Clinicopathological Features Predicting Recurrence of Intracranial Meningiomas

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Abstract

A series of 11 recurrent meningiomas was studied. Most lesions occurred in women. The youngest patient was 17 years old and the oldest was 73 years. The mean age was 44 years. Multifactorial risk factors were involved in the tumor regrowth including age of patients, location of tumors, adequacy of initial surgery, certain histopathological features and subtypes of tumors. Tumors in young adults tended to have a rapid interval of regrowth as well as a tendency of multiple recurrences. Brain invasion, extensive bone and muscle involvement, foci of necrosis and hemorrhage, high mitotic index, angioblastic and papillary patterns were common pathological risk factors. Additionally, recurrent tumors may retain their original pathological appearance or become more aggressive by showing marked cellular pleomorphism. Area of liposarcomatous component was encountered in one recurrent lesion.

Generally, a meningioma is considered as a benign intracranial tumor. It is, however, capable of invasion in adjacent structures beyond its anatomical boundaries such as skull, dural sinuses and brain as well as being malignant[1]. Furthermore, some patients may suffer from multiple recurrences which require repeated surgery resulting in an increased risk of morbidity and mortality. Tumor recurrence, thus, is regarded as one of the most difficult problems for neurosurgeons[1]. In this communication, we have studied in particular the clinical and pathological features of recurrent meningiomas.

MATERIAL AND METHOD

We encountered 11 patients who had undergone craniotomy for recurrent meningioma at the Department of Surgery, Chulalongkorn Hospital between January 1991, and December 1995. All clinical records of these patients were studied after review of the microscopic material. Tissues obtained from the initial and repeated operations were fixed

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Table 1. Clinicopathological features of 11 patients with recurrent meningioma.

Case No.	Age	Sex	Location	Number of recurrence	Duration of recurrence	Pathological aspects of primary tumor				Treatment	Pathology of recurrent tumor
						subtype	necrosis	fibrosis	invasion		
1.	17	F	Parasagittal	3	10 mo.	Transitional	+	-	Brain	Complete	Same
2.	18	F	Convexity	3	1 yr.	Fibroblastic	-	-	-	Complete	Malignant meningocytic type with liposarcoma
3.	34	F	Parasagittal	1	8 yr.	Angioblastic and papillary	-	+	-	Complete	Same
4.	45	F	Parasagittal	1	2 yr.	Angioblastic	-	+	Brain	Incomplete	↑ pleomorphism, frequent mitoses
5.	45	M	Parasagittal	3	2 yr.	Angioblastic and papillary	-	-	Brain	Complete	Same
6.	47	F	Parasagittal	1	6 yr.	Transitional	+	-	-	Complete	↑ pleomorphism
7.	47	M	Parasagittal	1	4 yr.	Fibroblastic	-	-	-	Incomplete	Meningocytic type
8.	51	F	Sphenoid ridge	1	1 yr.	Meningocytic and angiomatous	-	+	Brain	Complete	Same
9.	52	F	Sphenoid ridge	1	5 yr.	Transitional	-	-	Muscle	Incomplete	Same
10.	57	F	Cavernous	1	3 yr.	Transitional	-	-	-	Incomplete	Same
11.	73	F	Convexity	2	3 yr.	Malignant meningocytic	+	+	-	Complete	Same

M = Male; F = Female; yr = year; mo - month

in 10 per cent formalin and stained routinely with hematoxyline and eosin (H&E). Immunohistochemistry using antibodies to vimentin, keratin, epithelial membrane antigen were done on some cases.

RESULTS

Of 11 patients, 9 were women and 2 men (Table 1). The youngest patient was 17 years old, the oldest was 73 years and the mean age was 44 years. History of multiple recurrences was noted in 4 cases; two of whom were young adults (case 1, 2). Progressive headache and increased intracranial pressure were common clinical features followed by seizures, hemiparesis, visual impairment, cranial nerve dysfunction, altered personality, and aphasia. The initial symptom in one example was exophthalmos (case 9). The most frequent recorded sites in decreasing order of frequency were parasagittal region in 6 cases, convexity in 2 cases, sphenoid ridge in 2 cases, and the cavernous sinus in 1 case.

The interval between the first and second operations for recurrent tumors ranged from 10 months to 8 years and the median time was 3.3 years. Five patients had a short period of recurrence less than 2 years, three were less than 4 years, and three were longer than 5 years. One patient underwent surgery three times (case 11) and three cases required four craniotomies for repeated recurrences (cases 1, 2, 5). Seven patients had recurrence after presumably "complete" removal, and four after "incomplete" removal. Two patients died in this series (cases 2, 4) and the remaining patients had residual symtoms as a result of surgical effects. The follow-up period ranged from 3 to 9 years.

The most frequent subtypes of primary meningioma were transitional (4 cases), angioblastic meningioma (3 cases), papillary (2 cases), fibroblastic (2 cases), meningiocytic meningioma with angiomatous component (1 case), and malignant meningocytic meningioma (1 case). Two lesions had both angioblastic and papillary patterns (Fig. 1). Analysis of the histologic features revealed invasion of the brain in 4 instances, large area of fibrosis in 4 cases, frequent mitoses in 3 cases, foci of necrosis in 3 cases, foci of hemorrhage with hemosiderin deposit in 2 cases, and invasion of muscle in one case.

Correlating such histological features with the subtype of tumor disclosed that brain invasion was found in 2 cases with angioblastic type; 1 with transitional pattern; and 1 with angiomatous meningioma. Necrosis was noted in 2 cases with transitional and 1 malignant meningocytic meningioma (Fig. 2 A, B). High mitotic index was observed in 2 tumors of angioblastic and papillary type and an example of malignant meningocytic meningioma. Fibrosis was seen in 2 lesions of angioblastic type and 1 each in angiomatous meningioma and malignant tumor (Fig. 2C).

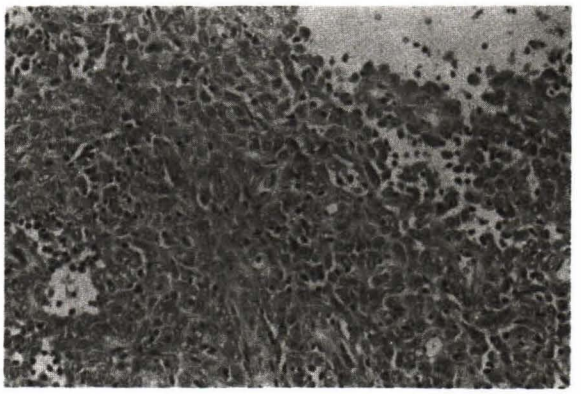

Fig. 1. Angioblastic meningioma with papillary pattern in Case 3 (H&Ex200).

We also examined the histopathology of the recurrent tumors. Marked nuclear pleomorphism was seen in 3 cases; (Fig. 3A) one with original transitional type, one with angioblastic meningioma and one with fibroblastic lesion (case 2, 4, 6). Recurrent neoplasm of the latter tumor also contained an area of liposarcomatous component (Fig. 3B, C).

DISCUSSION

The problem of recurrent meningiomas has been experienced by many neurosurgeons although most intracranial meningiomas are generally benign lesions with a good prospect of permanent cure after surgical intervention[1]. Several clinical and pathological parameters for predicting the risk factors of tumor recurrence have been reported including the adequacy of the initial surgery, the anatomic site of the tumors, subtypes of the meningiomas, and certain histological features such as brain invasion[2,3]. Our results provided additional risk factors relating the recurrence of tumors and revealed some unusual aspects of the recurrent lesions.

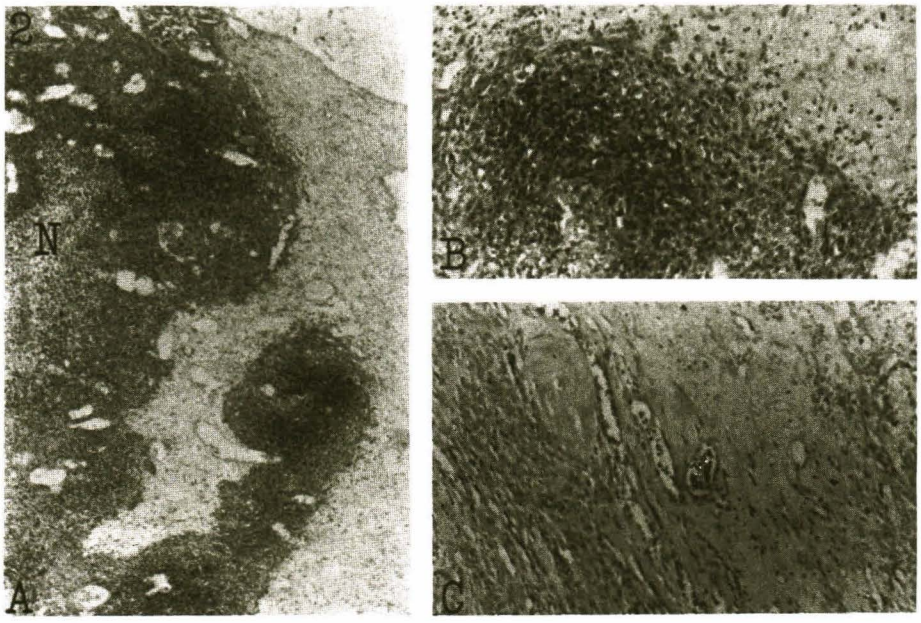

Fig. 2. Photomicrographs showing various histological findings
A. Area of necrosis (N) within the tumor (H&Ex40)
B. Brain invasion (H&Ex100)
C. Large area of fibrosis (H&Ex100)

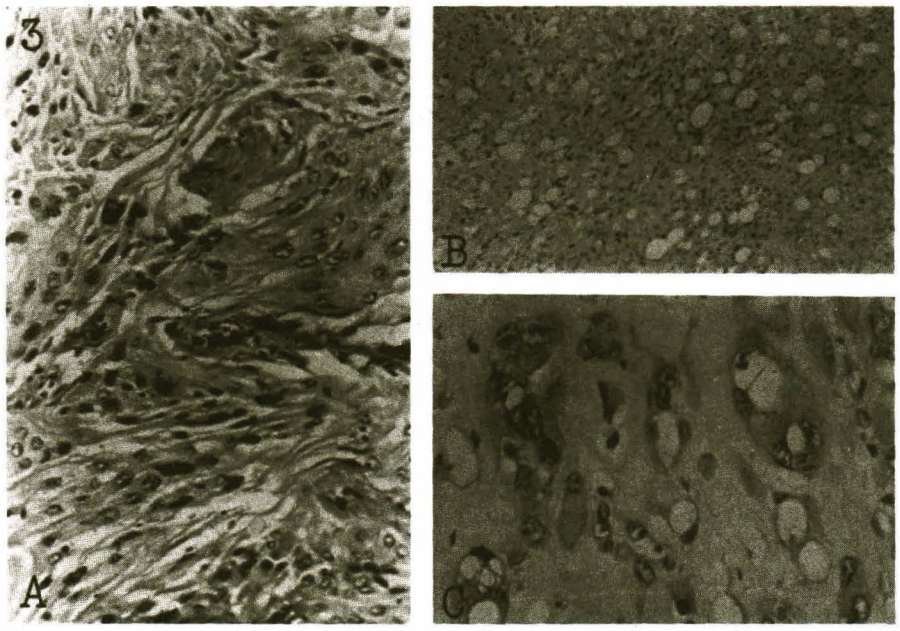

Fig. 3. Photomicrograph of recurrent tumor in Case 2.
A. Nuclear pleomorphism of malignant meningioma. (H&Ex200)
B. Low-power view showing liposarcomatous component (H&Ex40)
C. Higher-power view of liposarcomatous cells (H&Ex400)

Generally, meningiomas in children and young adults are uncommon and they have a reputation for rapid growth and being frequently malignant[2,4]. The findings of brain invasion in our cases and evidence of liposarcomatous component in recurrent mass observed in our case 2 supported this view. Furthermore, it is also striking to find that the tumor in young adults had a rapid interval of regrowth and a tendency of multiple recurrences, as noted in our examples.

Several authors have suggested that the tumors are likely to recur if they are in certain locations such as the sphenoid wing, the inner part of the skull base, and the ventricle[1,5-7]. It is, however, surprising to find that either convexity or parasagittal-falx lesions in which complete resection can be accomplished with ease have a high recurrent rate as observed in our study. Most neurosurgeons have also accepted that the main factor influencing tumor recurrence is the efficacy of surgery[5,8,9]. Recurrence will certainly ensue if the tumor is inadequately removed as noted in our cases. This complication still exists even after "total" removal because the tumor may anatomically escape the surgeon's inspection due to its location such as behind the dural sinus as seen in our cases. Furthermore, surgeons may not be able to detect microscopic invasion of the lesions. For example, 3 cases in this study with complete surgery showed microscopic evidence of brain invasion (cases 1, 5, 8). It should be noted that the regrowth in patients with complete macroscopic resection may be as high as 19 per cent of cases[1]. Therefore, adequacy of surgery alone cannot clarify the causes of recurrence of all meningiomas. The pathological view point, thus, should receive more attention.

There is a broad agreement that some variants of meningiomas such as angioblastic or papillary meningiomas are known to have a greater tendency to recur as shown in this series[7,10]. Several histological features including high mitotic index, nuclear pleomorphism, invasion of brain, focal necrosis and hemorrhage described in our study are also correlated with recurrence although the frequency is variable[11]. Invasion of adjacent muscle noted in one patient (case 9) could be an additonal factor for the regrowth of tumor. We also found large areas of fibrosis in 4 cases. Such a finding is most likely related to a repair process of ischemic, hemorrhagic or necrotic tissue. We have not been able to locate a description concerning the presence of fibrosis in recurrent meningiomas.

Regarding the pathological appearance of the recurrent lesions, the tumors may be either the same or become more aggressive by showing marked nuclear plemorphism. The finding of liposarcomstous component in one example (case 2) is unusual. A review of the literature disclosed only one similar case report. Kasantikul et al described a 19-year-old girl who had a liposarcoma arising within the same location of previously removal of an intraventricular benign meningioma as observed in our patient[12]. The authors have suggested that this unusual complication is related to the mesenchymal property of both meningioma and liposarcoma[12].

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การศึกษาทางคลินิกพยาธิวิทยา เพื่อทำนายการงอกใหม่ของเมนิงจิโอมาภายในโพรงศีรษะ

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ได้ทำการศึกษาในผู้ป่วยด้วยเนื้องอกเมนิงจิโอมาที่งอกใหม่หลังผ่าตัด 11 ราย พบว่ามีหลายปัจจัยที่ทำให้เกิดการงอกใหม่ อาทิเช่น อายุผู้ป่วย, ตำแหน่งของรอยโรค, ขอบเขตการผ่าตัดครั้งแรก, ชนิดและลักษณะพยาธิวิทยาของเนื้องอก ผู้ป่วยมักเป็นเพศหญิงและมีอายุเฉลี่ย 44 ปี, ผู้ป่วยอายุน้อยมีแนวโน้มที่มีเนื้องอกเกิดซ้ำได้หลายหน ในระยะเวลาที่รวดเร็ว พบการงอกใหม่ในผู้ป่วย 7 รายที่ได้รับการผ่าตัดเนื้องอกออกหมดในการผ่าตัดครั้งแรก และใน 4 รายซึ่งการผ่าตัดครั้งแรกไม่สามารถตัดเนื้องอกออกได้หมด ตำแหน่งของรอยโรคที่พบบ่อยที่สุด พบที่บริเวณ parasagittal เนื้องอกชนิดแองจิโอ-บลาสติก และแพพิลแลรี, ร่วมกับการลุกลามไปยังเนื้อสมอง หย่อมเน่าตายภายในเนื้องอก, หย่อมเลือดออกและไฟโบรซิส เป็นปัจจัยเสี่ยงที่พบบ่อยที่สุด เนื้องอกที่เกิดซ้ำอาจมีรูปลักษณ์คงเดิม หรือมีการเปลี่ยนแปลงไปเป็นเนื้องอกชนิดร้าย และยังพบส่วนของไลโปซาร์โคมาร่วมด้วย 1 ราย

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