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Original investigations

Remarks on the follow-up of cerebellar astrocytomas*

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Summary. A retrograde study was performed in 105 patients operated upon between 1950 and 1972 for a cerebellar astrocytoma. Complete histories were available for 89 patients. Forty-five patients died within the first 3 months after operation. Of the 32 patients who were still alive, 14 patients had been operated upon 20–30 years previously and 18 patients 10–19 years previously. Twelve patients died over 3 months after the operation; in 6 cases, recurrence of tumour was the cause of death. Of the 7 patients who were irradiated postoperatively, 5 died. In 26 patients the tumor had infiltrated the brain-stem and only 7 patients survived the operation. However, 2 patients are still alive after 25 and 10 years, respectively. The findings indicate that patients operated upon for a localized cerebellar astrocytoms can be considered cured and irradiation and chemotherapy are not warranted. When the tumour has infiltrated the brain-stem, a survival period of more than 20 years is possible after partial resection.

Key words: Cerebellar astrocytoma – Brain-stem glioma – Pilocytic astrocytoma – Prognosis

Introduction

It has recently been suggested that postoperative treatment of pilocytic cerebellar astrocytoma with chemotherapy or radiotherapy may double the 5-year postoperative survival rate [3, 8, 10]. Survival times for above 5 years for patients suffering from these gliomas can be found in the literature published a long time ago. This suggests that the long survival currently emphasized by authors, and claimed to be a success of radiotherapy or chemotherapy, might actually be independent of these postoperative treatments, being inherent rather in the biological behaviour of the tumour itself, even in cases with subtotal resection.

Methods and results

We performed a follow-up investigation on 105 patients operated upon for cerebellar astrocytoma between 1950 and 1972. During this period, no chemotherapy was available; radiotherapy was performed in only a few cases, using "old-fashioned" methods. Tumour specimens were examined histologically at the Institute of Neuropathology of the University of Bonn. The diagnoses are summarized in Table 1: pilocytic astrocytomas were present in 96 cases.

Table 2 shows the results of our follow-up investigation. Full data were available for 89 patients, 45 of whom died postoperatively, i.e. within 3 months of the operation. This high mortality is explained by the tendency, 20–30 years ago, to operate very radically, with large resections. Twelve patients died more than 3 months after the operation (Table 5) and 32 patients are still alive. The longest follow-up period is at present 30 years and this patients shows no signs of recurrence; 22 patients have no complaints or are only slightly handicapped, 8 are moderately and 2 severely handicapped. None of these 32 patients shows symptoms suggesting a recurrence, however. Table 3 shows the age of the patients at the time of operation. Patients older than 30 years showed no differences from the younger patients as regards tumour size and histology: only the operative mortality was higher in this group. Table 4 shows the location of the tumours and the nature of the operation (total or subtotal removal): in 23 cases no data concerning this point were obtainable from operation records. Of the 68 patients whose tumour was located in the cerebellum and/or the fourth ventricle, 5 died more than 3 months after operation.

In 26 cases the tumour had infiltrated the brain-stem. Of these patients, only 6 survived the operation and 4 of these died from 4 months to 5.5 years after operation. *One of these patients is still living, however, 22 years after the operation, although the tumour had infiltrated the brain-stem and extended around the aqueduct.* In this case, after a subtotal operation, a Torkildsen operation was performed and no radiotherapy was given. The last of these patients to be operated upon is still living 10 years after partial resection of an astrocytoma which had infiltrated the floor of the fourth ventricle. In 29 of the patients who are still living 10–30 years after operation (Table 2, group 3c), the tumour was confined to the

Table 1. Histological diagnosis in 105 patients operated upon for cerebral astrocytoma between 1950 and 1972

1. Typical pilocytic astrocytoma	96
2. Anaplastic astrocytoma	3
3. Mixed oligodendroglioma-astrocytoma, ependymoma-astrocytoma	3
4. Diffuse gliomatosis	1
5. Wrong diagnoses (one medulloblastoma, one haemangioblastoma)	2

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Table 2. Results of follow-up investigation

Group 1: No data	9 patients
Group 2: Incomplete data	7 patients
Group 3: Full data	89 patients
Group 3a: Postoperative mortality	45 patients
Group 3b: Died after 3 months (Table 5)	12 patients
Group 3c: Still living in 1983 (14 patients 20–30 years after operation) (19 patients 10–19 years after operation)	32 patients

Table 3. Age at operation

Youngest patient	25 months
Oldest patient	60 years
Older than 20 years	19%
Older than 30 years	13%

Table 4. Tumour location in 105 patients (figures in parenteses concern the 32 patients still living)

	Total extirpation	Subtotal extirpation	Not exactly reported	Total
A. Cerebellum alone	32 (25)	10 (2)	23 (2)	68 (29)
B. Cerebellum and brain-stem	0 (0)	26 (1)	0 (1)	26 (2)
C. Not exactly reported				9 (11)
				105 (32)

Table 5. Causes of death in 12 patients who died more than 3 months after operation

A. No tumour recurrence:			
1. Survival time	8	months	– chronic inflammation
2. Survival time	1	year	– medulloblastoma
3. Survival time	2	years	– inflammation
4. Survival time	5	years	– haemangioblastoma
5. Survival time	5	years	– diffuse gliomatosis
B. Probably/proven recurrence:			
6. Survival time	6	months	– radiation
7. Survival time	6	months	– infiltration fourth ventricle
8. Survival time	14	months	– recurrence, reoperation, radiation
9. Survival time	2	years	– recurrence, reoperation, radiation, inferior pons
10. Survival time	4	years	– spinal metastases
11. Survival time	5.5	years	– inferior medulla oblongata
12. Survival time	10	years	– mixed ependymoma-astrocytoma

cerebellum, partly involving the fourth ventricle and the local cisterns, and in 2 patients the tumour had infiltrated the brain-stem. In this group, a total extirpation was performed in at least 25 patients.

Table 5 shows the causes of death of the 12 patients who died after more than 3 months.

Postoperative radiotherapy was only given to 7 patients, 5 of whom died 2 years after the operation. One patient has no complaints at present and the fate of the last patient is unknown.

Three patients with anaplastic astrocytomas died immediately after the operation. At the time of operation they were 12, 21 and 54 years old. This last patient had been operated upon for a cerebellar cyst at the age of 13 years, i.e. 41 years before the second operation.

Discussion

In 1909, Harvey Cushing [2] performed subtotal resection of a cerebellar cystic glioma in a 26-year-old patient who *survived the operation without any postoperatively treatment* and 21 years later showed no signs of recurrence.

There are many examples such as this in the literature of some years ago, but these are apparently unknown to many current investigators. It must be stressed that cerebellar astrocytoma, i.e. pilocytic astrocytomas, do not behave in the same way as astrocytomas of the cerebral hemispheres. They are slow growing, benign, grade I gliomas and the fate of the patient depends first of all on the location and the extent of the tumour. As confirmed by our present investigation, the postoperative clinical cause of these tumours is independent of any adjuvant radiotherapy of chemotherapy. Their benign nature has been emphasized ever since the first papers on brain tumours were published [1, 2, 5]. It should be remembered that in the 1920s and 1930s operations were performed without modern anaesthesia and without a surgical microscope, the operation being frequently restricted to simple evacuation of the cyst, with or without incomplete extirpation of the tumor. Gjerris and Klinken [6] recently reported that 80% of children with cerebellar astrocytomas are still alive 15–40 years after the operation.

Gliomas infiltrating the brain-stem have, of course, a bad prognosis, which can be only slightly influenced by radiotherapy. But even in some patients with definite neoplastic infiltration of the brain-stem, a quite long survival is possible. One of our patients is still living 22 years after the operation. Entzian et al. [4] have recently confirmed the good results obtained in patients operated upon for circumscribed pontine gliomas.

In assessing the "success" of any postoperative treatment, clinicians have to be very cautious, taking into account that pilocytic astrocytomas, especially in the brain-stem, usually grow intermittently, with large rest intervals—or they may stop growing spontaneously (Fig. 1). Every neuropathologist with experience of human brain tumours has observed at least one case of brain-stem glioma, such as that in Fig. 1, which has survived a long time in spite of its location and although no postoperative treatment has been administered.

Our results and those in the literature of some years ago confirm that the postoperative survival time of patients with cerebellar astrocytomas was very good even before the introduction of modern radiotherapy and chemotherapy. The question as to whether these therapeutic procedures will improve the prognosis still remains to be answered. To do so, controlled studies are needed. In view of the long survival time inherent in these gliomas, such studies will not be easy to perform or to evaluate exactly. Single reports such as that of Edwards et al. [3] on three patients whose long survival was

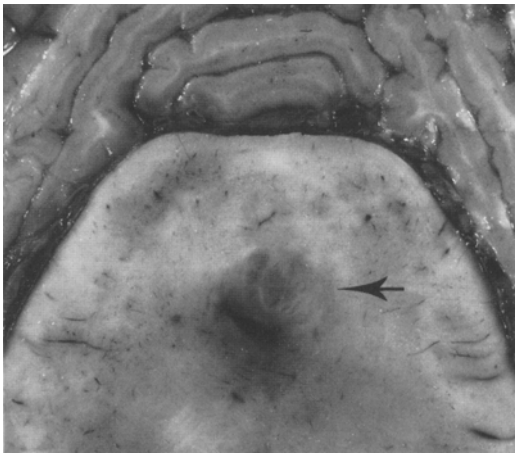

Fig. 1. A small peri-aqueductal glioma is evident. This tumour was diagnosed in 1952 (patient's age: 9 years), and in view of its "inoperability" only a Torkildsen drainage was performed. The patient survived 30 years, without any adjuvant therapy. She died in 1982, at the age of 39 years, from cerebral haemorrhage

attributed to chemotherapy do not, of course, represent sufficient evidence. Herbst [8] recommends radiotherapy in patients with subtotal extirpation, but how effective this might be in prolonging survival time remains to be proven. Cushing's patient treated in 1909 by a subtotal operation showed no signs of tumour recurrence 21 years after the operation. Kleinmann et al. [9] described five cerebellar astrocytomas with malignant transformation, four of which had been originally treated with radiotherapy. One of these patients had been operated upon by Cushing (subtotal extirpation) 48 years before, and in this case recurrence showed signs of malignancy. What role might radiotherapy have played in these malignant transformations? With regard to histological malignancy it should be stressed that, in cerebellar and brain-stem pilocytic astrocytomas, degenerative cell changes simulating malignant changes are not infrequent [7]. It is hence very important in doubtfoul cases to perform an accurate morphological investigation to avoid a wrong diagnosis of "anaplastic" astrocytoma in a tumour, the non-surgical treatment of which is destined to succeed anyway.

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