Pilocytic Astrocytoma of the Velum Interpositum

—Case Report—

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Abstract

A 72-year-old male presented with a pilocytic astrocytoma in the velum interpositum manifesting as a 5-day history of dizziness attacks and unstable gait. Computed tomography and T₁-weighted magnetic resonance imaging with gadolinium enhancement demonstrated a small, homogeneously enhanced mass in the velum interpositum. The tumor was removed subtotally, and the structure of the splenium was intact. The histological diagnosis was pilocytic astrocytoma. The MIB-1 growth fraction was 5%. The tumor may have originated from the splenium or the thalamus. The aggressive histology indicates the need for close neuroimaging follow-up.

Key words: pilocytic astrocytoma, velum interpositum, heterotopic tumor

Introduction

The velum interpositum (tela choroidea superior) is a triangular space located in the transverse cerebral fissure at the bottom of the splenium or fornix.¹²⁾ Embryologically, the space develops through fusion of two layers of the pia mater between the roof of the third ventricle and the under-surface of the corpus callosum.¹²⁾ The walls of the velum interpositum are formed by the fornices, the roof by the corpus callosum covered with pia mater, and the central area of the floor by the roof of the third ventricle.¹²⁾ The bilateral sides continue to the internal side of the thalamus, the so-called "tenia thalami," over the stria medullaris thalami.¹²⁾

Various tumors may arise from the velum interpositum, or invade from neighboring tissues. Arachnoid cysts arise between the layers of the arachnoid tissue, probably from the tela choroidea, and bulge upward into the velum interpositum.¹⁵⁾ Meningiomas sometimes arise from the velum interpositum and are confined predominantly to the third ventricle and pineal region without dural attachment.¹⁰⁾ Subependymomas occasionally occur in the septum pellucidum⁶⁾ and tend to grow toward the third ventricle.

We describe a case of pilocytic astrocytoma that occurred in the velum interpositum. The most frequent localizations of this type of tumor are the cerebellum, hypothalamus, optic chiasm, and brainstem.^{8,16)}

Case Report

A 72-year-old male was admitted to our hospital with a 5-day history of dizziness attacks and unstable gait. On admission, his consciousness was clear, and neurological examination showed no deficits. Cranial computed tomography (CT) showed a small high-density mass lesion with mild homogeneous enhancement below the splenium of the corpus callosum (Fig. 1). T₁-weighted magnetic resonance (MR) imaging revealed an iso- and hyperintense mass (15 × 15 mm) extending to the splenium of corpus callosum in the velum interpositum, with homogeneous enhancement after administration of gadolinium-diethylenetriaminepenta-acetic acid. Sagittal MR imaging showed the mass had compressed the splenium in posterosuperior direction and extended to the internal side of the bilateral thalamus. The bilateral internal cerebral veins were apparently below the tumor. The pineal body was intact (Fig. 2).

The tumor was removed subtotally through the occipital interhemispheric and transtentorial approach. The structure of the splenium was intact.

Fig. 1 Computed tomography scans, before (left) and after (right) administration of contrast medium, showing a homogeneous enhanced mass lesion on the midline under the splenium of the corpus callosum.

Splenic incision exposed a well-demarcated and grayish tumor in the space of the velum interpositum. The splenium and the tumor were distinctly separated by pia mater or capsule. The tumor was soft, hypervascular, and easily removed. Cerebrospinal fluid leaked from the third ventricle upon penetration of the tela choroidea.

Histological examination of the specimen strongly suggested a pilocytic astrocytoma with anaplastic change (Fig. 3A). The typical appearance of pilocytic astrocytoma occurred in many areas, for example, Rosenthal fibers, but some areas had moderate

nuclear atypia and a few mitotic figures (Fig. 3B, C). The growth fraction, measured using MIB-1 monoclonal antibody (AMAC, Inc., Westbrook, Me., U.S.A.), was 5% (Fig. 3D). Immunohistochemical staining for glial fibrillary acidic protein (GFAP) was strongly positive. Immunoreactivities for neuron-specific enolase, synaptophysin, cytokeratin, and epithelial membrane antigen were negative.

The patient suffered disturbance of recent memory postoperatively. He was discharged one month later, and MR imaging 4 months after surgery showed no recurrence of the tumor.

Discussion

The present case is the first of pilocytic astrocytoma located in the velum interpositum. The tumor probably originated as a primary leptomenigeal astrocytoma arising from heterotopic neuroglial cell nests in the pia mater of the velum interpositum. A pilocytic astrocytoma in the cerebellopontine angle may have been derived from heterotopic glial nests present in the subarachnoid space.⁴⁾ Review of 25 cases of solitary primary leptomenigeal glioma showed one involved the entire central nervous system, three showed diffuse spread in the brain, 10 were solitary in the brain (convexity 6, sylvian fissure 2, suprasellar 1, cerebellopontine angle 1), and 11 were in the spinal cord.¹³⁾ The presence of a primary leptomenigeal glioma in the left parietal region arising from heterotopic neuroglial cell nests within the subarachnoid space was proved by the

Fig. 2 Axial T₁-weighted magnetic resonance (MR) image (left) showing a mixed (iso- and hyper-)intensity mass lesion under the splenium of the corpus callosum. T₁-weighted MR image with gadolinium-diethylenetriaminepenta-acetic acid (center) demonstrating moderately homogeneous enhancement, and sagittal T₁-weighted MR image (right) showing the mass compressing the splenium upwards. The tumor is not related to the pineal body.

Fig. 3 Photomicrographs showing the biphasic histological pattern of closely interwoven bundles of relatively broad bipolar fibrillated cells forming an intersecting pattern and a small amount of microcystic degeneration (A: HE stain, $\times 200$). Cellular atypicity, mitotic figure (arrowhead), variability in the size of nucleus (B: HE stain, $\times 400$), and Rosenthal fibers (arrows) are also visible (C: HE stain, $\times 400$). Immunohistochemical staining for Ki-67 showed a relatively high percentage of positive cells (5%) (D: $\times 200$).

presence of laminin.⁷⁾ In our case, the splenium or the thalamus may have been the origin. Several gliomas have arisen from the corpus callosum.^{2,3,6,9,14)} Glioma arising from the splenium sometimes involves the roof of the third ventricle. If the present tumor had originated from the corpus callosum, extensive infracallosal growth of the tumor would be expected.¹⁾ However, the expansion of the tumor was not identical to that of typical callosal glioma, and the tumor found to be well demarcated from the corpus callosum. Therefore, the origin of tumor cannot be assumed to be the corpus callosum. No case of glioma arising from the thalamus and expanding into the velum interpositum has been reported. The expansion of this tumor was not identical to astrocytic tumors originating from either side of the thalamus, because the tumor was present in the midline and the internal cerebral veins were not compressed to either side. At surgery, the tela choroidea was present in the roof of the third ventricle.

Pilocytic astrocytoma usually appears as mixed (hypo-, hyper-) density on CT with moderate enhancement.⁸⁾ T₁- and T₂-weighted MR imaging of this tumor generally shows iso- or slightly hypo- and hyperintense signals, respectively.⁸⁾ The edge of the tumor is clear with little surrounding edema. Gadolinium-enhanced T₁-weighted MR imaging shows the tumor as a mass lesion with intensive enhancement.^{5,8)} The MR imaging findings in the present case were identical to those reported previously for pilocytic astrocytoma.

Histological examination of the tumor specimen indicated the presence of pilocytic astrocytoma. The astrocytic nature of the tumor was evident from the GFAP staining. The characteristics of pilocytic astrocytoma are Rosenthal fibers and a biphasic histological pattern consisting of microcystic and compact areas including fascicular formation. The tumor specimen contained closely packed bundles in a fascicular pattern and a slight tendency to un-

dergo microcystic degeneration. Rosenthal fibers were also visible. Sometimes, fibrillary astrocytoma adapts to the environment and has a pilocytic appearance when the tumor cell infiltrates the nerve tract, including the corpus callosum, the internal capsule, the cerebral peduncle, and the pontine tracts.¹¹⁾ In our case, the possibility that the tumor might be fibrillary astrocytoma undergoing pilocytic change cannot be excluded completely. However, we do not think that this is likely because of the location of this tumor, and the clear demarcation between corpus callosum and tumor. Moreover, the tumor was almost totally resected, and no typical appearance of fibrillary astrocytoma was observed. Adult-type pilocytic astrocytoma may occur in older patients and tends to change to an anaplastic form.¹¹⁾ In our patient, moderate nuclear atypia and a few mitotic figures were also found, and MIB-1 staining revealed a high level of proliferative activity (5%) (Fig. 3). These features strongly suggest the behavior of this tumor was aggressive, and therefore close neuroimaging follow-up of the patient is necessary.

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