Cerebral Leiomyoma in a Child

A case of primary cerebral leiomyoma in a 12 year-old boy with unique clinical features is described. He presented with fever, and the magnetic resonance imaging demonstrated a well demarcated mass in the subcortical white matter of the right temporal lobe. The mass showed low signal intensity on T1-weighted images and high signal intensity on T2-weighted images with a strong homogeneous gadolinium-DTPA enhancement. The mass was removed in toto and was composed of fasciculating, monotonous oval to spindle cells which had both immunohistochemical and ultrastructural features of primitive smooth muscle differentiation. The patient is free of recurrence during the follow-up period of 56 months. Detailed clinicopathologic findings are discussed.

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Key Words : *Child, Fever, Leiomyoma, Magnetic resonance imaging*

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INTRODUCTION

Primary smooth muscle tumor arising in the central nervous system is an extremely rare occurrence. Since Kroe et al.(1) had described the first case of an intrasellar leiomyoma in 1968, 16 cases have been reported in the world literature (2~14). This report describes an unusual case of primary mesenchymal tumor of the temporal lobe in a child with enduring fever. The lesion was composed of monotonous cells having both immunohistochemical and ultrastructural characteristics of smooth muscle cells. This is an atypical clinical presentation of a primary cerebral mesenchymal tumor. Also the case gives some implications on the histogenetic point of primary cerebral smooth muscle neoplasm.

CASE REPORT

Clinical Findings

The patient was a 12 year-old boy with a history of fatigue over an 8 month period and headache associated with fever for a month. He had been relatively healthy until he was nine years old when he began to show the symptoms of depression and a decline in his school performance. His family history revealed that his father had a history of pulmonary tuberculosis 10 years earlier. Prior to the admission to Seoul National University Children's Hospital, he had been managed at a local hospital where anemia and abnormal cerebrospinal fluid (CSF) findings were detected. The laboratory findings and the hospital course were as follows; hemoglobin and white blood cell (WBC) count of the peripheral blood were 7.8 g/dl and 6,300/mm^3 (segmented form, 60%), respectively. The CSF WBC count was 35/mm^3 (polymorphonuclear leukocytes, 60%; lymphocytes, 40%), and the protein and glucose levels were 68 mg/dl and 40 mg/dl, respectively (blood glucose level, 85 mg/dl). Although no micro-organism was isolated, he was empirically treated with cefotaxime and gentamicin. The computerized tomography (CT) taken due to persistent fever revealed an isodense homogeneously enhancing mass accompanied by surrounding edema in the right temporal area. He was transferred to Seoul National University Children's Hospital for further evaluation and treatment. On admission, he showed generalized pallor and the body temperature ranged from 37.0℃ to 38.8 ℃. Neurological deficits were absent. Optic fundi were normal. The peripheral blood hemoglobin was 8.2 g/dl. Peripheral blood leukocytosis was absent, and the lumbar CSF cell count was normal. However, the CSF protein level was elevated up to 160 mg/dl. Serum C-reactive protein (CRP) was 4+ to 6+ while erythrocyte sedimentation rate(ESR) fluctuated from 5 to 145 mm/hour. Repeated Mantoux tests were negative. No organism was isolated from the blood and the CSF. Despite administration of cefotaxime, methicillin and metronidazole,

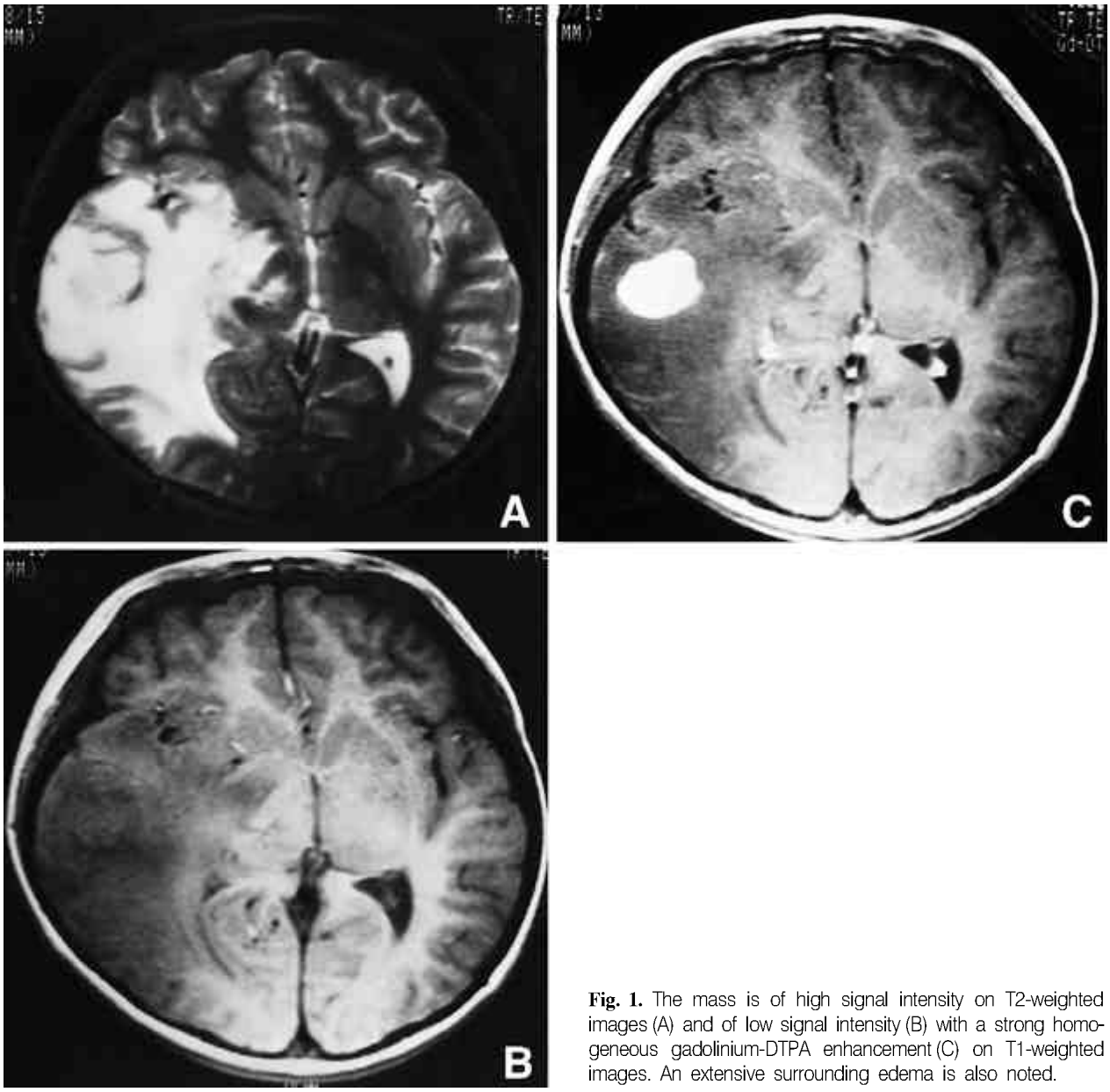

Fig. 1. The mass is of high signal intensity on T2-weighted images (A) and of low signal intensity (B) with a strong homogeneous gadolinium-DTPA enhancement (C) on T1-weighted images. An extensive surrounding edema is also noted.

fever was persistent. On magnetic resonance imaging (MRI), the mass was of low and high signal intensities in T1-weighted and T2-weighted images, respectively. There was a strong homogeneous gadolinium-DTPA enhancement. An extensive surrounding edema was also noted (Fig. 1). The MRI findings suggested a tumorous lesion with compact cellularity rather than an inflammatory or infectious lesion.

The preoperative diagnosis was lymphoma or granulomatous lesion (including fungal infections), and the right temporal craniotomy was performed on May 10, 1993 to define the nature of the lesion. On operation, the tumor was not visible on the cortical surface, and cortical incision along the superior temporal sulcus revealed a well-demarcated, reddish firm vascular mass, which was totally removed. Postoperatively, the fever and the headache subsided dramatically, and he was free of recurrence for 56 months on follow-up examinations including brain CT or MRI.

Pathologic Findings

Histologically, the tumor was composed of rather monotonous, oval to elongated spindle cells having a moderate amount of eosinophilic cytoplasm. The cells were arranged in a partly fascicular pattern and the individual cells showed mild nuclear pleomorphism without mitotic figures (Fig. 2). The stroma was slightly

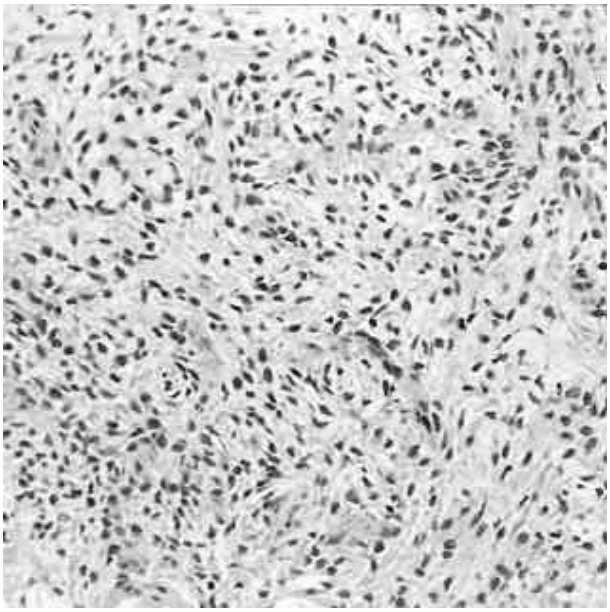

Fig. 2. The representative portion of the tumor shows spindle cells arranged in a fascicular pattern. Note the loose stroma, small capillaries and mild pleomorphism of tumor cells. The cells have a moderate amount of eosinophilic cytoplasm, and mitotic figures are not encountered (H&E, ×100).

edematous or myxoid and collagen deposit was minimal on Masson's trichrome staining. Many capillaries were found within the tumor, while inflammatory reaction, necrosis or hemorrhage was absent.

Immunohistochemical staining for neuron specific enolase (DAKO), S-100 protein (DAKO), glial fibrillary acidic protein (DAKO), vimentin (DAKO), desmin (DAKO) and p53 (DO7 ; Novocastra) using monoclonal antibodies and avidin biotin conjugate method (ABC method) gave constantly negative reactions, while occasional tumor cells demonstrated weakly positive reactions to smooth muscle actin (DAKO). The ultrastructural findings were characterized by well-developed basal lamina surrounding individual cells, a small amount of thin filaments along with focal condensations and subsarcolemmal dense plaques, and sparse organelles, all of which are consistent with the ultrastructural features of primitive smooth muscle differentiation (Fig. 3). Based on the above findings, the present case was thought to be a type of primary intracranial smooth muscle neoplasm. Although the determination of whether the lesion is benign or malignant was impossible on histopathological grounds alone, the lack of mitotic figures and mild degree of pleomorphism along with the patient's clinical course strongly support the diagnosis of leiomyoma.

DISCUSSION

Since Kroe et al. reported a 68 year-old woman who had an intrasellar leiomyoma (1), a total of 16 cases of primary intracranial smooth muscle tumor has been described, and the profile of reported cases (2~14) were summarized in Table 1. There were eight males and

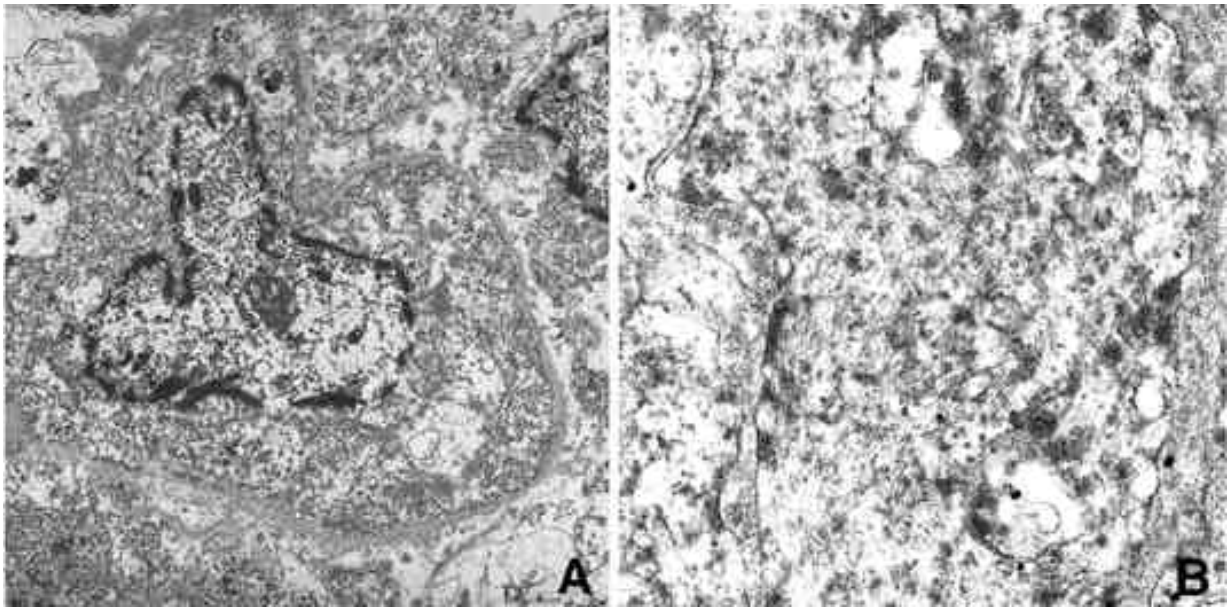

Fig. 3. The ultrastructural findings of more primitive tumor cells show continuous basal lamina surrounding individual cells (A, × 9,000), while small amount of myofilaments along with focal densities and subplasmalemmal dense plaques are seen in more differentiated counterparts (B, ×57,500).

Table 1. Cases of primary intracranial smooth muscle tumor reported in the literature

Case No.	Series (reference)	Age	Sex	Location	Radiological studies	Histology	Treatment	Postoperative course*
1	Kroe et al., 1968	68	F	intrasellar	angio	benign	STR	9 mo, NER
2	Galatioto and Gaddoni, 1971	26	F	cerebellum	–	malignant	–	died after adm before surgery
3	Thierauf and Weiland, 1978	4	F	suprasellar	brain scan CT, angio	benign	STR	?
4	Anderson et al., 1980	35	M	sellar suprasellar	CT, angio PEG	malignant	STR, RT	32 mo, NER
5	Li, 1987	47	M	pineal	CT	malignant	STR	11 mo, died
6	Asai et al., 1988	73	M	dura, T	CT, angio, bone scan	malignant	GTR, RT	discharge, NER
7	Carneiro et al., 1989	9	M	leptomeninx, P paraventricular	CT, angio	myofibro-blastoma	GTR	96 mo, NER
8	Louis et al., 1989	72	F	LV, trigone	CT	malignant	GTR	6 mo, NER
9	Paulus et al., 1991	4	M	?	?	malignant myxoid	?	?
10	ditto	9	M	?	?	malignant	?	?
11	ditto	4	F	?	?	malignant	?	?
12	Kazumoto et al., 1992	38	F	cerebral, T	?	benign	?	?
13	Prayson et al., 1993	70	F	cerebral, O	MRI, angio	myofibro-blastoma	NTR	1 mo, died pulm embolism
14	Janisch et al., 1994	28	F	leptomeninx	MRI	malignant	biopsy	10 days, died
15	Lach et al., 1994	47	M	cerebral, P	CT	angiogenic benign	GTR	48 mo, NER
16	Skullerud et al., 1995	33	M	pineal TE	CT, MRI	malignant	GTR, RT	> 24 mo, NER
17	Wang et al., 1997	12	M	cerebral, T	CT, MRI	benign	GTR	56 mo, NER

* The time of the last follow-up and the oncological status reported are listed.
abbreviations: P, parietal ; T, temporal ; O, occipital ; LV, lateral ventricle ; TE, teratoma ; angio, angiography ; CT, computerized tomography ; PEG, pneumoencephalography ; MRI, magnetic resonance imaging ; STR, subtotal removal ; RT, radiation therapy ; GTR, gross total removal ; NTR, near total removal ; mo, month(s) ; adm, admission ; NER, no evidence of recurrence ; pulm, pulmonary

eight females, and their age ranged from 4 years to 73 years. Five cases were children younger than 16 years. Only three cases were diagnosed to have a benign leiomyoma, while rest were malignant or mixed with other components. The location of the tumor was mentioned in 13 cases, and three of them were located around the sellar area, two at the pineal gland (of these one was from the pineal teratoma), one at the parietal lobe, one at the temporal lobe, one at the occipital lobe, one at the cerebellum, one at the temporal dura, one at the trigone of the lateral ventricle, one at the parietal leptomeninx and near the ventricular wall and the remaining one was of diffuse leptomeningeal leiomyomatosis. In addition to the present case, three lesions were found at the cerebral hemispheric lobes in the literature review.

In categorizing this mesenchymal lesion as a type of smooth muscle neoplasm, the major problem was that the tumor cells were weakly positive to smooth muscle actin and negative to desmin, and these immunohistochemical findings were consistent with ultrastructural findings. The ultrastructural findings can be summarized as follows; a small amount of the filaments with focal densities and subplasmalemmal dense plaques, well developed basal lamina and sparse rough endoplasmic reticulum. Although the findings are not fully conclusive, they have been fairly compatible with the features of primitive or immature smooth muscle cells. Therefore the lesion was classified as leiomyoma.

There are several possible theories related to the origin of primary intracranial smooth muscle tumors. Origin from the embryonic rests (15, 16), neoplastic transformation from the perivascular connective tissue (17~19) and mesenchymal cells (20), derivation from the inner layers of the arachnoid and pia (21) or smooth muscle of the vasculature (1~3, 9) have all been suggested. According to previous reports, the theory of vascular smooth muscle origin were widely accepted. As in the case of Kroe et al. (1), in the present case the tumor was solely composed of cells showing smooth muscle differentiation, and was rich of small vessels compared with ordinary smooth muscle neoplasm of other organs, all of which support the view that vascular smooth muscle cells are the tentative origin of the

primary cerebral leiomyoma.

The clinical presentation of the primary intracranial smooth muscle tumor is mainly neurological deficits. Fever as a clinical presentation of such a tumor has not been reported. The present patient manifested with fever, and although the possibility of concomitant infection as a cause of the fever can not be completely excluded, the disappearance of fever just after the excision of the tumor supports the view that the fever was related to the tumor itself. How the lesion caused the fever still remains unknown.

Louis et al. described the CT findings of their case of intraventricular leiomyosarcoma (10). On CT scan the mass looked like a meningioma. Though the tumors were not of intracranial origin, Haykal et al. noted the computerized tomographic similarity between meningiomas and their two cases of metastatic leiomyosarcoma (22). Buff et al. also emphasized that the CT and MRI characteristics of metastatic leiomyosarcoma are indistinguishable from those of a typical benign meningioma (23). The CT and MRI findings of the present case are similar to those of a typical meningioma though an extensive surrounding edema was noted. It is well known that in some cases of meningioma, there is rather an extensive surrounding edema. However, the intraaxial location of the mass led the authors to other diagnostic possibilities.

In the literature, only two cases have been followed up to the time of death after surgery. Of those, one died of pulmonary embolism. The number of cases with available postoperative outcome is small and the durations of follow-up for the reported cases were short. However, the benign histology of the tumor, radical removal or radiation therapy seemed to be related to favorable results. In the present case, gross total removal was feasible and radiation therapy was reserved for any recurrence which may arise. He is now under close clinical follow-up, and if the tumor recurs, a wider excision and radiation therapy will be adequate choice of treatment.

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