Metastatic Adenocarcinoma of the Dura Mimicking Petroclival Meningioma

—Case Report—

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Abstract

A 27-year-old female presented with gait disturbance and left facial paresthesia. She had a history of breast and lung masses not yet identified. Magnetic resonance (MR) imaging revealed a tumor suggesting a petroclival meningioma. Her symptoms worsened rapidly. MR imaging showed enlargement of the tumor. Subtotal removal of the tumor was performed. Histological examination revealed metastatic adenocarcinoma. Examination of the other masses confirmed adenocarcinoma originating from lung carcinoma. Dural metastases can be difficult to preoperatively differentiate from meningioma clinically or radiographically. MR spectroscopy and laboratory examinations such as cytologic and serologic studies are valuable for differential diagnosis. The final diagnosis of the tumor depends on the histological findings. However, careful monitoring of the patient's course is very important to detect rapid growth of metastases.

Key words: dural metastasis, meningioma, adenocarcinoma, magnetic resonance spectroscopy, immunohistochemistry

Introduction

Various diseases have clinical and radiographical presentations that mimic meningiomas, and may be difficult to differentiate from meningiomas preoperatively. Several types of dural lesions can mimic meningiomas, including solitary fibrous tumors, gliosarcomas, leiomyosarcomas, hemangiopericytomas, melanocytomas, Hodgkin's disease, plasmacytomas, inflammatory pseudotumors, neurosarcoidosis, plasma cell granuloma, Rosai-Dorfman disease, Castleman disease, xanthomas, rheumatoid nodules, and tuberculomas.⁹⁾ Dural metastatic tumors may also present with radiographic similarities to meningiomas.^{7,19)}

We treated a young female with a dural mass lesion that was initially considered to be a petroclival meningioma but was finally identified as a metastatic adenocarcinoma originating from the lung.

Case Report

A 27-year-old female presented at the emergency

room complaining of headache and left facial paresthesia with gait disturbance persisting for one month. Computed tomography (CT) showed an isodense mass at the left petroclival region with almost homogeneous hyperdense enhancement. Her symptoms improved with steroid therapy. The patient was admitted to our hospital for further examination 6 days later.

Neurological examination revealed left facial paresthesia and slight right hemiparesis. Her past history included a right mammary mass, which had been followed as a fibroadenoma for 3 months prior to admission, and an abnormal shadow in the right lung, which was believed to be atelectasis but had not been followed up for 6 months. Both T₁-weighted and T₂-weighted magnetic resonance (MR) imaging showed the petroclival tumor as isointense compared with the cerebral cortex, and the mass measured 2.0 × 3.0 × 4.0 cm. There was slight edema of the left brain stem. The mass was almost homogeneously enhanced after intravenous injection of gadolinium-diethylene triamine penta-acetic acid. Digital subtraction angiography showed a tumor stain fed by the left meningohypophyseal trunk (Fig. 1). The clinical impression at this point suggested a meningioma.

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Fig. 1 Digital subtraction angiogram with left internal carotid artery injection on admission showing the meningo-hypophyseal trunk (arrow) feeding the petroclival tumor.

Fig. 2 T₁-weighted magnetic resonance (MR) image with gadolinium-diethylene triamine penta-acetic acid performed 3 weeks after admission, showing tumor growth to 2.5 × 3.5 × 4.2 cm.

The patient was discharged and readmitted for surgery one week later. She presented with left facial paresthesia, left fourth and left eighth cranial nerve pareses, and right severe hemiparesis. Her level of consciousness was dull, with a Glasgow Coma Scale score of 14. Repeat MR imaging performed 3 weeks after the previous imaging revealed the tumor had grown to 2.5 × 3.5 × 4.2 cm (Fig. 2).

Microsurgical resection of the tumor was performed via the anterior petrosal approach. Most of the tumor was located in the infratentorium. The

Fig. 3 A: Photomicrograph of the petroclival tumor showing nests of epithelial cells with round nuclei, partially forming papillary and ductal structures. HE stain, ×100. B: Photomicrograph of the petroclival tumor showing immunopositivity for cytokeratin 7. ×400.

tumor was attached from the base of the tentorium to the upper clivus. The tumor was strongly adherent to the pons and peduncle and encased the superior cerebellar artery, so could not be resected around these sites. The fifth and sixth cranial nerves were compressed and were preserved, but the fourth cranial nerve, which was encased by the tumor, was sacrificed. The tumor looked like meningioma except for its cauliflower appearance, so was impossible to differentiate from meningioma during the operation.

Histological examination showed nests of epithelial cells with round nuclei, partially forming papillary and ductal structures (Fig. 3A). No enlargement of the nucleoli was observed, and few mitoses were detected. Immunohistochemical examination revealed neoplastic cells positively stained for cytokeratin (Fig. 3B) and negatively for S-100

Table 1 Primary cancers in patients with metastatic tumors to the dura

Author (Year)	Surgical case series		Autopsy case series	
	Rumana et al. (1998) ¹⁴⁾	Kleinschmidt-De Masters (2001) ¹⁰⁾	Kleinschmidt-De Masters (2001) ¹⁰⁾	Posner and Chernik (1978) ¹²⁾
Study period	1993–1996	1990–2000	1982–1999	1970–1976
Total no. of patients	22	33	27	105
Breast	5 (22.7%)	6 (18.2%)	5 (18.5%)	23 (21.9%)
Lung, adenocarcinoma	4 (18.2%)	3* (9.1%)	1 (3.7%)	6* (5.7%)
Lung, others	2 (9.1%)		2 (7.4%)	
Renal cell	2 (9.1%)	2 (6.1%)	0	1 (1.0%)
Melanoma	2 (9.1%)	8 (24.2%)	1 (3.7%)	5 (4.8%)
Prostate	ND	1 (3.0%)	7 (25.9%)	13 (12.4%)
Lymphoma	ND	3 (9.1%)	2 (7.4%)	17 (16.2%)
Others	7 (31.8%)	10 (30.3%)	9 (33.3%)	40 (38.1%)

*Total cases of lung tumors including adenocarcinoma and others. ND: not described.

protein. MIB-1-positive staining was detected in 9.5% of the cells.

The postoperative course was uneventful, and the patient's symptoms improved gradually. Although the fourth cranial nerve had been sacrificed, fourth cranial nerve paresis was not detected. She underwent conventional radiation and fractionated radiosurgery for the residual tumor.

Chest CT was performed to examine the abnormal shadow in the right lung, and revealed a right lung mass. The patient underwent biopsy of the right breast and right lung masses. The immunohistochemical diagnosis of the lung mass was adenocarcinoma of lung origin. The brain and breast tumors had a similar appearance to the lung adenocarcinoma. Presumably the lung adenocarcinoma had metastasized to the brain and right breast. The patient was transferred to another hospital and underwent systematic chemotherapy. No new symptoms appeared and MR imaging of the head performed 6 months later did not reveal regrowth of the metastatic brain tumor.

Discussion

The present patient had a tumor that was initially considered to be a petroclival meningioma, but the final diagnosis was metastatic adenocarcinoma originating from the lung. Dural metastatic tumors are fairly common (Table 1).^{10,12,14)} The primary tumor varies with the dates of the series and the establishment of the diagnosis at surgery or autopsy. Recent studies have found unusual tumors, such as carcinoma of the colon, endometrium, cervix, and stomach, laryngeal squamous cell carcinoma, adenosquamous carcinoma of the bladder, intravas-

cular lymphomatosis, Ewing sarcoma, ocular melanoma, and germ cell adenocarcinoma.^{10,14)}

In Japan, only 0.8% of intracranial metastatic tumors occur in the cerebellopontine angle, and metastatic tumors are responsible for only about 1% of all cerebellopontine angle tumors.³⁾ Although petroclival tumors may be reported as cerebellopontine angle tumors, petroclival tumors are very rare, with only two reported cases.^{6,18)} The primary tumors were adenocarcinomas of the breast⁶⁾ and thyroid.¹⁸⁾ In our case, the primary tumor was an adenocarcinoma of the lung, which is a common tumor, but the location of the metastasis to the petroclival region is very rare.

MR imaging and angiography sometimes show similar findings for metastatic tumors and meningiomas, so metastatic tumors from meningiomas are difficult to differentiate using CT, MR imaging, or angiography.^{2,5,11,13,15)} Previously dural tail sign was reported to be specific for meningiomas,⁴⁾ but is now considered to be nonspecific and may be associated with other dural-based lesions.^{13,15,19)} MR spectroscopy may be valuable for the differential diagnosis of dural metastatic tumors and meningiomas prior to embolization because a pattern of lipid and/or lactate signals are only observed in the metastatic tumors.¹⁾ On the other hand, the use of MR spectroscopy is limited to very large metastases in the differential diagnosis of dural metastatic tumors and meningiomas prior to embolization.¹⁶⁾ Laboratory examinations such as cytologic study of the cerebrospinal fluid and serologic study can help to differentiate between meningiomas and metastatic tumors.⁸⁾

Ultimately, the diagnosis of the tumor relies on the histological findings. In our case, immunoreactivity

to cytokeratin 7, thyroid transcription factor-1, and surfactant proapoptin were found, whereas mammary globulin transcript was absent, so the diagnosis of the lung tumor was adenocarcinoma of lung origin. The brain and breast tumors in our patient had a similar appearance to the lung adenocarcinoma and so were considered to be metastatic tumors from the lung adenocarcinoma.

In our case, the MR imaging and angiography findings suggested meningioma, but repeat MR imaging performed 3 weeks later revealed tumor growth, and the patient's symptoms rapidly worsened, indicating that metastatic tumor was one of the most likely diagnoses. Therefore, observation of the patient's course is very important. Our patient had to undergo surgery for the brain tumor before further examinations of her lung and breast could be completed.

Most dural metastatic tumors are associated with adjacent primary or secondary tumors of the skull or soft tissues of the head and neck, and hematogenous metastases along the meningeal arteries can also cause dural involvement.¹⁷⁾ In our case, such hematogenous metastases along the meningeal artery to the dura could have been present.

References

- 1) Bendszus M, Warmuth-Metz M, Burger R, Klein R, Tonn JC, Solymosi L: Diagnosing dural metastases: the value of 1H magnetic resonance spectroscopy. *Neuroradiology* 43: 285-289, 2001
- 2) Buff BL, Schick RM, Norregaard T: Meningeal metastasis of leiomyosarcoma mimicking meningioma: CT and MR findings. *J Comput Assist Tomogr* 15: 166-167, 1991
- 3) The Committee of Brain Tumor Registry of Japan: Report of Brain Tumor Registry of Japan (1969-1996). *Neurol Med Chir (Tokyo)* 43 (Suppl): 17-18, 2003
- 4) Goldsher D, Litt AW, Pinto RS, Bannon KR, Kricheff II: Dural "tail" associated with meningiomas on Gd-DTPA-enhanced MR images: Characteristics, differential diagnostic value, and possible implications for treatment. *Radiology* 176: 447-450, 1990
- 5) Higuchi M, Fujimoto Y, Miyahara E, Ikeda H: Isolated dural metastasis from colon cancer. *Clin Neurosurg* 99: 135-137, 1997
- 6) Hirota N, Fujimoto T, Takahashi M, Fukushima Y: Isolated trigeminal nerve metastases from breast cancer: an unusual cause of trigeminal mononeuropathy. *Surg Neurol* 49: 558-561, 1998
- 7) Huang PS, Oz M: Malignant carcinoid tumor metastatic to the dura mater simulating a meningioma. *Neurosurgery* 29: 449-452, 1991
- 8) Huang TW, Young YH: Differentiation between cerebellopontine angle tumors in cancer patients. *Otol Neurotol* 23: 975-979, 2002
- 9) Johnson MD, Powell SZ, Boyer PJ, Weil RJ, Moots PL: Dural lesions mimicking meningiomas. *Hum Pathol* 33: 1211-1226, 2002
- 10) Kleinschmidt-De Masters BK: Dural metastases. A retrospective surgical and autopsy series. *Arch Pathol Lab Med* 125: 880-887, 2001
- 11) Morioka T, Matsushima T, Ikezaki K, Nagata S, Ohta M, Hasuo K, Fukui M: Intracranial adenoid cystic carcinoma mimicking meningioma: report of two cases. *Neuroradiology* 35: 462-465, 1993
- 12) Posner JB, Chernik NL: Intracranial metastases from systemic cancer. *Adv Neurol* 19: 579-592, 1978
- 13) Quint DJ, McGillicuddy JE: Meningeal metastasis of the cerebellopontine angle demonstrating "dural tail" sign. *Can Assoc Radiol J* 45: 40-43, 1994
- 14) Rumana CS, Hess KR, Shi WM, Sawaya R: Metastatic tumors with dural extension. *J Neurosurg* 89: 552-558, 1998
- 15) Senegor M: Prominent meningeal "tail sign" in a patient with a metastatic tumor. *Neurosurgery* 29: 294-296, 1991
- 16) Sijens PE, van Dijk P, Oudkerk M: Correlation between choline level and Gd-DTPA enhancement in patients with brain metastases of mammary carcinoma. *Magn Reson Med* 32: 549-555, 1994
- 17) Takahashi JA, Llena JF, Hirano A: Pathology of cerebral metastases. *Neurosurg Clin N Am* 7: 345-367, 1996
- 18) Takami T, Ohata K, Tsuyuguchi N, Mao Y, Inoue Y, Wakasa K, Hara M: Cavernous sinus metastasis from thyroid papillary adenocarcinoma. *J Clin Neurosci* 9: 598-600, 2002
- 19) Toye R, Jeffree MA: Metastatic bronchial adenocarcinoma showing the "meningeal sign": case note. *Neuroradiology* 35: 272-273, 1993

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