Malignant Meningiomas : A Clinical Review

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Abstract : Among 98 surgically-treated intracranial meningiomas, 12 (% 12.2) patients with atypical and anaplastic meningiomas, are reviewed. All were operated between 1983-1994. Out of 12 patients, 7 (58%) had malignant meningioma and 5 (42%) showed atypical features histopathologically. Tumours in eight patients were recurrences, most in grade 3 resected patients, showing the importance of the grade of the surgical resection. Cases were reviewed according to their clinical, histopathological and radiological findings and survivals in the light of the literature.

Key Words: Atypical and malignant, meningiomas, radiation, recurrence

INTRODUCTION

In general, meningiomas are accepted as benign neoplasms but some malignant features and recurrences have been described (1,5,8,18,20,24). As definite proof of malignancy is the haemotogenous far metastasis, there were no certain differences between benign and malignant meningiomas (2,3,10,11,22,25). Recently, attention has been focused on some histological features to find a difference between benign and malignant meningioma. The histopathological criteria used to define malignant meningioma were derived from the World Health Organization (WHO) classification which considers six criteria; hypercellularity, loss of architecture (sheeting), nuclear pleomorphism, mitotic index, focal necrosis and brain invasion (9,12,17,27,29,30). Meningiomas were classified as typical, atypical, and anaplastic according to the histopathological signs of anaplasia (9,12,17,27,30).

Although, meningiomas are classified histopathologically, some radiological features that might be helpful in predicting their malign behaviour, are studied in the literature (6,14,23,26).

Our intracranial meningioma patients are reviewed and clinical, radiological and histopathological findings and survival are discussed.

MATERIAL AND METHODS

This study includes 12 intracranial atypical or anaplastic meningioma patients who were operated in Dokuzeylül University Medical Faculty, Department of Neurosurgery between 1988 and 1994.

The age, sex, symptoms, localizations, adjuvant therapies and recurrences are shown in Table 1.

Computed tomography (CT) was used in the diagnosis and early in postoperative period in all patients. All patients were operated and the surgical excisions were graded according to Simpson's grading system (21) (Table 3). Histopathological evaluations were made at the Pathology Department and tumors were classified using the criteria recommended by WHO Table 2) (12, 17, 30).

Patients were followed up at intervals of 6 months and CT scans repeated if new symptoms or signs were found.

Table 1 : Summary of the patients.

Patient	Age	Sex	Complaints	Neurological Findings	Localization	SG (*)	HG (**)	A.T.	Number of Recurrences
1	5	F	Headache, Left Sided Weakness	Left Hemiparesis Bilateral Papil edema	Right Frontoparietal	2	3	RT	2
2	64	M	Speech disturbance, Right Limb Paraesthesia	Left papill oedema, Sensorial dysphasia, Right hemiparesis	Left Parietal	3	3	RT	4
3	60	F	Headache, Epileptic Seizure, Left hemiparesis	Left homonim lenianopi, left spastic hemiparesis	Right sphenoid wing, Right parietal (Double lesion)	3	3	RT	4
4	59	M	Headache, hemiparesis	Left hemiparesis, Left Trigeminal Nerve paresis	Right parietal	2	3	–	1
5	45	M	Left sided Epileptic Seizure	Normal findings	Right Parietal	2	2	–	Name
6	56	F	Headache, Left hemiparesis	Left sided central Fasial palsy, Left hemiparesis, Bilateral papil edema	Right Temporoparietal	2	2	–	Name
7	70	M	Epileptic Seizure, Right hemiparesis	Right sided central fasial palsy, Right hemiparesis	Left frontal	2	3	RT	2
8	28	M	Headache, Loss of Vision	Bilateral exophtalmus, papil edema, Left sided loss of vision	Right tentorial	2	2	RT	2
9	60	M	Epileptic Seizure, hemiparesis	Left hemiparesis	Right parietal, parasellar	3	3	–	Name
10	60	F	Left Exophthalamus	Left sided exophtalmus	Left sphenoid wing	3	3	RT	3
11	20	F	Headache, Vomiting	Left trigeminal nerve palsy, Temporal hemianopia, Left cerebellar findings	Left sided middle and posterior fossa	3	2	RT	2
12	25	F	Headache, Left hemiparesis	Right papil edema, Left hemiparesis	Right fronto-temporal	2	2	–	Name

SG = Surgical Grade, HG = Histopathological Grade, AT = Adjuvant Therapy, RT = Radiotherapy
(*) Surgical Grades are determined according to Simpson Grading system (21)
(**) Histopathological Grades are determined according to WHO Criteria (29)

Table 2 : Histopathological classification of the tumors according to WHO criteria.

Patient	Hypercel-lularity	Pleomor-phism	Necrosis	Mitotic Activity	Loss of architecture	Brain invasion	Histopatholo-gical Grade	Histological Type
1	2	3	1	2	3	0	10 = Grade 3	Anaplastic
2	2	2	2	2	2	1	11 = Grade 3	Anaplastic
3	1	2	2	2	1	0	8 = Grade 3	Anaplastic
4	1	2	1	2	1	1	8 = Grade 3	Anaplastic
5	1	2	0	2	1	0	6 = Grade 2	Atypical
6	2	1	1	1	1	0	6 = Grade 2	Atypical
7	2	2	1	3	1	1	10 = Grade 3	Anaplastic
8	1	1	1	1	1	0	5 = Grade 2	Atypical
9	2	1	2	3	1	1	10 = Grade 3	Anaplastic
10	2	1	2	3	1	1	10 = Grade 3	Anaplastic
11	1	1	1	1	0	0	4 = Grade 2	Atypical
12	1	1	0	1	1	0	4 = Grade 2	Atypical

First five criteria 0 = Absent, 1 = Rare, 2 = Common, 3 = Plentiful, Brain invasion 0 = Absent, 1 = Present.
WHO Grading System Sum of the points 0-3 = Benign (Grade 1), 4-7 = Atypical (Grade 2),
8-11 = Anaplastic (Grade 3), >12 = Sarcomatosis (Grade 4).

Table 3 : Surgical resection grades according to the Simpson Classification	
Grade 1	Total resection of the tumour, dural attachments and any abnormal bone
Grade 2	Total removal of the tumour with bipolar coagulation of the dural attachments
Grade 3	Total removal of the tumour without dural coagulation or resection.
Grade 4	Subtotal (partial) removal of the tumour
Grade 5	Simple decompression of the tumour

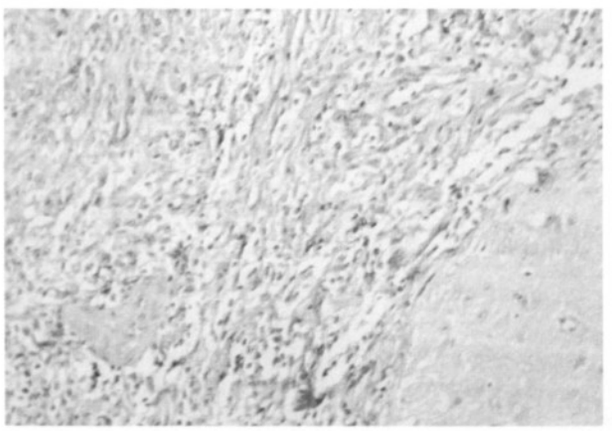

Fig. 1 : Photomicrograph of the tumor in Patient 2 as an example of the anaplastic form. Hypercellularity, pleomorphism, nuclear atypia and brain invasion is seen (H.E. x 100)

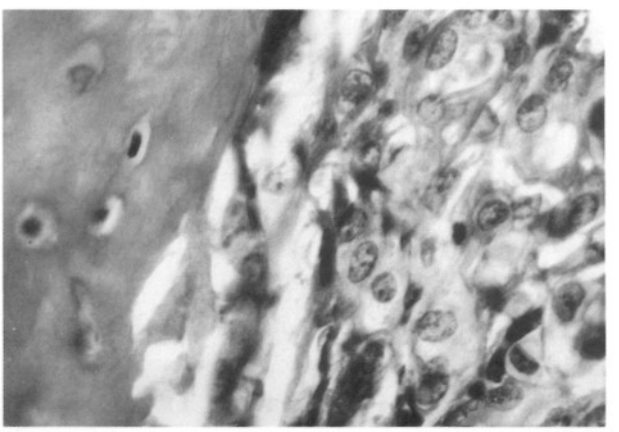

Fig. 3 : Another example of anaplastic form, Photomicrograph of the tumor in Patient 10. Hypercellularity, pleomorphism, nuclear atypia, necrosis and adjacent tissue infiltration is seen (H.E. x 400)

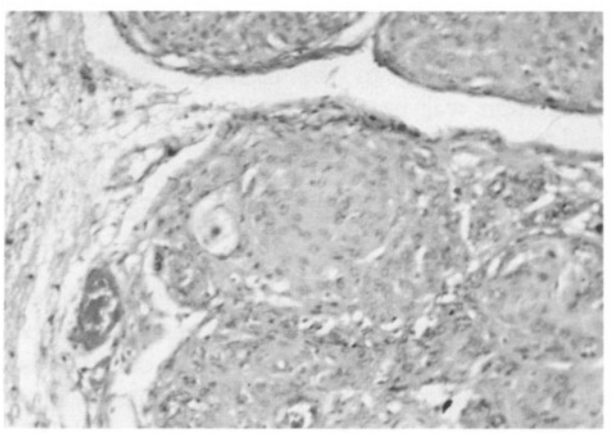

Fig. 2 : Photomicrograph of the tumor in Patient 5 as an example of the atypical from. Hypercellularity, high cytoplasmic ratio, nuclear atypia and leptomeningeal infiltration is seen (H.E. x 100).

RESULTS

Among 506 operated intracranial tumours, 98 cases (%19) were histopathologically meningioma of which 12 were malignant (5 atypical, 7 anaplastic), according to WHO criteria (Table 2). Patients were between 5 and 70 years (mean age 46) and sexual distribution was equal.

Headache, hemiparesis and papillaedema were the most frequent symptoms and signs in this series and late epileptic seizures occurred in four patients.

All patients were studied with CT. CT features are summarized in Table 4. Moderate or severe contrast enhancement was seen in 66%, and irregular border and moderate or severe oedema in 66% and 60% respectively. Other CT criteria hyperostosis, calcification, necrosis or haemorrhage were rarely seen.

Table IV : CT features of the patients.

Patient	Contrast Enhancement	Shift	Edema	Necrosis	Haemorrhage	Calcification	Hiperostosis	Irregular Border
1	Severe	Present	Severe	Absent	Absent	Absent	Absent	Present
2	Mild	"	"	Present	"	"	"	"
3	Moderate	Absent	Mild	Absent	"	"	"	"
4	"	"	"	"	"	"	"	Absent
5	"	"	"	"	Present	Present	Present	Present
6	Mild	"	"	"	Absent	Absent	Absent	Absent
7	Severe	"	Moderate	"	"	"	"	Present
8	Moderate	Present	"	"	"	"	"	"
9	Mild	"	Severe	"	"	"	"	Absent
10	Severe	"	"	"	"	"	"	Present
11	"	"	Moderate	"	"	Present	"	"
12	Moderate	Absent	Mild	"	"	Absent	"	"

Oedema is graded as Absent, Mild (<1 cm), Moderate (1-3 cm), and Severe (>3 cm).

The tumours were localized on the right side in 8 patients, the others were left sided. In 4 patients The tumors were basally located.

All 12 patients received surgery. According to the Simpson classification Grade 2 resection was performed in 7 and Grade 3 in 5 patients. Because of no bone infiltration Grade 1 resection was not performed (Table 1).

Recurrence occurred in 7 patients and 3 were operated with Grade 2, and 4 with Grade 3 resection. Of the 5 patients who were free of recurrence four had received Grade 2 and the other had Grade 3 recestion. There was no operative mortality.

Seven patients whose tumours recurred received radiotherapy postoperatively. The histopathological classification of 6 of the 7 was Grade 3 and the other was Grade 2. As CT scan of the Grade 2 patient showed multiple meningeal implants, he was sent to radiotherapy. Only one of six patients had a recurrence after radiotherapy and the histopathological Grade was 3.

Two patients died in the late postoperative period (30 days after the operation) of pulmonary infection. One patient whose postoperative CT scan showed multiple meningeal implants was lost to follow-up.

The follow-up period in this series was between 1 and 3 years except for one patient who was followed-up for nine years. Nine patients are still alive.

DISCUSSION

Meningiomas constitute about 15-20% of all primary intracranial tumours and are generally considered benign mesenchymal tumours originating from arachnoidal cells (1-3,5,12,13,16,18,22). This ratio is 19.3% for our clinic. But some recurrences and malignancies have been described (1,5,8,18,20,25).

The incidence of malignant meningioma varies between 2 and 10% of all primary intracranial neoplasms (12,5,8,15-18,20,25). In our series, malignant meningiomas were 2% of all intracranial tumours and 12.2% of all intracranial meningiomas. These ratios are similar to the literature. The sexual distribution was reported as 2/1 and 1.7/1 female predominance by Rohringer (16) and Adegbite (1) respectively and 1.3/1 male frequency by Alvarez (2). In our series the number of female and male patients was equal.

Increased intracranial pressure (ICP) symptoms such as headache, vomiting, weakness and late epileptic seizures were common complaints in our patients which is similar to previously published series by Mac Carty et al. (13). Thomas et al. (25), Zülch et al. (30) and others. Neurological findings such as papile-oedema, hemiparesis or cranial nerve palsies are in harmony with the literature, too.

Some criteria including contrast enhancement, shift, oedema, necrosis, haemorrhage, calcification, hyperostosis and irregularity of the tumour border have been investigated previously and some controversies have been published. While, Smith et al.(23),

Alvarez et al. (2), and Dietman (6) found no correlation between malignancy of the tumour and marked surrounding aedema, New et al. (14) postulated the presence of marked peripheral oedema indicated malignancy. We found regular or severe surrounding oedema in CT scans of 60% of our patients. Contrast enhancement, another sign of malignant meningioma was found more regularly and moderately by Alvarez et al., as in 66% of our patients. Irregularities such as fringes or mushrooming of the tumour border have been accepted as valuable features of malignancy in the literature (2,6,14,26) and it was found in 66% of our patients. But, other features such as hyperostosis, calcification, necrosis or haemorrhage as CT findings of malignancy in the literature was rarely seen in our patients.

Certain proof of malignancy is far metastasis via haematogenous or another way (2,3,10,11,22,27). In the literature some histopathological features including increased cellularity and mitosis, pleomorphism, necrosis, loss of architercture and brain or peripheral tissue infiltration were studied as determinants of malignancy for meningiomas and a scale was prepared by WHO (9,29,30). During the past decade, there has been increasing evidence of meningioma with intermediate biological behaviour, i.e., atypical meningioma. Although, the definition of atypical meningioma varied somewhat between the participants of the working group, its inclusion in the new WHO classification was readily adopted (12,17). According to this scale, 7 of our patients were classified as anaplastic and 5 were atypical.

While the criteria are searched onebyone, all patients had increased cellularity as did the cases of Alvarez et al. (2), Burger et al. (3), Jellinger et al. (10) and others in the literature. Alverez and Adegbite et al. (1) reported no specific association of mitotic activity with any histological type, but in our series common plentiful atypical mitosis and increased mitotic activity was found in 66% of cases which is higher than in benign cases. On the other hand, although there is general agreement that cerebral infiltration is an indicator of tumour aggressivity with an incidence of 60-70% in Burger's (3), Crompton's (5), and Kepes's (11) series, this found only 45% of our cases. Loss of architecture, necrosis and pleomorphism are other histopathological features similar to the literature.

Primary treatment is surgery but sometimes adjuvant therapy may be necessary, especially for recurrent tumour cases (1,9,21). Radiotherapy is the most common adjuvant treatment modality (4,7,9,19,28). Recently, some techniques such as brachitherapy or estrogen therapy have been used. All our patients underwent surgery, Grade 2 resection in 7 and Grade 3 in 5.

When the correlation between the resection grade and recurrences was examined it was seen that there was a higher recurrence in the Grade 3 (4/5) than the Grade 2 (3/7) resected patients. Also, the surgical grade as a significant factor influencing recurrence has been mentioned by Crompton (5), Jellinger (10), Simpson (21) and, Skullerud (22).

Radiotherapy was recommended for 7 patients whose tumours recurred and it was learned the one patient discontinued therapy. Three were operated with grade 2 and others with grade 3 resection. Also it is seen that the recurrences were more frequent in grade 3 resected patients in the radiotherapy group. We conclude that the frequency of recurrences can correlate with the surgical resection grade whether with adjuvant therapy or not.

High mortality rates are described in the literature for malignant meningiomas (1,2,9,13,16). In our series, two patients died from extracranial infection during the late postoperative period but were not considered as postoperative mortality. This result can be explained by the small patient group and postoperative follow up period.

It is thought than an aggressive surgical approach is an important factor affecting survival as we have seen in the patient followed for 9 years.

In conclusion, we believe that aggressive surgery is necessary for all malignant meningiomas and radiotherapy can be an adjuvant therapy especially for recurrences.

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