Intraparenchymal Meningioma: Clinical, Radiologic, and Histologic Review

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Key words
- Cyst formation
- Fibrous type
- Intraparenchymal
- Magnetic resonance imaging
- Meningioma

Abbreviations and Acronyms
CT: Computed tomography
GTR: Gross total resection
MRI: Magnetic resonance imaging
WHO: World Health Organization

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BACKGROUND: **Although meningiomas are usually attached to the dura matter, intraparenchymal and subcortical meningiomas do not show dural attachment.**

METHODS: **A total of 39 cases of intraparenchymal meningiomas including subcortical meningiomas were reviewed.**

RESULTS: **Compared with ordinary meningiomas, intraparenchymal meningiomas occurred more frequently in males and at younger ages. Unusual magnetic resonance imaging findings such as heterogeneous enhancement and cystic components were frequently recognized. Histologic analysis revealed half of the intraparenchymal meningiomas to be of the fibrous type, and approximately 20% of the tumors were diagnosed as World Health Organization grade II–III disease. Compared with sylvian fissure meningiomas, which also lack dural attachment, patients with intraparenchymal meningiomas were younger than those with sylvian fissure meningiomas. Gross total resection was performed more frequently for intraparenchymal meningiomas than for sylvian fissure meningiomas. More patients with intraparenchymal meningiomas than those with sylvian fissure meningiomas showed malignant phenotypes, and fibrous phenotypes were twice as common among intraparenchymal meningiomas as among sylvian meningiomas.**

CONCLUSIONS: **Because of the unique features described earlier, which contrast with those of ordinary meningiomas, there is a possibility that intraparenchymal meningiomas are not precisely diagnosed. Collectively, the information collected from the study cases may facilitate the appropriate management of these rare tumors.**

INTRODUCTION

Meningiomas are extra-axial tumors that are usually attached to the dura matter, aiding preoperative diagnosis. However, some meningiomas lacking dural attachment also occur, most commonly in the intraventricular region, pineal region, and within the sylvian fissure. Meningiomas occurring in the subcortical region that are not associated with the sylvian fissure are rare. Intraparenchymal meningiomas are considered to be the same as subcortical meningiomas on the basis of their location within the brain parenchyma and the absence of dural attachment, regardless of whether they reach the surface of the brain.[1]

Because of their rarity, intraparenchymal meningiomas are often misdiagnosed as gliomas, cavernous angiomas, malignant lymphomas, or metastatic tumors. Especially in cases with uncommon features of meningiomas, such as cystic components, it is difficult to correctly diagnose these lesions. Because the treatment strategy and operative techniques used with meningiomas are different from those used with gliomas or metastatic tumors, it is important to understand the characteristics of intraparenchymal meningioma and make an accurate preoperative diagnosis. To better characterize the presentation of these rare meningiomas, we collected reported cases of intraparenchymal meningioma or subcortical meningioma[1-37] and reviewed them together with the single case presented in Table 1. Data from sylvian fissure meningiomas were summarized separately and compared with those from intraparenchymal meningiomas. Cases with sarcomatous tumor histology or an association with meningioangiomatosis were excluded. Radiation-induced secondary meningiomas were also excluded. Magnetic resonance imaging (MRI) or computed tomography (CT) scan detection of calcification, cystic components, or surrounding edema was also evaluated. Data on each feature are summarized in Table 2.

ILLUSTRATIVE CASE

A 59-year-old man presented with numbness in his right upper limb and right side of his face. T1- and T2-weighted imaging revealed the presence of an isointense mass with no cystic component. The mass was homogeneously enhanced with T1-weighted gadolinium imaging (Figure 1A and B), was not attached to the dura matter, and appeared to be located in the intraparenchymal. During surgery to remove the mass, the dura matter was opened. It appeared normal, with no

Table 1. Reported Cases of Intraparenchymal Meningiomas

Author Year	Age (years)	Gender	Symptom	Location	Extend of Resection	Pathology
Emoto 1954[5]	24	F	Headache, vomit, left hemiparesis	Frontal	GTR	Fibroblastic
Taptas 1961[30]	0.3	F	Enlargement of the head	Temporoparietal	GTR	Fibroblastic
Teng 1961[32]	24	M	Vomit, enlargement of the head	Frontal	GTR	Psammomatous
Mendiratta 1967[16]	0.5	M	Seizure, enlargement of the head	Temporal	GTR	Meningothelial and fibroblastic
Koos 1970[12]	0.9	M	Seizure	Frontal	GTR	Fibromatous
Suematsu 1973[29]	0.4	M	Seizure	Parietal	GTR	Fibroblastic
Satyanarayana 1975[24]	0.5	M	Enlargement of the head	Frontoparietal	GTR	Fibroblastic
Morimoto 1976[17]	17	F	Seizure	Parietal	GTR	Malignant
Dong 1980[2]	0.3	M	Enlargement of the head	Temporal	ND	Fibroblastic
Sano 1981[23]	0—14	ND	ND	ND	ND	Fibroblastic
	15—19	ND	ND	ND	ND	ND
Schut 1983[25]	5	M	Facial twitching	Temporal	GTR	Mix (fibroblastic, transitional, psammomatous)
Legius 1985[13]	1.2	M	Seizure	Parietal	GTR	Fibromatous
Drake 1986[3]	12	M	Seizure	Temporal	STR	Transitional
Sakai 1987[21]	0.9	M	Seizure	Frontal	GTR	Fibroblastic
Schroeder 1987[26]	7	M	Seizure	Frontal	GTR	Fibroblastic
Mamourian 1991[14]	2	F	Macrocephaly	Frontal	GTR	Meningioma
Matsumoto 1992[15]	6	M	Seizure	Frontal	GTR	Transitional
Kaneko 1993[8]	12	F	Seizure	Temporal	GTR	Meningothelial
Nakahara 1993[18]	56	M	No	Cerebellar cortex	GTR	Fibroblastic
Kohama 1996[11]	1.8	F	Seizure	Frontal	GTR	Fibroblastic
Sanli 1996[22]	23	M	Seizure	Frontal	GTR	Psammomatous
Teo 1998[33]	2	F	Bulbar dysfunction and right hemiparesis	Brainstem	PR	Clear cell
Shimizu 1999[28]	46	F	Seizure	Temporoparietal	GTR	Fibrous
Wada 2000[34]	45	F	Numbness in the right fingers	Parietal	GTR	Chordoid
Karadereler 2004[9]	14	M	Seizure	Temporal	GTR	Fibromatous
Kim 2005[10]	41	F	Seizure	Frontal	GTR	Anaplastic
Tekko 2005[31]	54	F	Headache	Temporal	GTR	Meningioma
Zhang 2007[36]	16	M	Seizure	Parietooccipital	GTR	Atypical
Dutta 2009[4]	36	F	Headache	Temporal	GTR	Rhabdoid
Yamada 2010[35]	60	M	Motor weakness in right lower limb	Parietal	STR	Meningothelial
Shimbo 2011[27]	10	M	Seizure	Frontal	GTR	Meningothelial with chordoid
Jiang 2012[1]	23	M	Left upper limb and facial nerve palsy	Brainstem	GTR	Papillary

Continues