Radiotherapy in Recurrent Malignant Meningiomas with Multiple Spinal Manifestations

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Meningiomas are the most common non-glial primary brain tumors, comprising about 15-20% of all intracranial neoplasms and about 12% of tumors arising in the spinal cord (1-3). Most meningiomas are characterized by a natural history of slow growth and a low-grade malignancy. Transformation into a more anaplastic tumor is possible, however, and described in about 8% of the cases (4).

Pathologically high cellularity, necrosis, mitosis and nuclear pleomorphism are features of malignancy. Clinical criteria include rapid onset of signs and symptoms secondary to local invasion into brain tissue, local recurrence after total removal within a short period of time, extracranial metastasis, and, in rare cases, dissemination of meningioma cells through the cerebrospinal fluid (5, 6).

We report a case of recurrent anaplastic meningioma with multiple spinal manifestations treated successfully by radiotherapy following several local surgical resections which previously failed to control this tumor.

Case report. A 51-year-old patient presented in 1984 with sensory deficits confined to the left leg without previous disease. On admission the neurological examination showed an incomplete Brown-Sequard syndrome, characterized on the right side by increased deep tendon reflexes of the leg. An intradural extramedullary spinal tumor at the level of the fifth and sixth thoracic vertebral bodies was demonstrated by magnetic resonance imaging. On surgery this was found to be represented by a meningioma, which was completely removed through T5-T6 laminectomy (Simpson's grade I) (7). The histologic feature revealed hypercellular meningioma, containing cells with pleomorphic nuclei, numerous mitotic figures and foci of necrosis. The tumor was diagnosed as malignant meningioma (WHO III). Postoperatively the patient recovered from surgery with significant neurological improvement.

In 1991, the patient became symptomatic with weakness initially localized to the left hand and successively spreading to the forearm muscles. Subsequently two tumor nodules located on the surface of the spinal cord in the cervical region were detected by MRI and were resected. Histological findings were consistent with those of the primary tumor.

In 1992, the patient again developed recurrent anaplastic meningiomas arising from the spinal cord at the level of C5, C7, T2, T4 and T10 (Figure). Cranial computed tomography indicated another recurrent tumor in the left cerebellar lobe. At that time the patient did well but reported occasional paresthesias involving the left leg. Physical examination revealed no dermatologic stigmata of neurofibromatosis. CSF cytology showed no tumor cells. Again surgery was performed and the cerebellar and thoracic lesions were completely resected. Postoperatively the patient underwent radiotherapy. Because the recurrent spinal and cerebellar tumors were considered to be metastases via the cerebrospinal fluid, systemic irradiation of the brain and the spinal cord seemed to be justified. A total dose of 45 Gy was delivered by 4 MV photons in 1.8 Gy fractions throughout a 5-week period. The whole brain including the cranial meninges, was treated by use of two parallel opposed lateral portals. The patient's eye lenses, face and pharynx were shielded by customized blocks. The spinal canal received irradiation to two dorsal portals. To smear out over or underdosage beneath the surface the junctions of the whole brain and spinal portals were shifted three times (8). Radiotherapy was continued in the cervical region (C4-C7), macroscopic residual tumor was boosted to 50.4 Gy total dose. The irradiation was well tolerated, and the patient reported only slight side-effects, such as headache and weakness. No effects on peripheral blood count were noted.

Three years after completion of the treatment no tumor was seen in the periodic follow-up MRI. The patient now remains neurological stable with only slight alterations in short-term memory but no signs of paresis, paresthesias or sensory deficits.

Discussion. Most meningiomas are regarded as benign, malignant features accounting for less than 10% only (1). Meningiomas are uncommon in children and in general they cause symptoms by slow progressive mass enlargement resulting in compression of adjacent brain tissue (4, 6).

Complete surgical exstirpation is the treatment of choice in the management of symptomatic meningiomas. Long-term survival correlates well with Simpson's grade of resection (7). The incidence of recurrence after complete surgery is approximately 9% for benign but much higher for malignant meningiomas (9). Radiotherapy is usually reserved for inoperable, residual or recurrent operable disease following surgery, and for tumors of malignant histology (10). Wara et al. (10) and Carella et al. (11) demonstrated the benefit of radiation therapy in patients with recurrent or incompletely resected meningiomas. The 5-year relapse-free survival was 76% in 55 patients, who received postoper-

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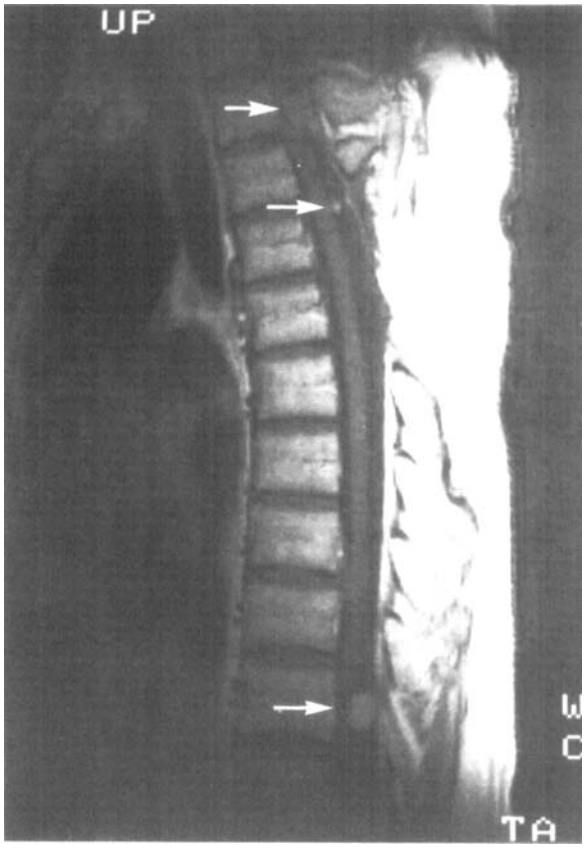

Figure. A pretreatment MRI showing recurrent tumor nodules arising from the spinal cord at the level of T2, T4 and T10 which are compatible with meningiomas.

ative radiotherapy, delivering a total dose of 55 Gy compared with 29% in 34 patients treated by surgery alone. Glaholm et al. (12) described 5-year survival rates of about 78% in patients treated by postoperative irradiation for benign meningiomas. The results of postoperative radiotherapy for malignant meningiomas are less satisfactory. Review of the literature reveals a large variation of reported results, which may probably also be due to small numbers of cases described in each series (12–15). Carella et al. (11) recorded good results in 8 of 11 patients treated by irradiation after surgical resection with disease-free survival over 1 to 10 years of follow-up; whereas several other groups reported poor long-term survival despite postoperative irradiation (15) (Table). Typically the target volume in radiotherapy of malignant meningiomas is limited to the tumor bed with a margin. However, in our patient with recurrent meningiomas metastasizing via the cerebrospinal fluid irradiation of the entire CSF pathway seemed probably to be appropriate.

Metastasis of malignant meningiomas are rare and have been described in about 0.1% of cases (16). Meinigoma cells may metastasize to extraneural organs, but in view of the physiologic pathways also spread along the cerebrospinal fluid is possible and induces multiple spinal or intraventricular tumor sites (17). However, multiplicity resulting from multicentric foci may also occur in association with Recklinghausen's disease (18). In our case no dermatologic signs of neurofibromatosis were seen and the histological pattern of the anaplastic meningiomas on the surface of the spinal cord was similar. The spinal lesions were not attached to the dura in the cervical region, but no tumor cells were found in CSF cytology. Therefore it remains unclear whether the spinal and cerebellar recurrences were metastatic implantations or tumors of multicentric origin.

Table

Results of postoperative irradiation for malignant meningiomas

Author	Survival-rate	Follow-up period
Carella et al. (11)	8/11	1 to 10 years
Glaholm et al. (12)	33%	5 years
Goldsmith et al. (13)	48%	5 years
Hoffmann et al. (14)	58%	4 years
Forbes & Goldberg (15)	0/4	4 years

In our patient a total dose of 45 Gy was delivered by irradiation of the cranio-spinal axis after surgical resection of several malignant tumor nodules, which were histologically confirmed as anaplastic meningiomas. This therapeutical procedure resulted up to now in disease-free survival over 3 years of follow-up.

In view of this case and considering different treatment modalities reported in the literature, we recommend postoperative radiotherapy in all cases of anaplastic meningiomas even after complete surgical resection (13). In selected cases of multicentric or metastasizing malignant meningiomas with multiple spinal manifestations systemic irradiation of the entire CSF route may improve tumor control and prognosis for the patient. Further prospective trials are necessary to clarify the role of multimodality treatment programs for malignant meningiomas.

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