

## Case Report

# Intraventricular Glioblastoma Multiforme with Previous History of Intracerebral Hemorrhage : A Case Report

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GBM is the most common primary brain tumor, but intraventricular GBM is rare and only few cases have been reported in the literature. The authors report a case of 64-year-old man who had a remote history of previous periventricular intracerebral hemorrhage. Brain computed tomography (CT) and magnetic resonance (MR) imaging showed an intraventricular lesion with inhomogeneous enhancement, infiltrative borders and necrotic cyst, and obstructive hydrocephalus. The patient underwent surgical removal through transcortical route via the bottom of previous hemorrhage site and the final pathologic diagnosis was GBM. We present a rare case of an intraventricular GBM with detailed clinical course, radiological findings, and pathological findings, and the possible origin of this lesion is discussed.

**KEY WORDS :** Glioblastoma multiforme · Intraventricular tumor · Intracerebral hemorrhage · Obstructive hydrocephalus.

## INTRODUCTION

Lesions that affect the lateral ventricle include a large variety of benign tumors, malignant tumors, and cyst formations<sup>11,12</sup>. Tumors of the lateral ventricle may be classified by their origin as either primary or secondary form<sup>1,10</sup>. Primary tumors arise directly from structures within the lateral ventricle itself, such as ependyma, subependymal glia, choroids plexus, embryogenic remnants, and infectious or metastatic tissues<sup>1</sup>. Secondary tumors arise from structures adjacent to the lateral ventricle and subsequently grow into the lateral ventricle by either gentle extension or frank invasion<sup>1</sup>. Regardless of their tumor origin, the majority of ventricular tumors have benign histologic findings. Only 13% had malignant lesions such as glioblastoma, melanoma, or metastatic carcinomas<sup>13</sup>.

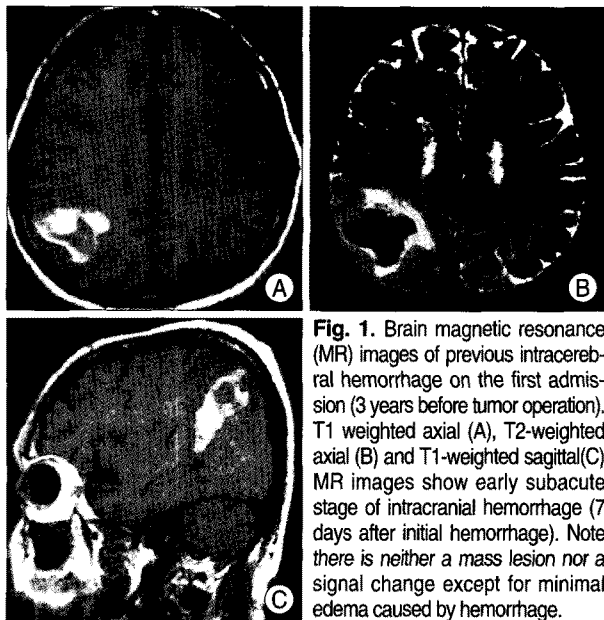
Glioblastoma multiforme (GBM) within the lateral ventricle is relatively infrequent and is found predominantly in the frontal horn or body. To the best of our knowledge, only a few cases of intraventricular GBM have been reported in literature<sup>9</sup>. Here, we report a case of intraventricular GBM at occipital horn who presented symptom of pro-

gressive obstructive hydrocephalus with previous remote history of intracerebral hemorrhage.

## CASE REPORT

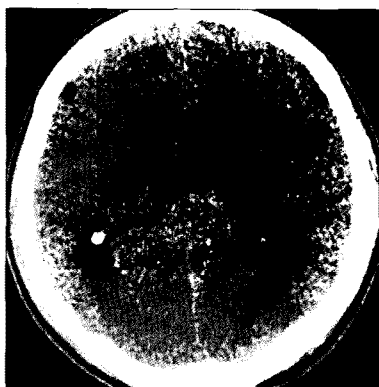
A 64-year-old man presented with a 6-week history of gait disturbance and progressive urinary incontinence. He also had memory difficulty and frequent episodes of disorientation. His gait had worsened to the degree that he could no longer ambulate without assistance. The patient also complained global headache, vomiting, and constant drowsiness which persisted for two weeks prior to visit. Urinary incontinence was described by his family members, even though he did not have a history of the prostatic disorders. On neurological examination, high cortical function was intact except for short-term memory such as digit recalling and expressive verbal memories. Both low extremities showed moderate motor weakness (muscle power grade III) and increased deep tendon reflexes in both knees. He had a past history of intracranial hemorrhage and underwent conservative management 3 years ago. At that time, brain MR imaging showed no occupying lesion in the brain except intracranial hemorrhage on the right parietal periventricular area (Fig. 1). The initial non-contrast brain CT scan showed obstructive hydrocephalus with enlargement of the medial occipital periventricular area and isodense ventricular cystic lesion (Fig. 2). This finding prompted an MR

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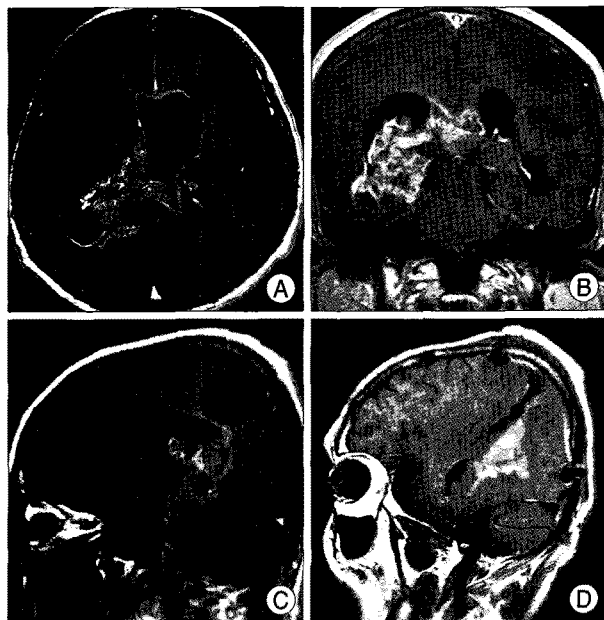
**Fig. 1.** Brain magnetic resonance (MR) images of previous intracerebral hemorrhage on the first admission (3 years before tumor operation). T1 weighted axial (A), T2-weighted axial (B) and T1-weighted sagittal (C) MR images show early subacute stage of intracranial hemorrhage (7 days after initial hemorrhage). Note there is neither a mass lesion nor a signal change except for minimal edema caused by hemorrhage.

imaging study, which confirmed the presence of rim-enhancing intraventricular solid and cyst lesion (Fig. 3). This lesion showed infiltrative pattern around the medial occipital ventricular wall and spreading into the splenium of corpus callosum and septum pellucidum. The tumor had irregular and inhomogeneous enhancing patterns on gadolinium-enhancing images. The thicker solid portion was located near the occipital horn, which had continuity to subependymal layer of previous hemorrhage site. These radiographic findings were indicative of a high-grade tumor. The tumor might originate from paraventricular subependymal layers and spread to adjacent structures.



**Fig. 2.** Initial brain computed tomography scan on the second admission demonstrates a large ventricle and an intraventricular lesion with periventricular edema.

A parieto-occipital craniectomy with a transcortical approach to the lesion was performed. We were able to access the lesion via route of previous hemorrhage site on the right parietal lobe. Grossly, the tumor was seen as hypervascular mass with hard consistency. In microsurgical findings, it was grayish-colored tumor and was predominantly firm, necessitating piecemeal removal. The tumor was very infiltrative in nature that no distinct plane between tumor and ependymal layer was identified. Frozen and permanent

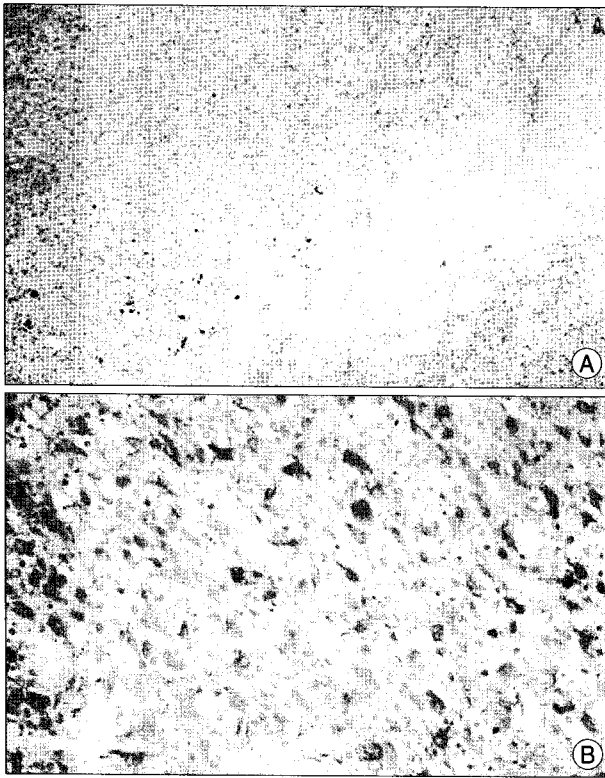


**Fig. 3.** Preoperative (A, B, C) and postoperative (D) magnetic resonance (MR) images on the second admission. T1-weighted Gd-enhanced MR image reveals an enhancing huge intraventricular mass. Axial (A) and coronal (B) images show that the heterogeneously rim-enhancing mass is located from the medial occipital periventricular area to septum pellucidum. Note the relationship between previous hemorrhage site and tumor on sagittal image (C). The mass was near-totally removed on postoperative Gd-enhanced sagittal image (D).

section of tumor showed mitotic figures, pseudopalisading necrosis and endothelial proliferation. Most of tumor cells were stained positive for GFAP (Fig. 4). The pathological diagnosis was glioblastoma. After operation, the symptoms of obstructive hydrocephalus were progressively improved. Two weeks after the operation, whole brain radiation therapy was started. His family refused concomitant chemoradiotherapy with temozolomide for the reason of economic status. He did not show any neurological deterioration during radiation therapy, and he was discharged in the middle of radiation schedules. He had some memory disturbance and mild hemiparesis (muscle power grade IV) at the time of discharge.

## DISCUSSION

According to the WHO classification which was first published in 1979 and modified in 1993, GBM is grade 4 which shows nuclear atypia, mitosis, and endothelial proliferation or necrosis. Glioblastoma represents 15%-20% of all intracranial tumors and approximately 50% of gliomas in adults<sup>8</sup>. Although capable of arising anywhere in the CNS, these tumors mainly present as a frontotemporal lesion (63%) of the cerebral cortex<sup>14</sup>. But, intraventricular glioblastoma multiforme (GBM) is relatively rare and is usually found predominantly in the frontal horn or body.



**Fig. 4.** Microscopic findings confirming glioblastoma multiforme. Necrosis with the pseudopalisading pattern of malignant nuclei and endothelial cell proliferation (A :  $\times 100$ ). A strong positive glioblastoma multiforme (GFAP) stain is noted (B : GFAP,  $\times 400$ ).

Intraventricular tumors can be categorized into two types according to their origin : primary and secondary. Neoplasms that originate from the ventricular wall and its lining are considered primary ventricular tumors, and those that arise in adjacent brain structures but with more than two-thirds of exophytic growth within the ventricle are considered secondary ventricular tumors with transependymal development (primary cerebral origin)<sup>2</sup>. The most common intraventricular gliomas include ependymomas, subependymomas, and subependymomal giant cell astrocytomas. Other less common variants, including choroids glioma, glioblastoma multiforme, and mixed glial-neuronal tumors, have been reported<sup>4</sup>.

The authors hypothesize that the origin of tumor in this case was the neuroglial cells of the white matter in the subventricular area. This periventricular glioblastoma may have grown into the ventricle by transependymal invasion and infiltrated into surrounding structures. Although we do not know the exact relationship between previous hemorrhage and the development of glioblastomas, we can consider two possible mechanisms of the previous hemorrhage and glioblastomas. One mechanism is tumor bleeding event during the development of hypervascular tumors. In our case, 3 years of long history did not meet the natural

history of glioblastomas, since glioblastomas usually show rapid progression and recurrence after the treatment. Additionally, the patient had long history of symptom free survival during untreated periods. So, this mechanism may be ruled out. The other is abnormal repair mechanism near the periventricular white matter which was injured by previous hemorrhage. The enhancing portion of the tumor was mainly located below the bottom of previous hemorrhage site on the sagittal image (Fig. 3C) and thicker solid portion of the lesion was located in occipital area had continuity to previous hemorrhage site (Fig. 3A). According to the radiological findings, we hypothesized that the development of periventricular GBM may triggered by the abnormal healing process in the subependymal zone. Subependymal zone have many pluripotent stem cells for regeneration after cell death. Doetsch et al.<sup>3</sup> introduced four distinct cell types reside in the subventricular zone (SVZ); The ependymal cells, astrocyte-like type B cells, type C cells and oligodendrocyte progenitors. The role of multipotential progenitors and neural stem cells in the adult SVZ as the cell origin of glioblastoma has been suggested by studies on human tumors<sup>6</sup> and transgenic mice<sup>5</sup>. Our case might be a case of malignant transformation of the quiescent neural stem cell or fast-proliferating multipotential progenitors residing in the adult SVZ during the repair process. Although we cannot explain the exact mechanism of malignant transformation, we think that abnormal subependymal healing process after massive hemorrhage might trigger the glial proliferation from neural stem cells in SVZ.

Considering MR imaging, the tumor which entered the ventricle might have expanded along the ependymal lining to the frontal horn and have constituted a necrotic cyst. Also, the glioblastoma might have invaded the opposite frontal lobe probably by crossing through the ependymal layer and/or corpus callosum. This maybe the result of invasion through the subependymal fascicular route.

Intraventricular GBMs have typical imaging characteristics of high-grade gliomas, including contrast enhancement and, sometimes inhomogeneity and infiltrative, irregular borders<sup>7-9</sup>. Well-circumscribed, minimally enhancing appearance of intraventricular GBM at the trigone was reported in only one case<sup>9</sup>. Most lateral ventricular tumors enlarge slowly and typically cause no symptoms until reaching a size large enough to cause obstructive hydrocephalus or compression of surrounding eloquent structures<sup>9</sup>. However, the interval between symptom onset and presentation is short, ranging between weeks and months<sup>10</sup>. Symptoms caused by obstructive hydrocephalus in this case were consistent with a large ventricular tumor.

## CONCLUSION

Intraventricular tumors show slowly progressive symptoms due to obstructive hydrocephalus or compression of surrounding eloquent structures. We experienced a rare case of an intraventricular GBM at the occipital horn of lateral ventricle which expanded by subependymal invasion to the ipsilateral and contralateral frontal horns and revealed an inhomogenous wall with necrosis.

### • Abbreviations

CNS, central nervous system; CT, computed tomography; GBM, glioblastoma multiforme; GFAP, glial fibrillary acidic protein; MR, magnetic resonance; WHO, World Health Organization.

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