Radiosurgery in Cerebral Tumours and AVM

V. Valentino

Institute of Neurosurgery of the University, Rome, Italy

Summary

In collaboration with the Institute of Neurosurgery, La Sapienza Rome University, we have treated 214 patients with stereotactic irradiation. The series began in March 1984 and includes 198 cerebral tumours of different histology and 16 AVM. 73% of the patients had been operated on before irradiation. From this first experience the following considerations can be drawn: (a) radiosurgery is not an alternative to neurosurgery except for particular cases; neurosurgery is therefore essential because the smaller the target area the higher the efficiency of stereotactic irradiation; (b) compared to conventional radiotherapy, damage to the brain is minimized as shown by NMR. The follow-up time is too short to allow any definite conclusion. However, positive effects have been observed in malignant gliomas and single metastases. In craniopharyngiomas and pituitary adenomas, tumour growth was arrested or decreased with the disappearance of the tumour in 3 adenomas and 1 craniopharyngioma. With regard to the response of meningiomas to irradiation we have shown that radiosurgery is able to cause a decrease in tumour size as well as reduced contrast enhancement, probably due to vascular changes and fibrosis. In AVM the efficiency of radiosurgery has been further confirmed.

Keywords: Radiosurgery; cerebral tumour; arteriovenous malformation; indication; result.

Introduction

"Radiosurgery" is a term introduced by Leksell to signify external irradiation to be performed as a single high dose on a defined target, using a stereotactic procedure.

From March 1984–March 1987 we used radiosurgery and/or stereotactic hypofractionated irradiation in 214 patients, comprising 198 cerebral tumours and 16 AVM.

Material and Methods

Besides 16 AVM, there were 90 gliomas, 31 metastases, 29 meningiomas, 26 pituitary adenomas, 8 pinealomas, 6 craniopharyngiomas, 6 dysgerminomas and two glomus jugulare tumours. Seventy-three per cent of these patients had been operated on previous to stereotactic irradiation, thus the diagnosis was supported by histology in 149 cases. In two patients stereotactic biopsy was performed. In the remaining 47 cases there was no histological support, and, apart from clinical evidence, diagnosis was based only on plain films of the skull, CT scan, and/or angiography and NMR.

One single high dose was used when the lesion did not exceed 25 mm in diameter. In lesions greater than 25 mm we used two different techniques related to the type and site of the lesion:
- Hypofractionated stereotactic irradiation plus a single high dose.
- Single high doses to multiple target fields using 10–25 mm diameter circular collimator channels.

All three techniques are in harmony with what has already been proven in radiobiology, i.e. the smaller the irradiated area the higher the efficiency of radiation.

A 6 MeV Linear Accelerator was the radiation source and irradiation was performed through several arches of different degree arranged on the basis of the site and size of the lesion.

The complete irradiation dosage varied according to the type of the lesion as well as the selected technique. In all patients we used the Greitz-Bergström's fixation head system which has shown to be accurate. Furthermore this system is non-traumatic, easily removable and reproducible, thus being the most adaptable to the different mentioned methods of irradiation.

Results and Remarks

In such a miscellaneous collection of cerebral tumours, the results cannot be analysed altogether.

It is apparent that in malignant gliomas and solitary metastases the advantages of radiosurgery are all concentrated on minor discomfort to the patient as well as the possible acute positive effect on the tumour and oedema, a favourable though transient event which has been observed (Fig. 1).

Dysgerminoma is known to be a very radiosensitive tumour. In our 6 cases a 10–15 Gy single dose was enough to allow in a few days or weeks complete clinical remission and disappearance of the tumour at CT scan. This neoplasm is also known to disseminate readily, and therefore precautionary irradiation of the neuraxis has been recommended. However, this may be a pre-
judice. Conventional irradiation of the neuraxis was performed in only two of our 6 cases. In spite of this, CFS dissemination of tumour occurred shortly after in both these patients, showing that, as in metastases, conventional irradiation is unable to prevent the occurrence of other possible localizations.

Radiosurgery was successful in the 8 cases of expanding processes in the pineal region as well as in the two cases of glomus jugular tumours. Tumours in the region of the pineal gland and quadrigeminal plate are clinically classified as pinealomas, but their histological characteristics can be very variable to such an extent that even the biopsy specimen is sometimes not conclusive (Backlund1). Of our 8 cases of pinealomas, only one underwent stereotactic biopsy and the tumour was said to be a dysgerminoma. In the other seven patients the diagnosis of pineocytoma in 3 and pinealoblastoma in the remaining 4 was reached on the basis of the patient's age, neuroradiological appearances and laboratory tests.

In pituitary adenomas, both cromophobe and hypersecreting, as well as in craniopharyngiomas — a total of 32 patients — tumour growth decreased (Fig. 2) in all except two cases; these were concerned with a recurrent invasive adenoma and a cystic craniopharyngioma. In 4 patients (three pituitary adenomas and one craniopharyngioma) there was neuroradiological disappearance of the tumour.

The response of meningiomas to conventional irradiation has long been disputed and is controversial. In our series there are 29 cases of meningiomas. In 6 cases of recurrent tumour, stereotactic irradiation was unable to prevent re-growth of the neoplasm in the previous or a different site. However, in 11 patients...