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Multiple Intracranial Seeding of Craniopharyngioma After Repeated Surgery

—Case Report—

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Abstract

A 17-year-old woman presented with a rare case of intracranial seeding of craniopharyngioma after repeated surgery. She initially presented with secondary amenorrhea and visual impairment. Magnetic resonance imaging revealed a suprasellar mass. Subtotal removal of the tumor was performed. The diagnosis was adamantinomatous craniopharyngioma. Seven months later, the patient underwent a second operation for recurrence of the craniopharyngioma. Subsequently, ventriculoperitoneal (VP) shunting and gamma knife surgery were performed. Twenty-seven months after the first operation, multiple cystic lesions were found in the right frontal and temporal lobes. Positive tumor cytology was observed in the cerebrospinal fluid obtained from the VP shunt chamber. These tumors were subtotally resected. However, the patient died from consecutive tumor recurrence 4 years after the initial diagnosis.

Key words: craniopharyngioma, ectopic seeding, MIB-1 labeling index, N-cadherin

Introduction

Craniopharyngiomas are benign maldevelopmental tumors arising from the embryonic squamous cell nests present in an incompletely involuted hypophyseal-pharyngeal duct, the remnants of Rathke's pouch. Such tumors usually originate from the pars tuberalis of the pituitary stalk and extend to the suprasellar and parasellar regions. Complete tumor excision is mandatory for craniopharyngiomas. However, attempted radical excision is associated with morbidity, especially hypothalamic dysfunction.[5,12] Recurrence often occurs at the primary site, whereas ectopic recurrence of craniopharyngioma is extremely rare. We report a case of postoperative seeding of craniopharyngioma with poor outcome.

Case Report

A 17-year-old woman initially presented with secondary amenorrhea, decreased visual acuity, and bitemporal hemianopsia. Magnetic resonance (MR) imaging on admission revealed a suprasellar mass extending into the third ventricle (Fig. 1). Bifrontal craniotomy and subtotal removal of the tumor was performed via a combined right subfrontal and lami-

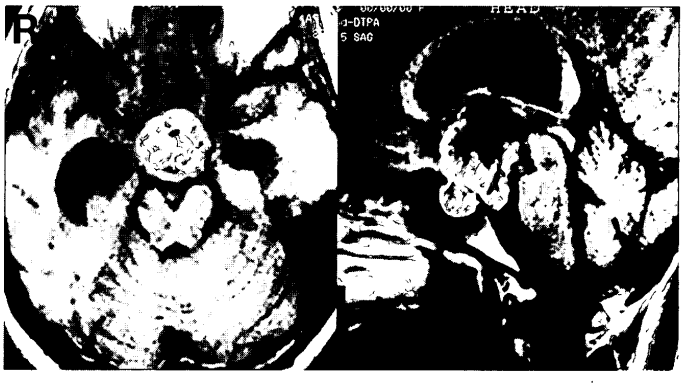

Fig. 1 T_1-weighted magnetic resonance images with gadolinium at the first admission showing a suprasellar mass.

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Fig. 2 T_1-weighted magnetic resonance images with gadolinium after the initial surgery showing residual tumor in the sellar and suprasellar regions.

na terminalis approach. The cystic portion of the tumor within the third ventricle was completely removed after the lamina terminalis was opened. The suprasellar part of the tumor was solid and was resected piece by piece after tearing the covering arachnoid membrane. A part of the tumor firmly attached to the infundibulum was not removed (Fig. 2). Histological examination confirmed the diagnosis of adamantinomatous craniopharyngioma (Fig. 3A). The MIB-1 labeling index of the tumor specimen was 3.0%. Immunohistochemical study showed diffuse expression of N-cadherin in the tumor cells (Fig. 3B). Postoperatively, the patient had transient diabetes insipidus.

Seven months after the initial surgery, the patient complained of appetite loss and nausea. MR imaging showed a recurrent cystic tumor at the suprasellar region. Cyst aspiration and partial removal of the tumor were performed again via the right subfrontal approach. Histological examination revealed an adamantinomatous craniopharyngioma without signs of malignant transformation. The patient developed acute hydrocephalus after the second operation, so a ventriculoperitoneal (VP) shunt was placed. Subsequently, the patient underwent gamma knife radiosurgery with a maximal dose of 23 Gy and marginal dose of 14 Gy for the residual suprasellar tumor.

Twenty-seven months after the first admission, the patient presented with persistent headache. MR imaging revealed multiple cystic lesions in the right frontal and temporal lobes, in addition to the enlarged suprasellar lesion (Fig. 4). Cerebrospinal fluid (CSF) was obtained from the VP shunt valve. Cytological study demonstrated tumor cells in the CSF (Fig. 5). Right temporal craniotomy was added to the bifrontal craniotomy and the tumors were removed. The tumors on the superior and middle temporal

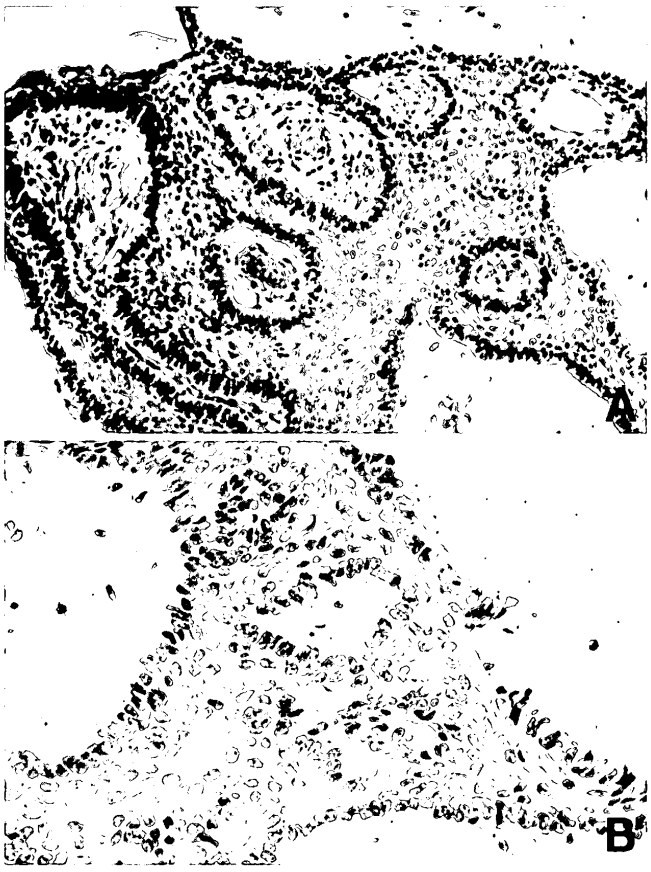

Fig. 3 Photomicrographs of the first surgical specimen. A: A section of tissue obtained from the right frontal lobe showing the typical features of craniopharyngioma, including identical epithelial nests with peripheral palisading and central stellate reticulum. HE stain, ×200. B: Immunohistochemical staining showing diffuse expression of N-cadherin in the tumor cells. ×400.

gyri, and on the frontal lobe could be easily dissected from the gliotic brain tissue, and were totally removed. Marked fibrosis and adhesion were observed in the chiasmatic and carotid cisterns, so the suprasellar tumor was partially resected. Histological examination of these ectopic lesions confirmed the diagnosis of adamantinomatous craniopharyngioma without malignancy (Fig. 6A). The MIB-1 labeling indices of the frontal and temporal masses were 6.2% and 5.1%, respectively. Immunohistochemical staining found focal expression of N-cadherin (Fig. 6B), and no staining for glial fibrillary acidic protein and epithelial membrane antigen. No relapse was observed during the follow-up period of 6 months after the third operation. However, recurrence of the suprasellar mass developed, which gradually increased in size. The patient refused a fourth operation and finally died from recurrence of the original tumor 4 years after the first admission.

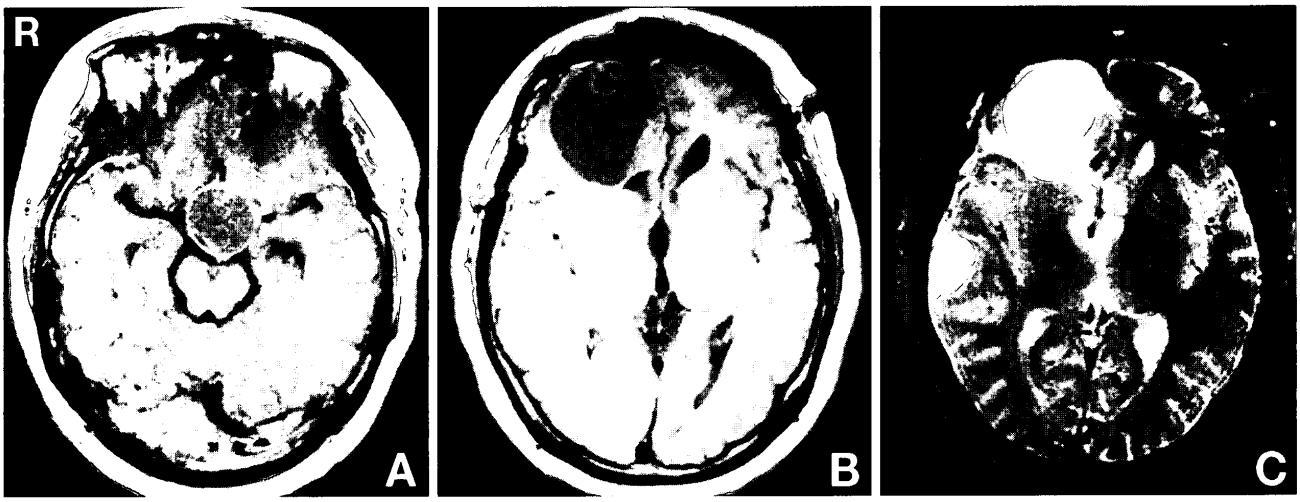

Fig. 4 T_1-weighted magnetic resonance (MR) images with gadolinium (A, B) and T_2-weighted MR image (C) at the third admission showing the right frontal and temporal tumors in addition to the suprasellar tumor.

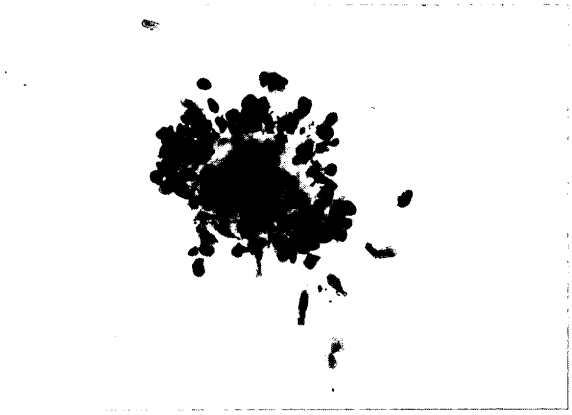

Fig. 5 Cerebrospinal fluid specimen showing clusters of cells with the cytological features of craniopharyngioma. Papanicolaou stain, ×400.

Discussion

Intracranial seeding of craniopharyngioma is extremely rare, with only nine reported cases.[2,3,6-11,15] Five of these cases were related to the surgical route,[2,6,9-11] but the other four cases developed distant from the surgical route: contralateral to the previous craniotomy site, anatomically unrelated to the previous surgical route, in the posterior fossa, and in the spinal canal.[3,7,8,15] In the present case, two ectopic tumors developed. The tumor in the frontal lobe was located along the surgical route but the tumor in the temporal lobe was distant from the craniotomy. Therefore, we consider that intraoperative seeding of the tumor cells was important in the tumor development. Tumor cells were observed in

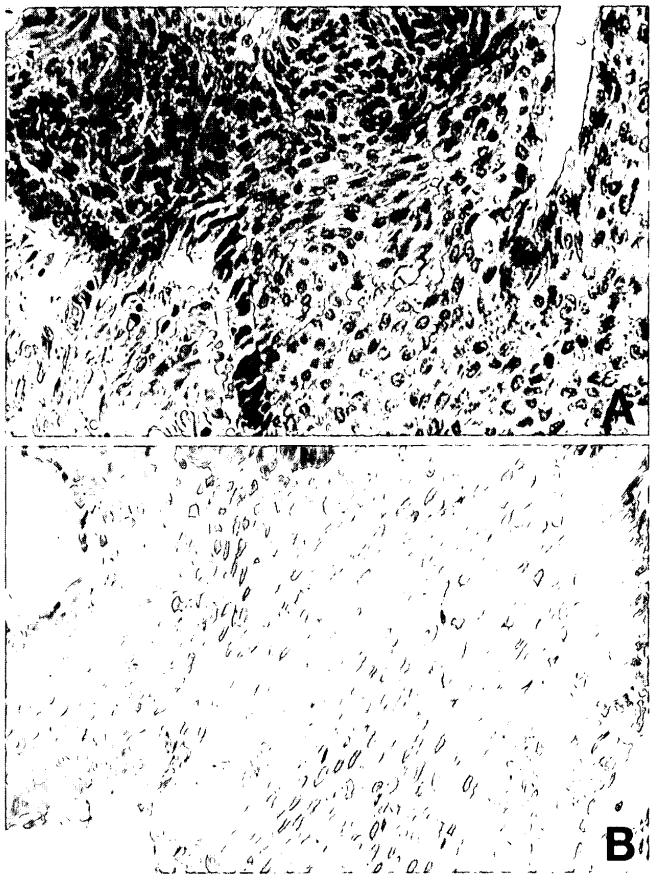

Fig. 6 Photomicrograph of the third surgical specimen. A: A section of tissue obtained from the right frontal lobe showing the typical features of craniopharyngioma. HE stain, ×400. B: Immunohistochemical staining showing focal loss of N-cadherin expression. ×400.

the CSF from the shunt chamber. Although CSF spread was suspected to be important in the pathogenesis of ectopic seeding, no direct evidence of positive CSF cytology had been found. This case clearly demonstrates CSF dissemination based on the positive CSF cytology.

The histological characteristics of ectopic recurrence remain to be elucidated. Histological examination of the 10 known cases including the present case revealed that four were the adamantinomatous type and one was the papillary type. No information was available on the remaining cases. No cases of ectopic seeding accompanied by malignant transformation have been reported. In the present case, high MIB-1 labeling index was observed in the initial tumor and was even higher in the recurrent tumors despite the microscopic findings of malignant transformation in the tumors. Therefore, we speculate that high proliferating potential was the main cause of the consecutive recurrence and the poor outcome in our patient. In addition, the diffuse N-cadherin expression observed in the original craniopharyngioma contrasted with focal loss of N-cadherin expression in the ectopic tumors. These findings have never been described in previous cases of ectopic craniopharyngioma. Decreased expression of N-cadherin was detected at recurrence or dissemination in patients with glioblastoma.[1,4,13,14] We speculate that in addition to the increased proliferating potential, focal loss of N-cadherin expression was important in the process of tumor cell detachment, ultimately resulting in dissemination and ectopic tumor formation. The present patient had undergone two operations before the ectopic tumors developed. It is difficult to decide which operation had most influence on the ectopic tumor formation. However, the first operation was more radical than the second operation. In addition, the tumor was removed piece by piece in the first operation. We assume that the first operation might have influenced the ectopic tumor formation.

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