	3 cm	4 cm	3 cm
Removal	total	total	total	total	total	total
Recurrence	no	no	no	yes	yes	yes
Metastasis	no	no	no	no	pulmonary	pulmonary
Outcome (mos)	72 ND	24 ND	72 ND	48 ND	6 D	14 D

D dead; *ID* intradural; *ED* extradural; *ND* no evidence of disease.

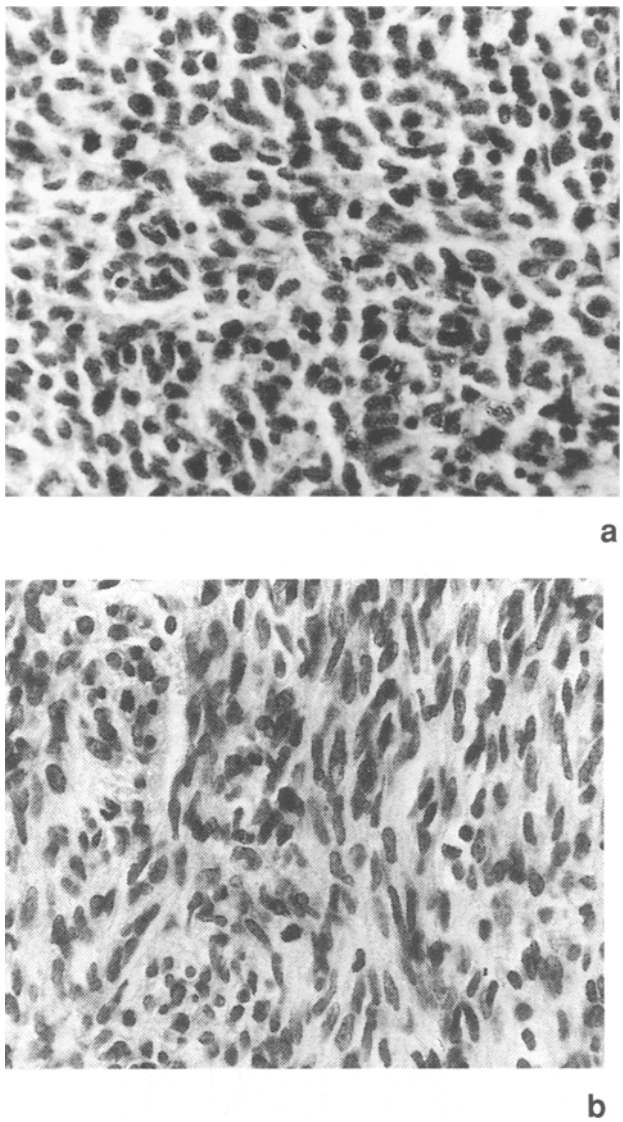

Fig. 1. (a, b) Malignant schwannoma with very high cellular density and several mitoses (H & E, × 400)

The morphological picture was characterized by high cellularity, nuclear pleomorphism, definite mitotic activity and focal necrosis; 4 were mainly composed of interwoven bundles of fusiform cells (Fig. 1), one was epithelioid and another one, previously reported [10], showed epithelioid and melanotic features. Immunoreactivity for S-100 protein was negative in 5 tumours available for immunostaining.

Results

The male/female ratio was 1 : 2 and the mean age of patients on admission was 42 years (range 22–68 years). Only one of these six patients had clinical evidence of von Recklinghausen's disease (NF). The mean duration of pre-operative clinical history was 20 months (range 3–72 months). The main presenting symptom was local or radicular pain, followed by motor disturbances; at diagnosis 4 out of 6 showed paraparesis. The site of the tumour was cervical in 1 case, dorsal in 3, lumbar in 2. Four of six tumours were intradural and 2 intra-extradural.

Plain x-ray films were normal in 4, in two they revealed a widening of an intervertebral foramen. Diagnostic CT scan or MRI was performed in all but one patient, all tumours enhanced after intravenous contrast. Radiological pictures were not peculiar and not different from those of benign schwannomas.

At surgery the tumours, 1 to 4 cm in size, were firm and apparently well delineated; in one case troublesome bleeding was noticed. Total removal of tumour was possible in all cases; no patient was irradiated postoperatively.

Three patients, one with von Recklinghausen's disease, were re-operated on for a local recurrence after a mean time of 9 months (range 3–18 months) and then irradiated; the histology at re-operation was not different from that seen at the primary operation. Two of these patients died of lung metastases. Thus at mean follow-up of 6 years (range 3–10 years), 2 patients were dead and 4 alive. 2 of these, treated with only radical surgery, were apparently cured (no evidence of disease after 6 years) according to the MRI follow-up; both had been operated on for very small tumours, less than 2 cm in size.

Discussion

Malignant schwannoma is a relatively rare tumour. Its incidence among nerve sheath tumours ranges 2% to 13% [8, 14]. Almost one-half of patients with peripheral malignant schwannoma have evidence of neurofibromatosis (NF) (von Recklinghausen's disease) [4]. On the other hand Ducatman [4] reported an incidence of 5% of malignant schwannomas in patients with NF1 compared to 0.001% in the general population.

Among spinal neurinomas the frequency of a malignant variant is less clear; in the past these tumours were not differentiated from other epidural mesenchymal malignant tumours; so Nittner [11] reported 35 generically classified "sarcomas" in 111 spinal neurinomas. Recently in a more detailed analysis Seppala [12] found 6 malignant tumours among 233 primary spinal tumours of histologically proven Schwann cell origin, a rate of 3% similar to 2% found in our series.

The literature provides only scattered papers deal-

Table 2. *Summary of 21 Cases of Spinal Malignant Schwannoma (3, 12, 13, 15, our Cases)*

Total cases	21
Sex	12 females, 9 males
Age	mean age 44 years range 13–70 years
von Recklinghausen	5 cases 24% lumbar 33%; thoracic 28%
Site	cervical 28%; sacral 10% intradural 52%; extradural 24% intra-extradural 24%
Treatment	surgery 21 cases radiotherapy 8 cases
Survival	1 year 76%; 5 years 23%
Outcome	recurrence 76%; metastasis 33% (5 outside SNC, 1 cerebral, 1 spinal)

Table 3. *Factors Influencing the Prognosis in Spinal Malignant Schwannoma*

	Survival	
	1 year	5 years
All cases (21 cases)	76%	23%
Total removal (18 cases)	81%	20%
Partial removal (3 cases)	33%	0%
Radiotherapy: yes (8 cases)	87%	37%
no (13 cases)	69%	15%
Dimension of tumour		
> 2 cm (5 cases)	80%	20%
< 2 cm (3 cases)	100%	66%
Neurofibromatosis (5 cases)	40%	0%

ing with primary spinal malignant schwannomas, single case reports, or a few cases not specifically discussed incorporated in larger series of benign spinal neurinomas [3, 12–14]. Thus the clinical features and the postoperative outcome of these malignant tumours, when primary spinal, are not defined. Seppala [12] comparing prognostically benign cellular with malignant spinal schwannomas found that the age of patients was significantly lower (mean 28 months) and the association with neurofibromatosis higher (3 with NF 1 or 2) in the 6 patients of the malignant group. All these had local recurrence after surgery, and all patients died between 2 months and 6 years even after radical surgery and postoperative radiotherapy. A somewhat more favourable prognosis was observed by others; Valdueza [15] reported a local recurrence in 3 out of 5 patients; but 4 patients, two free of disease, were alive after surgery from 7 months to 10 years. Out of 6 patients of our series, with radical surgery and without radiotherapy, 3 had further surgery for local recurrence; but 4 were alive after a mean follow-up of 4,5 years (range 2–6 years).

It is possible that the different outcome is explained by a different histological grade of malignancy of tumours; however, Ducatman [4] in malignant peripheral nerve sheath tumours did not find significant correlation between grade of malignancy and survival. Anyway the small number of primary spinal malignant schwannomas reported in a single series does not permit any conclusion.

We have tried to outline the clinical behaviour of this tumour and the efficacy of treatment collecting the scattered cases reported in the literature (Table 2).

Association with NF 1 or 2 is present in 24% of cases. These patients tend to be younger (mean age: 32 years vs 39 years). Clinical data and CT scan and MRI pictures do not permit differentiating malignant from benign schwannomas; thus, a pre-operative diagnosis of malignancy seems not possible. Moreover vertebral location and relation to dura of malignant schwannomas are not different from those which are benign.

The prognosis of primary spinal malignant schwannomas is poor; local recurrence occurs in 71% of cases. Seeding into the spinal canal is possible [15], while metastases, more often to the lung, were reported in 7 cases (33%). The 5-year survival rate is 23%, not different from that reported in clinical series of peripheral malignant nerve-sheath tumours, which ranges between 10% and 47% [1, 3, 4, 14, 16].

The prognosis seems to be poorer in patients with than in those without evidence of neurofibromatosis; all patients with NF had recurrences, 60% presented metastases and all died. The risk of local recurrence of tumour and survival seems not to be correlated with the age of patients, vertebral level or relationship of tumour with the dura, while a relationship with the tumour size cannot be traced because of incomplete reporting on these cases. Worthy of note is the fact that the patients with NF (24%) have a short survival, while some patients without NF (23%) have long survival (better than 5 years). The data confirm the hypothesis of Enzinger [5] that the biological behaviour is best evaluated on an individual basis.

Incomplete removal of tumour caused the worst prognosis (recurrence and metastasis in all cases), but recurrences (54% of cases) and metastases (18% of cases) are possible after total removal as well (Table 3). Even though the efficacy of radiotherapy is not definite different from Valdueza [15], we believe that postoperative radiotherapy is necessary even after seemingly complete removal of tumour. According to two of our cases perhaps cure could be obtained only with radical surgery when the tumour is very small. Microscopic tumoural spread in contiguous tissues, responsible for local recurrence after total removal of tumour, is reasonably more likely in larger tumours [2]. Chemotherapy in the treatment of malignant schwannomas is not yet proved successful and should be limited to cases of metastatic disease [7, 13].

Likewise for malignant peripheral nerve sheath tumours [4] negative prognostic indicators for malignant primary spinal neurinomas are the association with neurofibromatosis, the subtotal removal and probably a large size of tumour.

References

1. Ariel IM (1988) Tumors of peripheral nervous system. Semin Surg Oncol 4: 7–12
2. Basso-Ricci S (1989) Therapy of malignant schwannomas: usefulness of an integrated radiologic surgical therapy. J Neurosurg Sci 33: 253–257
3. D'Agostino AN, Soule EH, Miller RH (1963) Primary malignant neoplasms of nerves (malignant neurilemomas) in patients without manifestations of multiple neurofibromatosis (von Recklinghausen disease). Cancer 16: 1003–1004
4. Ducatman BS, Scheithauer BW, Piegras DG, Reiman HM, Ilstrup DM (1986) Malignant peripheral nerve sheath tumors. A clinicopathologic study of 120 cases. Cancer 57: 2006–2021
5. Enzinger FM, Weiss SW (1988) Soft tissue tumors. Mosby, Washington, pp 585–590
6. Fletcher CDM, Davies SE, McKee PH (1987) Cellular schwannoma: a distinct pseudosarcomatous entity. Histopathology 11: 21–35
7. Goldmann RL, Jones SE, Heusinkveld (1977) Combination chemotherapy of metastatic malignant schwannoma with vincristine, adriamycin, cyclophosphamide, and imidazole carboxamid. A case report. Cancer 39: 1955–1958
8. Ghosh BC, Ghosh L, Hivos AG, Fortner JG (1973) Malignant schwannoma. A clinicopathologic study. Cancer 31: 184–190
9. Kleihues P, Burger PC, Scheithauer BW (1993) The new WHO classification of brain tumors. Brain Pathol 3: 255–268
10. Megha T, De Santis M, Missori P, Lunardi PP, Palma L (1989) Su di un caso di schwannoma melanotico. Acta Oncol 10: 79–85
11. Nittner K (1977) Spinal meningiomas, neurinomas and neurofibromas and houglass tumours. In: Vinken PJ, Bruyn GW (eds) Handbook of clinical neurology, Vol 20. Amsterdam, pp 177–332
12. Seppala MT, Haltia MJJ (1993) Spinal malignant nerve-sheath tumor or cellular schwannoma? A striking difference in prognosis. J Neurosurg 79: 528–532
13. Thomeer RTWM, Bots GTAM, van Dulken H, Luyendijk W, Helle P (1981) Neurofibrosarcoma of the cauda equina. J Neurosurg 54: 409–411
14. Trojanowski JQ, Kleinman GM, Proppe KH (1980) Malignant tumors of nerve sheath origin. Cancer 46: 1202–1212
15. Valdueza JM, Hagel C, Westphal M, Hansel M, Herrmann HD (1991) Primary spinal malignant schwannoma: clinical, histological and cytogenetic findings. Neurosurg Rev 14: 283–291
16. White HR Jr (1971) Survival in malignant schwannoma. An 18-year study. Cancer 27: 720–729

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