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Myxopapillary Ependymoma in the Third Ventricle Area and Sacral Canal: Dropped or Retrograde Metastasis?

—Case Report—

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Abstract

Myxopapillary ependymoma (MPE) is a rare type of central nervous system neoplasm mostly located in the cauda equina and filum terminale regions. A previously healthy 22-year-old Chinese man presented with the first case of MPE in the third ventricle area and sacral canal initially manifesting as spinal cord compression. The patient was admitted with pain in the right lower extremity for 5 months and encopresis for 3 months. Magnetic resonance imaging of the lumbar spine revealed an intradural lesion at the S2 level. The patient accordingly underwent lumbar laminectomy surgery and gross total resection of the tumor. Shortly after surgery, a mass was found in the third ventricle. The patient subsequently underwent further craniotomy surgery, and the histopathological examination eventually revealed MPE. MPE usually undergoes intracranial retrograde metastasis, but we consider that our case was a dropped metastasis of the primary intracranial MPE. Neurosurgeons need to be aware of intracranial MPEs in patients with isolated spinal lesions, and long-term follow-up is important in patients who are diagnosed with MPE after surgical excision.

Key words: myxopapillary ependymoma, retrograde metastasis

Introduction

Myxopapillary ependymoma (MPE) is a rare type of central nervous system neoplasm and is a variant of ependymoma, so is mainly located in the cauda equina and filum terminale regions. MPE is a benign tumor but has various growth patterns and metastatic modes. We report a rare case of concomitant localization of MPE in the third ventricle area and sacral canal, and discuss the diagnosis and treatment of MPE.

Case Report

A previously healthy 22-year-old man was admitted to our hospital in December 2009 with a history of pain in the right lower extremity for 5 months and encopresis for 3 months. Neurological examination was unremarkable with no focal neurological, endocrinological, cognitive, or visual function deficits. Computed tomography (CT) and magnetic resonance (MR) imaging of the lumbar vertebra revealed an intradural lesion at the S2 level, which was enhanced after administration of contrast medium (Figs. 1 and 2). The lesion was initially thought to be a schwannoma or an atypical spinal tumor, so the patient underwent open surgery consisting of a lumbar laminectomy from S1 to S4. On opening the dura, the tumor appeared as a soft, grayish-pink, and highly vascularized mass measuring about 3.5 × 2.0 × 1.5 cm. The tumor was strongly adhered to the cauda equina and filum terminale, and surrounded by an incomplete capsule. Gross total resection was performed and the patient recovered without neurological deficits. To our surprise, histological examination found that the tumor cells were arranged in lamellae, with gravel-like formations, and partly showed ependymal differentiation (Fig. 3A, B). Immunohistochemical stain-

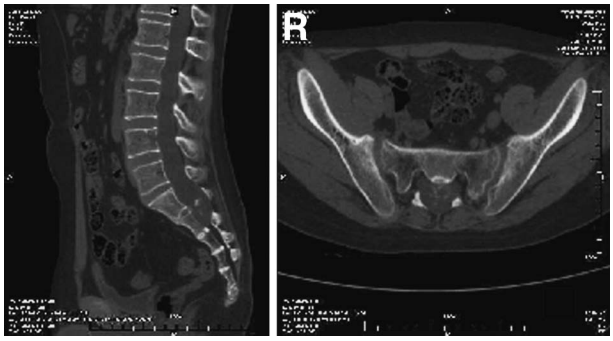

Fig. 1 Sagittal (*left*) and transaxial (*right*) computed tomography scans showing an intradural mass at the S2 level as isointense with calcification.

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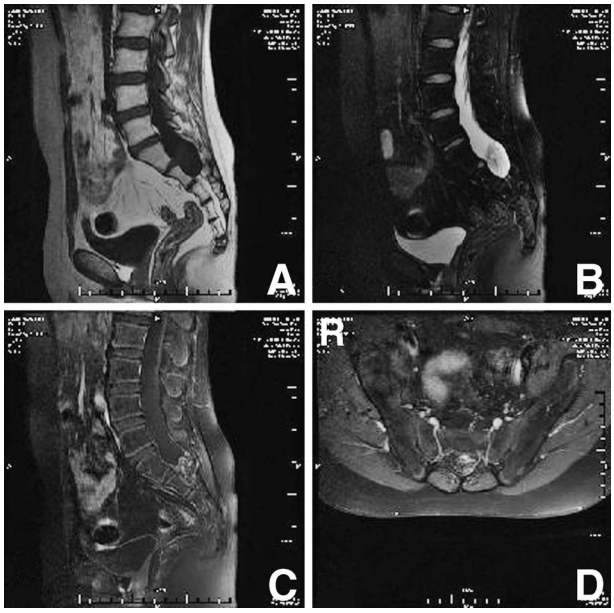

Fig. 2 Magnetic resonance images showing the lesion as slightly hypointense on the T_1-weighted image (A), and slightly hyperintense on the T_2-weighted image (B) at the S2 level, and obvious homogeneous enhancement with contrast medium on sagittal (C) and transaxial (D) T_1-weighted images.

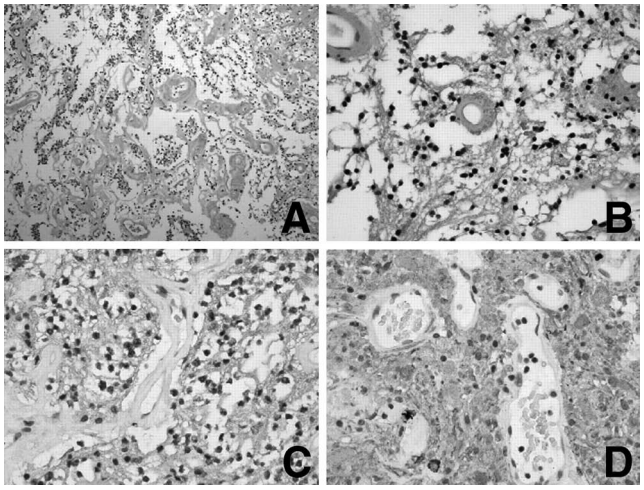

Fig. 3 A, B: Photomicrographs of the resected tumor specimens revealing the tumor cells with lamellar arrangement, with gravel body formation. Hematoxylin and eosin stain, original magnifications A: ×100, B: ×400. C, D: Immunohistochemical staining demonstrating the tumor cells positive for S-100 protein (C) and glial fibrillary acidic protein (D). Original magnifications C: ×400, D: ×400.

ing demonstrated that the tumor cells were positive for glial fibrillary acidic protein (GFAP) and S-100 protein (Fig. 3C, D), and negative for cytokeratin, chromogranin A, and epithelial membrane antigen (EMA). Therefore, the histopathological findings suggested that the tumor originated from glial cells.

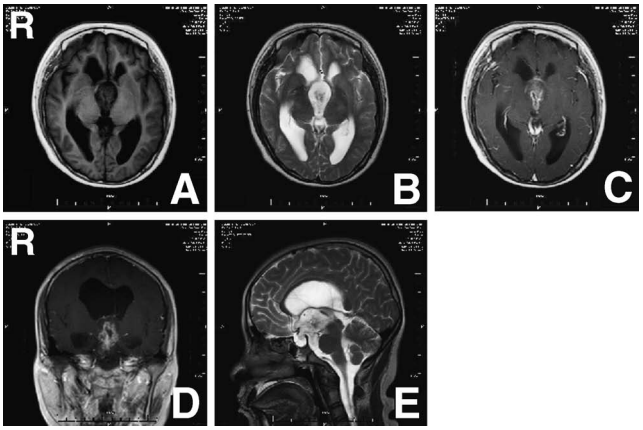

Fig. 4 Magnetic resonance images showing the lesion as slightly hypointense on the T_1-weighted image (A), slightly hyperintense on the T_2-weighted images (B, E) with severe hydrocephalus in the third ventricle, and obvious inhomogeneous enhancement with contrast medium on transaxial (C) and coronal (D) T_1-weighted images.

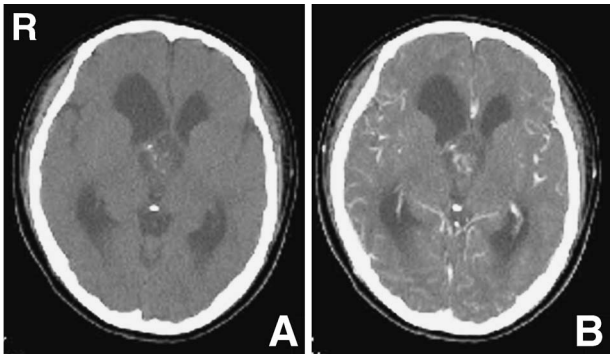

Fig. 5 Computed tomography scans showing the mass as mixed signal with fine calcification in the third ventricle (*left*) and slightly enhanced after administration of contrast medium (*right*).

Given that primary spinal cord glioma is rare, especially in the cauda equina and filum terminale regions, the patient underwent further investigations, including MR imaging of the brain, cervical, and thoracic spine, which identified a 3.0 × 3.0 cm mass in the third ventricle, appearing as slightly hypointense on T_1-weighted images and hyperintense on T_2-weighted images with severe hydrocephalus (Fig. 4). CT showed fine calcification (Fig. 5). Accordingly, the patient underwent a craniotomy via the transcallosal interforniceal approach, and a soft, grayish-pink mass was found in the third ventricle. Histological examination showed the same findings as those of the first operation, indicating that the tumors in the third ventricle and in the sacral canal were homologous and that the final diagnosis was MPE. Although the patient presented postoperatively with severe symptoms of hypothalamus injury, such as hyperpyrexia, diabetes insipidus, and electrolyte disturbances, the patient for-

tunately had recovered by the end of the 2-month treatment.

Discussion

Ependymoma is one of the least common central nervous system neoplasms, and is usually seen in children and young adults. MPE was first described as a variant of ependymoma by Kernohan in 1932.[8] MPE is usually located in the cauda equina and filum terminale regions, and characterized by the production of mucin and formation of papillae. Generally, MPE is a slow-glowing tumor and is designated histologically as grade I neoplasm according to the 2007 World Health Organization classification.[13] However, despite this benign character, dissemination and metastasis along the cerebrospinal axis and metastasis to distant sites have occasionally been reported.[1,3,4]

In our case, the sacral canal tumor was detected at first presentation, in association with a concurrent lesion in the third ventricle. This concomitant localization of MPEs in the third ventricle and sacral canal is extremely rare. Indeed, without preoperative brain imaging, we cannot determine whether our case was a spinal MPE with retrograde metastasis, or a dropped metastasis of the primary intracranial MPE. Nonetheless, by comparing the previously reported cases of spinal MPE with intracranial metastasis (Table 1) and primary intracranial MPE (Table 2), we favor the theory that our case was a dropped metastasis. Firstly, primary intracranial ependymoma deposits commonly travel to the spinal cord via the

Table 1 Reported cases of primary spinal myxopapillary ependymoma with intracranial metastasis

Author (Year)	Age (yrs), Sex	Primary site	Primary treatment	Sites of intracranial metastases
Slooff et al. (1964)[21]	14, M	cauda equina	STR + RT	medulla oblongata
Chan et al. (1984)[3]	9, M	filum terminale	CR	third and lt lateral ventricles, hypothalamus, suprasella
	9.5, M	filum terminale	CR	suprasellar
Davis and Barnard (1985)[4]	40, M	cauda equina	CR + RT	lt frontal lobe
	46, M	L3-L4	STR	rt cerebellum
	26, M	L2 to sacral canal	STR	rt cerebellum
Yücesoy et al. (2001)[27]	54, M	cauda equina, filum terminale	STR	intraaxial
Fassett et al. (2005)[6]	13, F	T11–L2	GTR	suprasellar and fourth ventricle
Higgins et al. (2005)[7]	36, F	T4–L1, L4–S2, cauda equina	STR + RT	lt CPA, prepontine and suprasellar cisterns, fourth ventricle, rt internal auditory canal, adjacent to medulla
Al-Hussaini and Herron (2005)[1]	61, M	lumbosacral	STR	fourth, lateral, and third ventricles
Plans et al. (2006)[15]	23, M	L4–S2	STR + RT	near infundibular recess of the third ventricle
Mridha et al. (2007)[14]	13, M	T2–L5	GTR	bil CPA
Schittenhelm et al. (2008)[19]	20, M	thoracic spine (multiple)	STR + RT	lt frontal lobe, third ventricle, bil CPA
	30, M	L4–S1	STR + RT	third ventricle, foramen magnum, lower cervical canal, multiple smaller spinal metastases

bil: bilateral, CPA: cerebellopontine angle, CR: complete resection, F: female, GTR: gross total resection, lt: left, M: male, rt: right, RT: radiotherapy, STR: subtotal resection.

Table 2 Reported cases of primary intracranial myxopapillary ependymoma

Author (Year)	Age (yrs), Sex	Primary site	Sites of metastases
Sato et al. (1983)[18]	29, M	rt lateral ventricle	—
Maruyama et al. (1992)[11]	8, F	rt occipital lobe	—
Warnick et al. (1993)[25]	37, F	lateral ventricle	—
Woesler et al. (1998)[26]	37, M	suprasellar	multiple spinal tumors
Matyja et al. (2003)[12]	37, M	rt lateral ventricle	—
Ralte et al. (2004)[16]	22, M	lt temporal lobe	—
Tseng et al. (2004)[23]	7, F	fourth ventricle	—
	20, F	bil cerebral falx	—
Tzerakis et al. (2004)[24]	68, M	lt frontal lobe	—
Lim and Jang (2005)[10]	62, F	fourth ventricle	—
Sparaco et al. (2009)[22]	30, M	lt CPA	—
DiLuna et al. (2010)[5]	8, M	medulla	—
Shaper et al. (2011)[20]	40, M	rt CPA	T8, conus medullaris, filum terminale
Chakraborti et al. (2012)[2]	50, F	fourth ventricle	—

bil: bilateral, CPA: cerebellopontine angle, F: female, lt: left, M: male, rt: right.

cerebrospinal fluid pathway, and 14 cases of primary intracranial MPE have been reported. In these cases, only two cases had metastases.[20,26] Therefore, primary intracranial MPE is likely to drop to the spine. Secondly, in our case, the isolated large mass was found in the third ventricle very shortly after the first surgery, which was not found in any previous case of spinal MPE with intracranial metastasis. Most previous patients presented with intracranial metastases a long time after the surgery for spinal MPE, because MPE is a low-grade tumor with slow growth. Intracranial metastases were diagnosed shortly after the initial primary spinal MPE diagnosis in 2 previous cases, like in our case, but these intracranial lesions were multiple not isolated.[19,27] Isolated large intracranial mass could not cause retrograde dissemination of spinal MPE shortly after the surgery. Of course, without direct clinical evidence, there is a third hypothesis of multi-centric occurrence, without metastases. However, a coincidence like this is extremely unlikely. In any case, MPE is a rare central nervous system neoplasm with various growth patterns and metastatic modes. If our case was a primary intracranial MPE, this would be only the fifteenth case of primary intracranial MPE, the first case of primary MPE in the third ventricle, and the third case of primary MPE with spinal metastasis.

The clinical manifestations of MPE are similar to those of other intracranial and spinal tumors. However, some patients can tolerate the compression effect of the tumor without any obvious discomfort due to its slow growth. CT and MR imaging findings of intracranial MPE usually demonstrate a well-demarcated solid tumor, so only provide indirect evidence for MPE diagnosis, and the calcification on CT imaging in our case has not been reported before. The cytological and histological diagnoses are determinative and the cytological features of MPE include myxoid background, hyaline globules, papillary structures, perivascular pseudorosettes, andothers.[9] Positive staining for GFAP,[2,20] S-100 protein,[2,19] and vimentin[6,10] has been reported in some MPEs. In our case, the tumor cells were positive for GFAP and S-100 protein. EMA staining has been reported to be focal,[1] faintly positive,[18] or negative[2] in MPE, but staining for EMA was not found in our case. The optimal management of MPE is complete resection, but surgical procedures may facilitate spread of metastases. Radiation therapy may be suitable for recurrence or for a number of small lesions with malignant behavior, but the effects of adjuvant radiation remain controversial.[17]

The present case demonstrated that MPE may have various growth patterns or metastatic modes. We consider our case to be a dropped metastasis of primary intracranial MPE. We recommend that neurosurgeons be aware of the possibility of intracranial lesions in patients with isolated spinal MPE, and stress that long-term follow up of patients with MPE is important after surgical excision. Finally, research is necessary to further treatments for intracranial and spinal MPEs.

Conflicts of Interest Disclosure

The authors have no personal financial or institutional interest in any of the drugs, materials, or devices in the article.

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