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Evaluation of Forty-Five Atypical and Malignant Meningioma Cases: Over the 12-Years Follow-Up Period

45 Atipik ve Malign Meningioma Vakasının 12 Yıllık İzlem Süresince Değerlendirilmesi

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ABSTRACT

OBJECTIVE: We investigated atypical and malignant meningiomas based on the Modified World Health Organization (WHO) histological criteria of malignance.

METHOD: We present 45 surgical cases (26 atypical and 19 malignant) of total 504 meningiomas operated in Social Security Ankara Education and Research Hospital between 1990-2002. Atypical and malignant meningiomas were diagnosed based on the modified WHO criteria.

RESULTS: Median age of atypical meningiomas was 45.8 with female dominance and of malignant meningiomas was 49.2 years with male predominance. Median survival time of atypical meningiomas for Simpson Grade I was 7.5 years; Grade II was 7.3 years; and Grade III was 7.2 years; while for malignant meningiomas was 7.3, 6.2, 5.6 years, respectively. Median recurrence free interval time was 6.6 years for atypical and 6.5 years for malignant meningiomas. Radiotherapy was performed on two recurred atypical meningiomas and 11 malignant meningiomas.

CONCLUSION: Although malignant meningiomas were accepted to be more aggressive than atypical meningiomas, survival time showed no difference between two groups in our series. Decision making about atypical meningiomas close to malignant forms and radical surgery greatly improved the results in both groups. We also experienced that radiotherapy was beneficial in malignant meningiomas.

KEY WORDS: Meningiomas, atypical, malignant, brain neoplasm, recurrence, follow-up, radiotherapy, surgery.

ÖZ

AMAÇ: Dünya Sağlık Örgütünün modifiye histopatolojik malignite kriterlerine dayanarak atipik ve malign meningiomaları araştırdık.

METOD: SSK Ankara Eğitim ve Araştırma Hastanesinde 1990-2002 yılları arasında opere edilen toplam 504 meningioma olgusundan 26sı atipik ve 19u malign olmak üzere 45 olguyu sunduk. Atipik ve malign tanıları modifiye WHO kriterlerine göre kondu.

SONUÇLAR: Ortalama yaş, atipik meningiomalar için 45.8; malign meningiomalar içinse 49.2 idi. Atipik meningiomalarda kadın; malignlerde ise erkek hakimiyeti vardı. Ortalama sağkalım süresi atipik meningiomalarda Simpson evre I için 7.5, evre II için 7.3; evre III için 7.2 yıl iken bu süre malign meningiomalar için sırasıyla 7.3, 6.2, 5.6 yıl idi. Ortalama nükssüz geçen süre atipik meningiomalar için 6.6 ve malign meningiomalar için 6.5 yıl idi. Radyoterapi 2 nüks atipik meningioma ve 11 malign meningiomada kullanıldı.

TARTIŞMA: Malign meningiomalar atipik meningiomalara göre daha saldırgan kabul edilseler de serimizde iki grup arasında sağkalım süresi açısından fark izlenmedi. Atipik meningiomalar için de cerrahi kararlar malign meningiomalara yakındır ve her iki grupta da radikal cerrahi, sonuçları büyük ölçüde iyileştirir. Ayrıca radyoterapinin malign meningiomalarda daha etkili olduğunu gördük.

ANAHTAR SÖZCÜKLER: Meningioma, atipik, malign, beyin tümörü, nüks, izleme, radyoterapi, cerrahi.

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INTRODUCTION

Meningiomas make up 13 - 19 % of primary intracranial neoplasms (8, 13, 14). They are regarded as benign and considered to have a good prognosis. However, the prognosis can be unfavorable in some cases. A malignant tendency has been reported in 2-10% of meningiomas (2). This rate of malignancy has led to studies by many neurosurgeons. Recent advances in the understanding of the pathology of meningiomas have produced more specific histopathologic criteria of malignancy. The World Health Organization (WHO) system classifies meningiomas as benign, atypical or malignant based on the loss of cell architecture, hypercellularity, nuclear pleomorphism, mitotic figures, focal necrosis and brain invasion (9, 10, 12). Microscopic studies have been a helpful guide in determining biological tendencies and the histopathological findings enable prediction of the malignant potential of meningiomas.

Surgical excision is the only accepted treatment in the current literature on meningiomas. The Simpson's classification system distinguishes five grades for surgical excision (18). This surgical grading system has become a consensus for the excision of meningiomas. Radical surgical excision has led to a lower recurrence rate according to the Simpson grading system. Some reports have demonstrated a correlation between Simpson's grading and prediction of the recurrence rate (2, 7, 9, 10, 13-15).

Atypical meningiomas have been accepted as an intermediate type between benign and malignant forms. However, a difference in prognosis has not been shown for atypical and malignant meningiomas in the current literature. We reviewed our experience with 45 consecutive surgical cases of atypical and malignant meningiomas over 12 years. The influence of radiotherapy on the recurrence rate was also evaluated.

PATIENTS AND METHODS

Patients

Five hundred-four consecutive patients with a diagnosis of meningioma were seen at the Social Security Ankara Education and Research Hospital, Department of Neurosurgery between January 1990 and July 2002. These patients' follow up records revealed that 26 (5.2%) were diagnosed as atypical and 19 (3.8%) as malignant meningioma. Malignant or atypical meningioma cases previously operated on at another medical center were excluded from this study.

The surgical excision was according to Simpson's grading system and histological grading was based on the WHO criteria. Age, gender, symptomatology, neurological status, control MRI or CT evaluations, location, Simpson's grading, recurrence rate, recurrence-free interval and post-operative radiotherapy were included in the data collection. For those patients not recently seen in the department, the most recent status was assessed via correspondence.

Histological Criteria of Malignancy

The WHO criteria of meningiomas consider malignant potential by using six histopathological features: hypercellularity (Figure: 1A), loss of architecture (Figure: 1B), nuclear pleomorphism (Figure: 2), mitotic index (Figure: 3), focal necrosis (Figure: 1A) and brain infiltration (Figure: 4A, 4B) (12). Jaaskelainen et al proposed that each of the WHO parameters be given a score from 0 to 3 with the exception of brain infiltration. This scoring

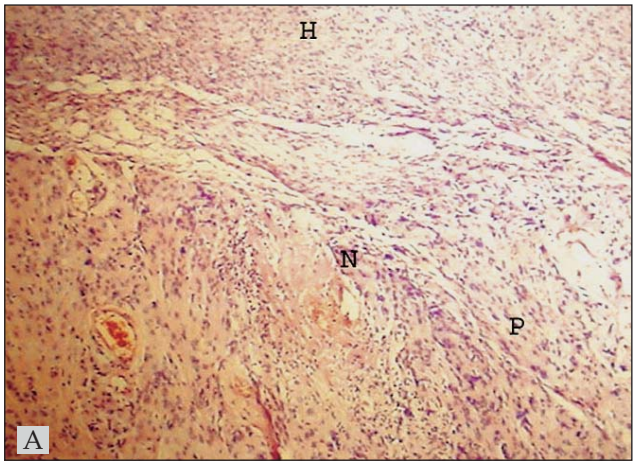
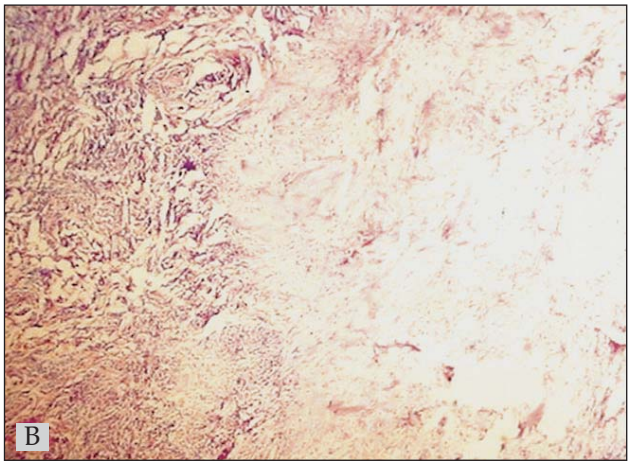


Figure 1: (A) Photomicrograph of atypical meningioma in case 32. There is hypercellularity (H) with loss of normal pattern (P) and focal necrosis (N) (H&E, x10). (B) Photomicrograph of malignant meningioma in case 23 showing geographical necrosis in the right half of the image (H&E, x4).



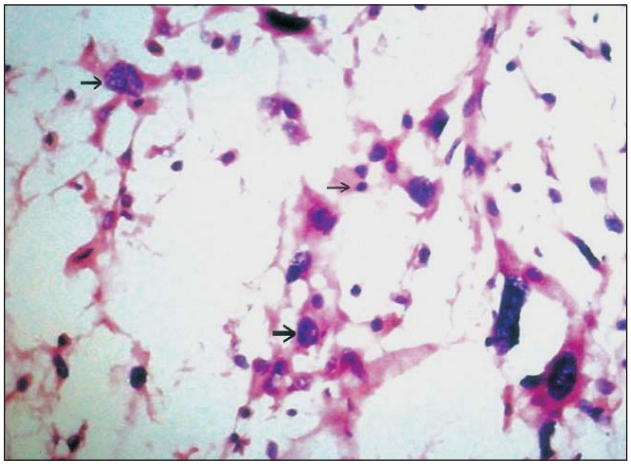


Figure 2: Photomicrograph of atypical meningioma in case 25 showing nuclear pleomorphism (Arrows)(H&E, x 40).

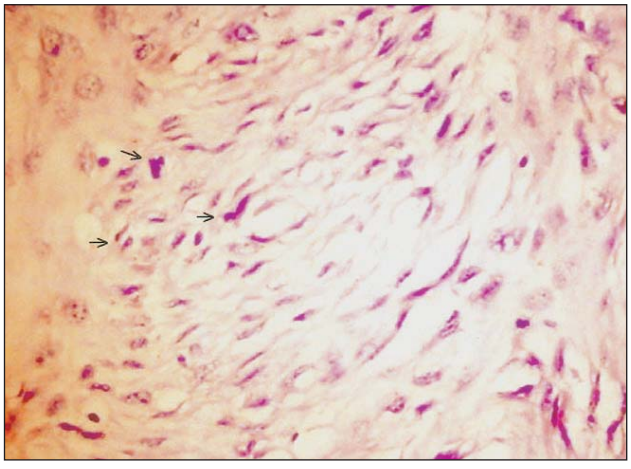
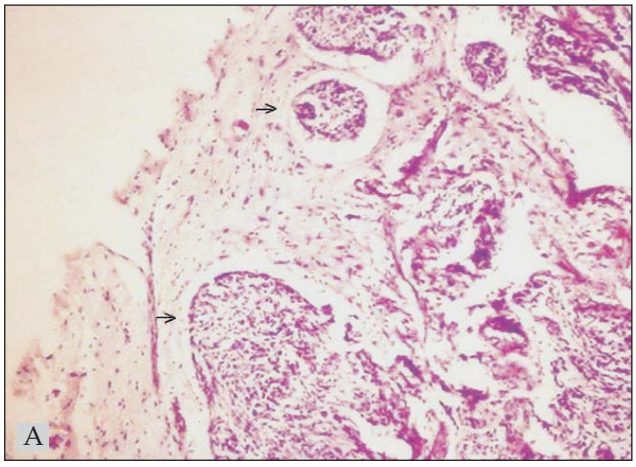


Figure 3: Photomicrograph of malignant meningioma in case 13 displaying typical and atypical mitotic figures (arrows)(H&E, x40).



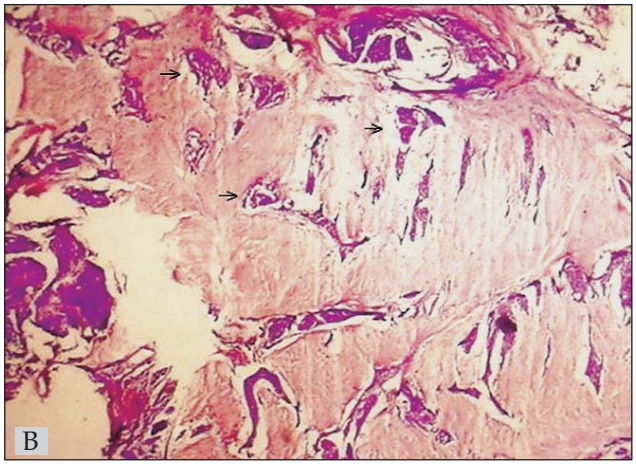


Figure 4: Photomicrograph of malignant meningioma in case 37 showing (A) brain and (B) dura mater invasion (Arrows)(H&E, x40).

system is accepted as a quantitative method for meningioma classification under the WHO criterion. Brain infiltration is scored as either histologically absent or present (9,10).

Loss of architecture was scored by partial or complete loss of arrangement as follows: absence was scored 0, incipient loss of lobular or fascicular arrangement was scored 1, identifiable loss of the normal arrangement adjacent 1 to 2 high-power fields (HPFs) was scored 2, multiple large and confluent uninterrupted loss of the normal arrangement on several neighboring HPFs was scored 3.

Nuclear pleomorphism was scored as follows: neoplastic cells showing uniform nuclei with dense chromatin and no nucleoli was scored 0,

predominant clusters of cells in the neoplastic tissue with two or three times larger nuclei and folded or notched irregular nuclear contour was scored 1, dominance of typical neoplastic cells with clear larger nuclei, pale chromatin, explicit nuclear membrane, and small or no prominent or absent nucleoli was scored 2, and vesicular nuclei with variable size chromatin and presence of distinct prominent nuclei was scored 3.

Mitotic rate was scored by the number of mitotic figures per 10 HPFs; no mitosis was scored 0, one to two mitotic figures was scored 1, three to four mitotic figures was scored 2 and over five mitotic figures was scored 3.

Hypercellularity was scored by distinct whorl formation and pattern, approximate whorl value per HPFs, and crowded and overlapping nuclei.

Necrosis was scored by evaluating the necrotic area in HPFs; no necrotic features was scored 0, rare necrosis less than _ HPFs in each involved slide was scored 1, frequently necrotic foci involving more than _ HPFs but less than 1 HPFs was scored 2, and an area of necrosis larger than 1 HPF was scored 3.

The partial scores were added for a total score. According to the Jaaskelainen scoring based on the WHO criterion, a total score between 0 and 2 was classified as benign. A total score between 3 and 6 was classified as atypical. A total score between 7 and 11 was classified as malignant. When the total score was 12 or higher, the tumor was classified as sarcomatous. All cases were reviewed without a previous knowledge of the patient's history by the same author (OU) and scored to differentiate atypical and malignant cases.

Surgical Grading

Simpson described five distinct grades of meningioma surgery (18) as follows; Grade I excision represents macroscopically complete removal with dural attachment of the tumor and of any abnormal bone. Grade II excision represents macroscopically complete removal of the tumor and its visible extension with endothermic coagulation of its dural attachment. Grade III excision represents a macroscopically complete removal of the intradural tumor without resection or coagulation of its dural attachment and without extradural extension. Grade IV excision represents a partial excision. Grade V excision represents a simple decompression or biopsy. The surgical excision rate for each case was obtained from the operative procedures according to Simpson's surgical grading.

Statistical Analyses

The parametric dates were compared with the Student T-test and non-parametric dates were compared with the Whitney-U test. Parametric or non-parametric dates for three or more groups were compared by ANNOVA and the Kruskal Wallis VA test. Cross tables were compared by Pearson x2 and Fisher's exact test. Backward Likelihood Ratio Logistic Regression Analysis was performed to determine the recurrence-related factors. The Cox-regression model was used to determine the survival related factors. A P value <0.05 was assigned to be statistically significant for each test.

RESULTS

Atypical Meningiomas

Twenty-six patients (5.2%) were diagnosed as atypical meningioma. 16 (61%) patients were women and 10 (39%) patients were men. The age distribution ranged 30 to 69 at the initial presentation (median age 45.8 years). The most common symptoms were headache (77%) and seizure (27%). Table I summarizes the symptomatology at the initial presentation. The most common neurological finding was hemiparesis (16%). Fourteen (54 %) patients were evaluated as neurologically intact at the initial presentation. The neurological statuses are summarized in Table II. The tumors were predominantly located at the right hemisphere

Table I: Symptoms at the initial presentation.

Symptoms	Atypical Meningiomas	Malignant Meningiomas
Headache	20(77%)	17(89%)
Vomiting	5(19%)	1(5%)
Nausea	5(19%)	1(5%)
Seizure	7(27%)	6(32%)
Cranial Nerve Deficit	3(12%)	2(11%)
Ataxia	2(8%)	3(16%)
Hemi paresis	4(16%)	8(42%)

Table II: Neurological status at the initial presentation.

Neurological Findings	Atypical Meningiomas	Malignant Meningiomas
Papil Edema	3(12%)	4(21%)
Cranial Nerve deficit	3(12%)	2(11%)
Hemiparesis	4(16%)	8(42%)
Ataxia	2(8%)	3(16%)
Normal	14(54%)	8(42%)

(40%). Tumor locations are summarized in Table III. Surgical resection was graded by the Simpson grading as follows; Grade I was 13 (50%) cases, Grade II was 11 (42%) cases and Grade III was 2 (8%) cases The median survival time in Grade I was 7.5 years, in Grade II 7.3 years, and in Grade III was 7.2 years (Table IV). The patients' follow up periods ranged from a minimum of 3.2 years to 12.6 years. The median follow up period was 8 years. The follow-up period distribution is summarized in Table V. Recurrence was observed from 14 to 31 months following surgery. The median recurrence time was 25 months (2.08 years) and the median recurrence-free interval was 6.6 years Table VI. No recurrence was observed in Grade I patients. Three (11.5%) cases recurred after Grade II surgical resection at the 14, 27 and 28th months of postoperative follow-up. One (3.9%) case recurred after Grade III resection at the 31th month of postoperative follow-up. All specimens of recurrent cases were histologically re-evaluated; there was no worsening of the histological picture. No mortality occurred. Radiotherapy (4500-6500 cGy in 25-33 fractions) was used for two (7.7%) of the recurring cases.

Table III: Locations of the tumors.

	Convexity	Parasagittal	Sphenoid wing	Tentorium	Lateral Vent	Basal	Posterior fossa
Atypical	11(42%)	6(23%)	5(19%)	2(8%)	1(4%)		1(4%)
Malignant	12(63%)	2(11%)	2(11%)	1(5%)		1(5%)	1(5%)
Total	23(51%)	8(18%)	7(16%)	3(7%)	1(2%)	1(2%)	2(4%)

Table IV: Median survival and recurrence rate of malignant and atypical cases by Simpson's surgical grade distribution.

Simpson Grade	Atypical Meningiomas			Malignant Meningiomas		
	Number	RR	MST	Number	RR	MST
I	13(50%)	-	7,5	15(79%)	4(21%)	7,3
II	11(42%)	3(11,5%)	7,3	3(16%)	1(5,3%)	6,2
III	2(8%)	1(3,9%)	7,2	1(5%)	1(5,3%)	5,6
IV	-	-	-	-	-	-
V	-	-	-	-	-	-

RR: Recurrence Rate, ***MST***: Median Survival Time (Years).

Table V: Patients' follow-up distributions.

	0-5 Years	5-10 years	10- 12,6 years
Atypical Meningiomas	12(45%)	8(31%)	6(23%)
Malignant Meningiomas	8(40%	7(39%)	4(22%)

Table VI: Incidence rate, Recurrence rate, Median recurrence time, and Mean follow-up length for atypical and malignant meningiomas.

Atypical Meningiomas				Malignant Meningiomas			
Incidence	**Recurrence**	**MRT**	**MFL**	**Incidence**	**Recurrence**	**MRT**	**MFL**
5,16%	15,4%	2,08	8	3,77%	31,4%	1,3	9

MRT: *Median Recurrence Time,* ***MFL:*** Mean Follow-up Length (Years).

Malignant Meningiomas

Nineteen cases (3, 8%) were scored as malignant meningiomas according to the WHO histological classification. The ages ranged from 13 to 69 years and the median age was 49.2 years. Nine (47%) cases were female and 10 (53%) cases were male. The most common symptom of malignant meningioma was headache (89%) and the most common neurological finding was hemiparesis (42%). The location was predominantly the left hemisphere (53%). Tumor locations are summarized in Table III. Grade I surgical excision was done in 15 (79%) cases, Grade II surgical excision in 3 (16%) cases, grade III surgical excision in one (5%) case (Table 4). Recurrence was observed in six patients during the follow up period. The patients' follow-up periods ranged between 2.3 and 12.6 years. The median follow-up period was 9 years. Follow-up period distribution is summarized in Table 5. Six (31.6%) cases recurred on follow-up at 1 year to 3 years postoperatively. The median recurrence time was 16 months (1.3 years) (Table VI). The median survival time in Grade I was 7.3 years, in Grade II 6.2 years, and in Grade III 5.6 years. The median recurrence-free interval was 6.5 years. Recurrence was observed in 3 (50%) cases on the parietal convexity, in 2 (33%) cases on the frontal convexity and in 1 (17 %) case on the petrous apex. The Simpson surgical excision rates in recurrence cases were as follows; Grade I was 4 (21%) cases, Grade II 1 (5.3%) case, and Grade III 1 (5.3%) case. Two (10 %) mortalities were observed during the follow-up period. Neurological worsening was present in 3 (16 %) cases. Eleven (58 %) cases were treated with radiotherapy in the postoperative period; the remaining 8 (42%) cases were not treated with radiotherapy among those 6 (31.6%) cases were recurred (Table VII). One patient died during the early postoperative course at the second surgical procedure and 5 (26%) cases were applied radiotherapy after the second operation. Three (15.8%) patients were not treated with radiotherapy.

Table VII: Effect of radiotherapy on survival time is summarized for malignant meningiomas.

	n	Rn	X ± SEM	Median	Min–Max
Radiotherapy	11	-	7,5 ± 0,6	7,5	6,3 - 8,6
No Radiotherapy	8	5(62,5%)	4,6 ± 1,7	6,1	1,3-7,9

Rn: Recurrence number

Statistical Results

No statistically significant difference was observed between males and females for atypical and malignant meningioma cases (P=0.345; P>0.05). Distribution of Simpson's grading between the two groups was not statistically significant (P=0.119; P>0.05). A higher rate of recurrence was observed in malignant meningiomas (31.6%) than atypical meningiomas (15.4%) although the distribution of recurrence did not show a statistically significant difference between the two groups (P=0.281; P>0.05). No statistically significant effect of radiotherapy on survival time was observed (P=0.813; P>0.05). There was a statistically significant difference for survival time between atypical and malignant cases (P=0.01; P<0, 05). The Simpson grading was statistically significant for survival time (P=0.048; P <0.05). The ecurrence rate was higher in the malignant meningioma cases (P=0.003; P<0.05). The effect of radiotherapy on survival time was statistically significant (P=0.043; P <0.05). Recurrence was not statistically significant for survival time (P=0.244; P>0.05). The survival time distribution of atypical and malignant meningioma was not statistically significant (P=0,238; P>0.05). Recurrent surgery and radiotherapy did not have a statistically significant effect on survival time (P=0.592; P>0.05).

DISCUSSION

We currently have two-treatment modalities for meningiomas: surgery and radiotherapy. The results of chemotherapy and hormone therapy do not currently look promising. Surgery is the primary option for treatment and it is strongly related to the recurrences by Simpson's observation(16,17). Simpson's Grade I represent a complete removal with dural attachment. However, there have been reports of recurrence in Simpson Grade I extirpated patients (16,17). This situation was attributed reasons such as microscopical residue, biological malignant tendency, and regional multi-centricity (3, 4, 5). The microscopical residue may develop during surgery by dissemination of tumor cells, or remnant tumor cells may be left in the two dural layers. Furthermore, the tumor may develop digitiform parenchymal invasion that may increase risk of residual tumor cells.

The other reason of recurrence is regional multi-focal tumor growth that is named multicentricity. This interesting observation was well demonstrated by Borovich et al in meningiomas that caused unexpected recurrence with remnant tumor tissue (4,5). Wide dural resection could reduce the incidence of recurrence. Additionally, Simpson's Grade I excision with wide dura mater resection was named Simpson Grade 0. Some authors reported less recurrence with Simpson Grade 0 extirpation (11). Our research results show that Simpson's surgical grading is significantly associated with survival time (P=0.01; P<0.05).

Meningiomas are predominantly seen in females (17). Mahmood and Alvarez have reported male predominance for atypical and malignant meningiomas (13). This male predominance was related to progesterone activity. Some biochemical studies have correlated progesterone activity with malignancy in meningiomas (2,6,13). Jaakelainen has reported an equal distribution for males and females (10). In our series, malignant meningiomas showed minimal male (53%) predominance and atypical meningiomas showed female (62%) predominance. (P=0.345; P>0.05).

Molecular and genetic research on meningiomas is a new area with many genetic and molecular targets being investigated. We did not perform genetic or molecular research in our cases as we aimed to compare our clinical results and histopathological findings with other studies under the WHO classification.

The most common symptom at the initial presentation was headache. Headache might be associated with dura mater reaction caused by the tumor invasion. Increasing intracranial pressure due to the mass effect of the tumor might cause headache. Most neurological problems were observed in the group of convexity locations that are associated with direct compression of the brain. A statistically significant difference was not observed between the groups for neurological status and symptoms (P=0.245; P>0.05).

The location of the malignant and atypical meningiomas was as follows: malignant meningiomas were most commonly observed at the left hemisphere (53%) and located on the parietal convexity (42%). Atypical meningiomas were most commonly observed at the right hemisphere (39%) and located on the parietal convexity (27%). Atypical and malignant meningiomas were predominantly located on both the parietal and parasagittal regions.

The malignant meningioma had better percentage of Simpson grade (Grade I 79%, Grade II 16%, Grade III 5%) than atypical meningiomas (Grade I 50%, Grade II 42%, Grade III 8%), but this was not statistically significant (P=0.119; P>0.05). This result demonstrated homogeneity of surgery in the groups. When atypical and malignant meningiomas were compared for recurrence the malignant meningiomas (31.6%) had a higher percentage of recurrence than atypical meningiomas (15.4%), which again was not statistically significant (P=0.281; P>0.05).

The incidence of atypical meningiomas is 4.7 – 7.32% and the recurrence rate is 15.4 - 54% (1, 2, 6, 7, 9, 13, 14, 16, 17, 18). The mean recurrence time ranges between 1.9 and 5.34 years. The incidence of malignant meningiomas is 1- 3.77 % and the recurrence rate is 31.4 – 83.3%. The mean recurrence time is 2 – 7.77 years (2,9). Alvarez and Mahmood reported that the mean recurrence time of malignant meningiomas was relatively long due to the results of one patient from each series increasing the results with 17 and 15 years after recurrence, respectively. Malignant meningiomas have been accepted as being more aggressive than atypical meningiomas. There was a statistically significant difference when the survival times of malignant and atypical meningiomas were compared (P=0.01; P<0.05). Mahmood has reported no difference of survival time between atypical and malignant meningiomas (15). The survival times of atypical meningiomas in the literature for 5, 10 and 15 years are 54–95%, 8–79% and 27.78% while the survival times of malignant meningiomas are 60 –79%, 16 - 34.5%, 30%, respectively (15). The median survival time of atypical meningiomas was 5.95 – 19.1 years and for malignant meningiomas this period was 6. 89 – 8,.75 years. These results contain the impending results of survival time and median survival time of both groups. Furthermore, the results show that the malignant meningiomas have a slightly higher and

better value survival time than atypical meningiomas. This result, however, conflicts with the accepted knowledge (1, 2, 4, 5, 7, 10, 13, 14, 18).

The role of radiotherapy in the management of the meningiomas is controversial in the literature(7, 10). The effect of radiotherapy on survival was statistically significant (P=0.043; P<0.05) and the recurrence rate was higher (88%) in the non-irradiated malignant meningioma cases. Furthermore, any event was observed in the radiotherapy-applied cases in the follow up period over the recurrence time for each case (Min = 3,1 years, Max = 7.75 years) (2). The median survival time was calculated as 8.5±0.6 years by the Cox regression model in the surgery- and radiotherapy-applied malignant meningioma group. Median survival time was calculated as 5. 6±1.7 years in malignant meningioma cases where only surgery was performed. These results indicate a beneficial effect of radiotherapy after surgery for malignant meningiomas and also that show that radiotherapy increases the survival time estimate by 3 years. Atypical meningiomas were not primarily irradiated in our series. Radiotherapy was performed on two atypical meningioma cases following recurrence. These two cases did not recur in the follow up period. Radiotherapy was not statistically significant for recurrence in atypical meningiomas (P=0.117; P>0.05). Recurrence was otherwise higher in non-irradiated malignant meningioma cases and this was statistically significant (P=0.003; P<0.05).

CONCLUSION

The histological criteria of atypical meningiomas are classified as between benign and malignant. Most articles report that malignant meningiomas are more aggressive than atypical meningiomas. However, our research results demonstrated that the difference between malignant and atypical meningiomas for survival time was statistically significant (P=0. 01; P< 0.05) while the recurrence distribution between the two groups was not statistically significant (P=0.281; P>0.05). Simpson's surgical grading had a significantly positive effect on survival and recurrence (P=0.045; P<0.05). Survival time was significantly higher in those treated with radiotherapy (P=0.043; P<0.05) and statistically there was a high recurrence rate in non-irradiated malignant meningioma cases (P=0.003; P<0.05).

These clinical findings and histological criteria in our study suggest that the malignant meningiomas show more aggressive behavior with a shorter median recurrence time (16 months) than the atypical forms (25 months); however, the distribution of recurrence was not statistically significant (P=0,281;P>0,05). Malignant meningiomas are supposed to be more aggressive with a higher recurrence rate (1, 2, 9, 10, 13, 17) but our findings did not support this . We have also observed that the Simpson's surgical grades were significantly associated with survival time and recurrence.

In light of this knowledge, our results and the available literature demonstrated these two intermediate malignant forms of meningiomas showed similar prognosis with different clinical behavior. The short recurrence period of malignant meningiomas might cause confusion on deciding which tumor acts more aggressively but we did not observe difference of recurrence distribution and survival time between the two groups, suggesting a similar prognosis for both forms of meningiomas.

Consequently, the malignant meningiomas are thought to show more aggressive behavior than atypical forms but our research results did not support the current opinion. Our experience showed that radical surgery greatly improved the results. We strongly recommend a wide radical extirpation if possible. Radiotherapy showed a beneficial effect when used for malignant meningiomas. We believe that these close intermediate malignant forms of meningioma might show different behavior with the same prognosis.

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