Correlation Analysis of MRI Features and Ki-67 Index in High-grade Meningioma with Recurrence of Tumors

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Introduction

Relapse of High-grade meningioma have markedly relations with their histologic proliferative features and invasive characteristic of biological behaviour. Although some immunohistochemical markers, such as Ki-67, have become an important prognostic indicator of high-grade meningioma, being able to provide their preoperative invasive features on MRI to determine more complete resection of the tumor and postoperative radiotherapy is the clinical goal.

Object

To observe the correlation of MRI imaging features and Ki-67 index in high-grade meningioma with recurrence of tumors.

Materials and Methods

30 patients, 17 female and 13 male, age range 7-73 years (average age 55 years), were performed MRI scanning and detected Ki-67 index. There were 13 grade 2(atypical) and 17 grade 3(anaplastic) cases in the series, where there were 16 patients with tumor recurrence including 3 grade 2 and 13 grade 3. The cystic components in the lesions, multiple lesions and vital intracranial structure involved, the latter including dural sinus, brain arterial trunk or optic nerve and extra-intracranial communication tumor, were detected by MRI.The patients were divided into two groups of <10% and ≥10 % of Ki-67 index. According to the average diameter of the lesions after MRI enhancement, the patients were divided into four groups of ≤30, 31-40, 41-50 and ≥51mm. Using if tumor recurrence as the dependent variable, and tumor grade, groups of Ki-67 index and tumor size, vital intracranial structures involved, cystic components and multiple lesions as independent variables, the logistic regression analysis was performed. 13 patients of recurrent meningiomas with previous history and histologic grade were analysed.

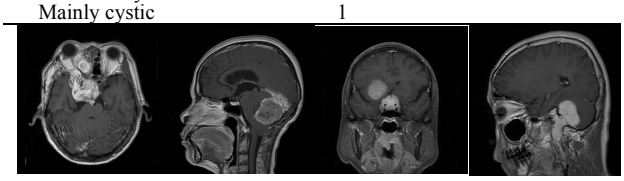
Result

Ki-67 index of grade 3 meningiomas(12.6±8.5%) was significantly higher than that of grade 2(5.7±4.3%)(t=2.695, p=.013). Table 1 shows the correlation of the histologic grade, Ki-67 index, size and involving vital intracranial structure of meningiomas with relapse. According the average lesion diameters on MRI enhancement, the groups of ≤30, 31-40, 41-50 and ≥51mm were 7(23.3%), 5(16.7%), 11(36.7%) and 7(23.3%), respectively. The solid, solid-cystic and mainly cystic lesions were 23(76.6%), 6(20%) and 1(3.3%), respectively. MRI showed that the vital structure involvement proved by surgical operation were 3(10%) optic nerve [image 1]，6(20%) dural sinus involved, including superior sagittal sinus, transverse sinus, sigmoides sinus, confluens sinuses[image 2], 1(3.3%) internal carotid artery encompassed[image 3], and 4(13.3%) extra-intracranial communication tumors[image 4].There were 6(20%) intracranial multiple lesions in the series. Logistic regression analysis showed that recurrent risk of meningioma increased with grade increase (Wald x^2=5.025,p=.025), vital intracranial structure involved(Wald x^2=4.527,p=.033) and tumor size increase (Wald x^2=4.158,p=.041). The recurrent risk of grade 3 meningiomas was 87 times that of grade 2(OR=87.95). The recurrence risk of vital intracranial structural involved was 65 times that of non-involved(OR=64.59). The tumor recurrence risk increased 4 times as the diameter of a tumor increased one grade(OR=5.041). There might be certain relation between Ki-67 index and the tumors relapse but no statistical significance due to the small size of the series(Wald x^2=3.583,p=.058, OR=0.396). The relation of cystic lesions and intracranial multiple lesions with the tumor relapse did not have statistical significance.

There were 13 patients with past medical history and pathologic grade among 16 recurrent meningioma, including 3 of grade 2 and 10 of grade 3 (see table 2). The past pathologic grade of the 3 of grade 2 was grade 1, with an average course of 64 months. There were 3 grade 3 in the first onset among the 10 of grade 3, and the average period of relapse was 17 months. The average course of another 4 past grade 2 was 29.3 months, and they developed to grade 3 after 1-2 relapses. The average course of the other 3 past grade 1 were 134 months, and they developed to grade 2 after 1-3 relapses during 120 months in average and then to grade 3 during 14 months in average.The average periods from 6 grade 1 to grade 2 and 7 from grade 2 to grade 3 were 86.3 and 22.7 months, respectively.

Table 1：Correlation of the histologic grade, Ki-67, size and involving vital structure of meningioma with relapse

Category	Recurrence n=16(%)	Non-recurrence n=14	x^2 & t	p
grade 2 grade 3	3(23.1) 13(76.5)	10 4	8.438	.004
Ki-67(Mean±SD)	12.3±8.4	6.6±5.7	2.123	.043
Vital structure Involved, extra-intracranl communication n(%)	10(62.5)	3(21.4)	5.129	.024
Multiple lesions n(%	5(31.3)	1(7.1)	2.712	.100
Lesion component Solid Solid and cystic Mainly cystic	 13 3	 10 3 1	3.017	.389



From left to right, **Im 1**: anaplastic meningioma, Axi enhancement MRI. The lesion involved orbital apex,optic nerve and sella turcica. **Im** 2: anaplastic meningioma, Sag. enhancement MRI. Tentorium Cerebelli was involved by the tumor. **Im 3**: atypical meningioma, Cor. enhancement MRI. The tumor located sella turcica circumvoluted bilateral internal carotid artery. **Im 4**: atypical meningioma, Sag. enhancement MRI. Extra-intracranial communication tumor located jugula foramen shows that the lesion enters carotid space.

Table 2:History,histologic evolving, vital structure involved and Ki-67 index of 13 recurrent high-grade meningioma

Patient No.	Current grade	Initial grade	Course (Month)	Relapse times	Vital structure involved	Ki-67 (%)
1	3	3	12	1		9
2	3	3	24	1		20
3	3	3	60	4	Optic nerve	5
4	3	2	5	1	Optic nerve	10
5	3	2	8	1	Transverse sinus confluens sinuses	5
6	3	2	32	2	Superior sagittal sinus	10
7	3	2	72	1	superior sagittal sinus	5
8	3	1, 2	96*	4	Transverse sinus Sigmoides sinus	13
9	3	1, 2	132**	3		10
10	3	1, 2	174***	5	extra-intracranial communication	30
11	2	1, 2	36	2	extra-intracranial communication Optic nerve	15
12	2	1	72	1	arteriae carotis interna	3
13	2	1	84	1		5

*Patient No.8: recurred twice as grade 1 during 7 years, A year ago recurred as grade 2. **Patient No.9: After 9 years recurred as grade 1, and 2 years ago recurred as grade 2. *** Patient No.10: recurred 3 times as grade 1 during 14 years, half year ago recurred as grade 2.

Discuss and conclusion

A vital intracranial structure involved and large tumor size increase the risk of the meningioma relapse. These two indicators of MRI might play an important role in preoperative prediction of the recurrence of meningioma. Ki-67 index can act also as a predictor of the tumor recurrence. The higher the grade of meningioma is, the higher recurrence rate and the shorter the duration between recurrences will be.

Reference

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