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Radiation-induced meningioma with a long latency period: a case report

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Abstract Multiple meningiomas were diagnosed in a 43-year-old man previously treated with high-dose craniospinal radiotherapy at the age of 7 years for medulloblastoma. We suggest that surveillance MRI after high-dose craniospinal radiotherapy should be extended to several (3–5) decades.

Introduction

Numerous neoplasms within the CNS have been reported as radiogenic in origin. Radiation-induced meningiomas are at least five times more frequent than gliomas or sarcomas [1]. Radiation-induced meningiomas have recently been reviewed in the literature [2–4]. Children appear particularly sensitive to the development of these tumours.

Review of published data has shown that high-dose radiation-induced meningiomas occur with an average latency period of 19.5 years (range 4–50 years [1]). Another report indicated an average latency of 14.4 years for high-dose radiation-induced meningiomas, with a range of 9–21 years [2]. After high-dose radiotherapy for medulloblastoma, radiation-induced meningiomas were described after latency periods from 5 to 27 years, with an average latency period of 17.8 years [2].

Case report

A 43-year-old man underwent complete surgical resection of a posterior fossa (vermis) medulloblastoma at the age of 7 years in 1963. He subsequently received high-dose craniospinal irradiation (250-kV roentgen therapy, 30.0 Gy craniospinal irradiation, 20.0 Gy boost to the tumour bed). In December 1997 he was admitted to hospital with a painless swelling in the left orbitotemporal area, with dislocation and protrusion of left globe. CT showed an intracranial, homogeneous high-density lesion with CT characteristics of meningioma infiltrating the left lateral orbital wall, with a second similar focus in the right occipital region.

In January 1998 partial neurosurgical resection of the tumour was performed. Histology showed atypical meningioma (WHO grade II). MRI later that year demonstrated a new dense focus in the left parietal parasagittal region, as well as progression of the previously detected focus in the right occipital region. In June 1998 stereotactic radiosurgery to the right occipital lesion was performed using a linear accelerator (6-MV X-rays, minimum TD 12.0 Gy) because of the patient's refusal to undergo further neuro-

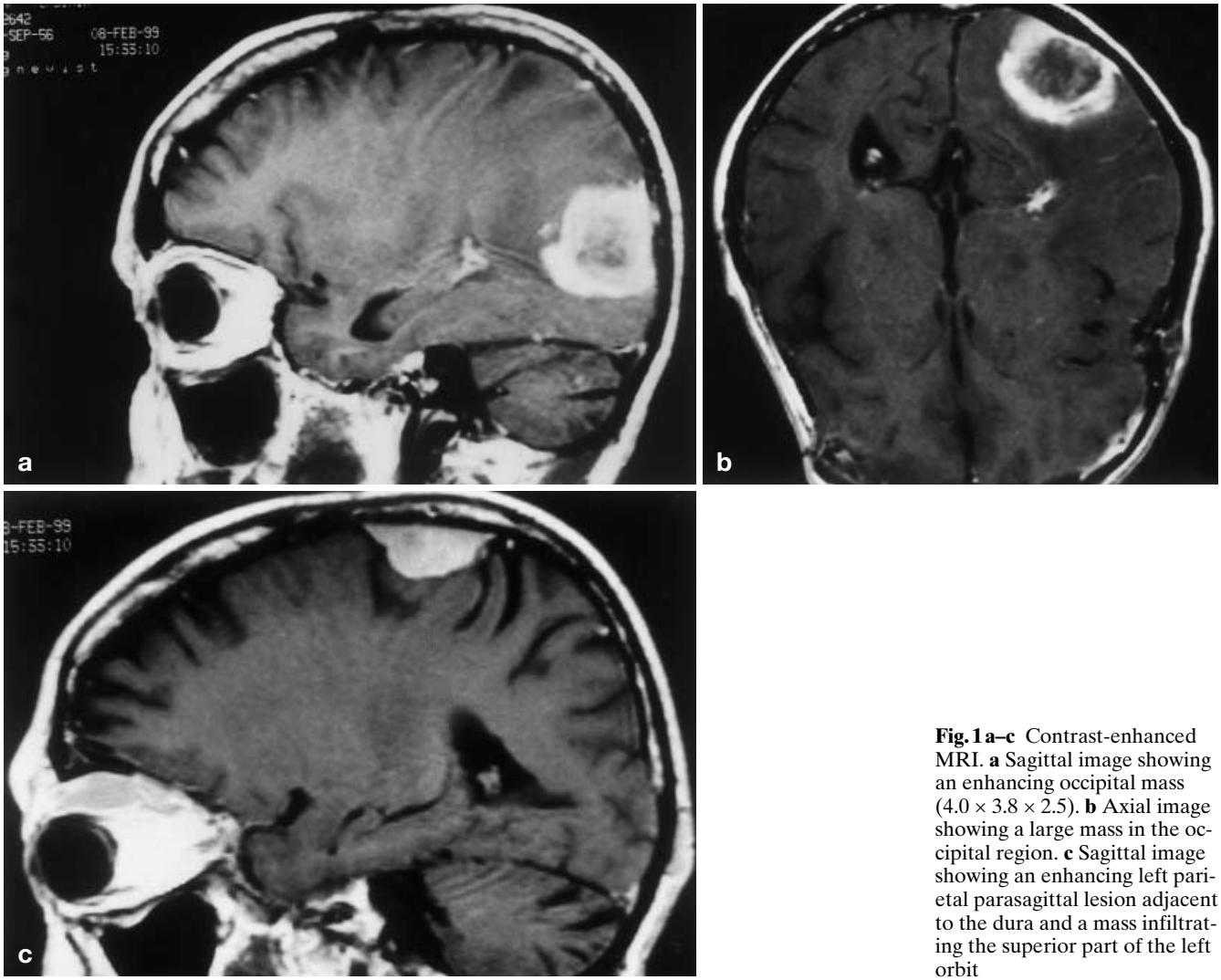

Fig. 1 a–c Contrast-enhanced MRI. **a** Sagittal image showing an enhancing occipital mass ($4.0 \times 3.8 \times 2.5$). **b** Axial image showing a large mass in the occipital region. **c** Sagittal image showing an enhancing left parietal parasagittal lesion adjacent to the dura and a mass infiltrating the superior part of the left orbit

surgical intervention. In February 1999, MRI identified further tumours in the left sphenoid with extension into the orbit and left sphenoid sinus, in the right occipital region, and in the left parietal parasagittal region (Fig. 1). After a second neurosurgical intervention (February 1999) on the left sphenoid tumour, histology again confirmed meningioma (WHO grade II). Partial resection of tumour was followed with external radiotherapy (TD 30 Gy, 6MV X-rays).

Discussion

This case fulfils all the criteria required for a radiation-induced meningioma, i. e. it occurred within the field of previous irradiation, the meningioma was not present prior to the first irradiation, the histology was different from the tumour that prompted the original radiotherapy, there was a 34-year latency between first irradiation and the appearance of the radiation-induced tumour and the patient was free of any pathological condition predisposing to tumours, such as xeroderma pigmentosa, retinoblastoma or immunodeficiency.

A review of high-dose radiogenic meningiomas [1] registered 27 radiation-induced meningiomas with an latency period of 4–50 years. In this review, medulloblastoma was the primary indication for radiotherapy in eight cases of radiation-induced meningioma, with the longest latency period being 28 years. The longest latency period in a recent review of 21 high-dose radiation-induced meningiomas was of 27 years [2]. The latency period in this reported case is one of the longest described after radiotherapy for medulloblastoma and the survival of this patient is close to the longest survival described for patients with medulloblastoma.

The length of the latency period is usually inversely related to the total radiation dose [4, 5]. The latency period in our patient is exceptionally long (34 years after a

total dose of 50 Gy). This suggests that the surveillance period with MRI for patients undergoing high-dose radiotherapy should be extended to several decades. Such systematic MRI follow-up may have disclosed meningioma before it manifested clinically (thereby reducing the latency period) but was not possible because of the patient's refusal to comply with regular MRI follow-up.

It has been suggested that all cases of radiation-induced meningiomas should be reported [2] in order to understand better the "many grey areas" of this pathological condition. Contemporary biomedical research is identifying new molecular genetic markers and mechanisms possibly related to the carcinogenic effects of ionising radiation, e. g. the *ATM* gene, p53 tumour suppressor, bax/bcl-2 gene equilibrium, DNA repair genes, etc. Ideally, future reports on radiation-induced meningiomas might include immunohistochemical data on the expression of such genes.

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