Solitary Metastatic Tumor Within the Optic Chiasm

—Case Report—

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Abstract

A 61-year-old female, previously treated for lung cancer, presented with a rare case of metastasis directly to the optic chiasm manifesting as visual deficits. Magnetic resonance imaging revealed a suprasellar mass similar to an optic glioma. At surgery, the optic chiasm appeared swollen with hypervascularity over the surface. The bilateral optic nerves and the pituitary stalk appeared normal. A small incision was made on the superior surface of the chiasm and biopsy specimens were taken. The histological diagnosis was adenocarcinoma, which was consistent with the primary lung cancer. She received whole brain irradiation, resulting in mild improvement of her vision. Suprasellar metastatic tumors to the pituitary gland, pituitary stalk, and hypothalamus are well documented, but solitary metastasis within the optic chiasm should be considered as one of several differential diagnoses of suprasellar tumors, in patients with or without a history of treated cancer.

Key words: brain metastasis, optic chiasm, suprasellar tumor, lung cancer, optic glioma

Introduction

Metastasis to the pituitary gland, particularly from lung and breast cancers, is quite common, and usually manifests as diabetes insipidus, anterior pituitary dysfunction, visual field defects, headache, and ophthalmoplegia.⁵⁾ Visual dysfunction due to suprasellar extension from pituitary metastases is known, whereas visual dysfunction due to metastasis directly to the optic chiasm is rare. We present a case of solitary metastasis within the optic chiasm.

Case Report

A 61-year-old woman presented with progressive deterioration of her vision for 2 months. She had undergone surgical excision and local radiotherapy for a lung adenocarcinoma one year previously. General physical examination was unremarkable. Neurological examination revealed a fully alert and cooperative patient except for the visual dysfunction. Ophthalmological examination revealed decreased visual acuity in both eyes and incomplete bitemporal hemianopsia (Fig. 1). Magnetic resonance (MR) imaging revealed a 1.0×0.8 cm suprasellar mass separate from the pituitary gland that was slightly hypointense on T₁-weighted imaging and hyperintense on T₂-weighted imaging, with homogeneous enhancement after gadolinium administration (Fig. 2A–C). The preoperative MR imaging appearance was similar to that of optic glioma. The sellar turcica was normal, and the posterior lobe

Fig. 1 Ophthalmological examination revealing incomplete bitemporal hemianopsia. Left: left eye, right: right eye.

of the pituitary gland remained hyperintense on sagittal T₁-weighted imaging (Fig. 2D). Angiography showed no vascular-rich tumor. Her pituitary gland function was normal, except for mildly elevated serum prolactin level. Her level of carcinoembryonic antigen, a tumor marker of adenocarcinoma, was within the normal range. Our preoperative diagnosis was optic glioma or metastatic tumor.

Surgery was performed through a right trans-sylvian approach to explore the suprasellar lesion. The optic chiasm appeared markedly enlarged and showed hypervascularity over the surface (Fig. 3A). Both optic nerves and the pituitary stalk also appeared normal. A small incision was made in the superior surface of the chiasm, and biopsy specimens were taken (Fig. 3B). Histological examination revealed adenocarcinoma, indicating a metastatic tumor originating from non-recurrent lung cancer (Fig. 4).

Fig. 2 (A) Preoperative coronal T₁-weighted magnetic resonance (MR) image revealing a slightly hypointense suprasellar mass. (B) Coronal T₂-weighted MR image revealing a hyperintense mass. (C) Coronal T₁-weighted MR image with gadolinium revealing a homogeneous enhanced mass in the suprasellar region. (D) Sagittal T₁-weighted MR image revealing a suprasellar mass distinct from the normal pituitary gland and stalk.

Fig. 3 (A) Intraoperative photograph revealing the markedly enlarged chiasm with hypervascularity over the surface (arrow) and normal optic nerve. (B) Intraoperative photograph showing a small incision made in the superior surface of the chiasm to take biopsy specimens. Asterisk: right anterior cerebral artery, rt ICA: right internal carotid artery, rt ON: right optic nerve.

Fig. 4 (A) Photomicrograph of the lung cancer revealing papillary-like structures of the adenocarcinoma. Hematoxylin and eosin stain, $\times 100$. (B) Photomicrograph of the brain metastasis revealing the same pathological appearance as the lung cancer. Hematoxylin and eosin stain, $\times 100$.

Postoperatively, she did well with no new deficits. Postoperative MR imaging revealed a new small mass in the cerebellum. She received 30 Gy whole brain irradiation over 2 weeks, resulting in mild improvement of her vision. She did well without neurological deterioration for 18 months. However, visual acuity of her right eye gradually worsened, resulting in blindness due to regrowth of the optic chiasm metastasis without new lesions. She died of progressive systemic cancer 32 months after the diagnosis of brain metastasis.

Discussion

Only nine cases of metastasis to the optic chiasm have been reported: eight cases of metastasis indirectly to the optic chiasm,^{3,9,13,14} and one case of metastasis directly to the optic chiasm.¹ All patients presented with visual deficits such as visual acuity deterioration and bitemporal hemianopsia, and two patients also had hormonal insufficiency. Optic chiasm metastasis was identified in three autopsy cases with multiple brain metastases,¹⁴ and three cases of chiasmal syndrome due to suprasellar metastasis were reported without revealing the precise region of metastasis.³ One case of optic chiasm metastasis was found expanding the infundibulum and infiltrating the hypothalamus,⁹ and one case of metastasis in the pituitary gland extending to the chiasm.¹³ A solitary metastasis in the optic chiasm was identified during surgery.¹ Therefore, including our case, only two cases of solitary metastasis directly to the optic chiasm have been found (Table 1). In the present case, preoperative MR imaging demonstrated the solitary metastasis within the optic chiasm, which was confirmed during surgery.

Three mechanisms have been suggested for optic chiasm metastasis: hematogenous spread of tumors; infiltration of the chiasm by tumor cells from nearby structures, mainly the pituitary gland; and dissemination or drop metastasis from cerebrospinal fluid (CSF) spread.^{1,3,14} Vascular support of the optic chiasm is derived primarily from the caudal side, via small branches of the anterior cerebral artery and the anterior communicating artery. The arteries are often in direct contact with the chiasm.⁸ In the present case, MR imaging found no lesions in nearby structures such as the pituitary gland, stalk, and hypothalamus. The intraoperative findings also revealed that the pituitary stalk was normal, and the clinical symptoms included only visual dysfunction, and not diabetes insipidus or hypopituitarism. No meningeal carcinomatosis was observed during the clinical course. Therefore, hematogenous spread of tumor directly to the optic chiasm is the most likely mechanism of metastasis in our case. The same mechanism was considered in the previous case,¹ but infiltration from metastasis of nearby structures or dissemination from the CSF spread may have occurred in the other cases of optic chiasm metastasis.^{3,9,13,14}

The differential diagnoses of suprasellar lesion separate from the pituitary gland include craniopharyngioma, germ cell tumor, optic glioma, and metastatic tumor. Craniopharyngiomas have a bimodal peak of incidence,

Table 1 Summary of cases of metastasis to the optic chiasm

Author (Year)	Age (yrs)/Sex	Prior history of cancer	Visual deficit	Hormonal insufficiency	CT findings	MR imaging findings	Therapy	Follow up (mos)/Outcome
Baeesa and Benoit (1999) ¹⁾	45/F	breast, 2 yrs previous	yes	no	2.5 × 2.7 × 3.0 cm hyperdense suprasellar mass, homogeneous enhancement	NA	biopsy, WBRT, chemotherapy	6/dead
Present case	61/F	lung, 1 yr previous	yes	no	NA	1.0 × 0.8 cm suprasellar mass, slightly hypointense on T1WI, hyperintense on T2WI, homogeneous enhancement	biopsy, WBRT	32/dead

CT: computed tomography, MR: magnetic resonance, NA: not available, T1WI: T₁-weighted image, T2WI: T₂-weighted image, WBRT: whole-brain radiotherapy.

occurring predominantly in children. Central nervous system germ cell tumors occur most commonly in the second and third decades of life.⁶⁾ Glioma is frequently located in the chiasm or optic nerves, and approximately 90% of these optic gliomas occur in children. Adult onset optic gliomas are markedly different from the optic gliomas of childhood, being typically malignant, rapidly progressive, and demonstrate uniform enhancement and expansion of the involved optic pathway.^{4,7)} Other rare differential diagnoses in aged patients include lymphoma and ectopic pituitary adenoma.^{10,16)} These lesions also appear as homogeneously enhanced mass on MR imaging. In our case, the optic chiasm metastasis was slightly hypointense on T₁-weighted imaging, hyperintense on T₂-weighted imaging, and homogeneously enhanced. Therefore, only the neuroimaging findings cannot differentiate optic chiasm metastasis from the other differential diagnoses.

For patients with solitary brain metastasis, a radical treatment approach involving surgical resection or stereotactic radiosurgery, followed by whole brain radiotherapy is recommended.¹²⁾ If a tumor invades the optic nerve, fractionated radiation is the best treatment because the tolerance of the optic apparatus is the limiting factor.²⁾ Surgical resection of optic chiasm metastasis is thought to be challenging and unsafe because of the significant morbidity.¹⁾ Chemotherapy is controversial. In general, chemotherapy is effective for brain metastases of small-cell carcinoma and germ cell tumors.¹¹⁾ Recently, gefitinib, a tyrosine kinase inhibitor of the epidermal growth factor receptor, has shown promising potential in palliative therapy for patients with brain metastasis of lung adenocarcinoma.¹⁵⁾ In our case, mild improvement of the patient's visual acuity was obtained by whole brain radiotherapy following surgical biopsy, and maximum quality of life was maintained for a long period. The therapeutic strategy in the present case seemed to be appropriate.

The present rare case of solitary metastasis within the optic chiasm shows that metastasis should be considered as one of several differential diagnoses of suprasellar tumors, in patients with or without a history of treated cancer. Preoperative neuroimaging diagnosis of suprasellar lesions is difficult in adults, so surgical biopsy to establish the pathology is essential.

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