

Central Neurocytoma

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Central neurocytoma is a rare, well-differentiated neuronal tumor and is usually located in the lateral or third ventricle of young adults. The occurrence of an intraventricular tumor with a characteristic magnetic resonance image findings including isointense signal in T1-weighted images, the presence of a cystic component, small signal-void areas due to calcification, heterogenous and hyperintense "bubbly" appearance in T2-weighted images in a young patient should suggest preoperatively the diagnosis of central neurocytoma. The typical immunohistochemical finding, positivity for synaptophysin, is the main pathological feature. We experienced two cases of central neurocytomas with typical radiological and histopathological findings. We expect growth arrest of these cases by subtotal removal to avoid postoperative neurologic deficit followed by radiation therapy.

KEY WORDS : Central neurocytoma · Synaptophysin · Subtotal removal · Radiation therapy.

Introduction

Central neurocytoma is described as intraventricular neuroepithelial tumor with neuronal differentiation, well demarcation, and predominant location in foramen of Monro region⁹. It comprises 0.1 to 0.5 per cent of all brain tumors^{2,8}. Since central neurocytoma was first described by Hassoun et al in 1982, the number of cases has been abruptly increased^{1,5} and characteristic radiological and histopathological features were established. Authors report two cases of central neurocytoma with typical radiological and histopathological findings, who underwent subtotal tumor mass removal safely with adjuvant radiation therapy and got favorable outcomes in one year and five years follow up.

Case Report

Case 1

A 37-year-old man presented with the history of headache and vomiting for four months. T2-weighted brain MRI showed bubbly appearance. The tumor seemed to be attached to the ventricular wall and displaced the septum pellucidum to the left, accompanying severe peritumoral edema and hydro-

cephalus. T1-weighted brain MRI with enhancement showed a round heterogenous lesion, measured by 5 × 4 × 4cm in diameter, with nonenhancing cystic portion in the right lateral ventricle and third ventricle (Fig. 1A). Operation was performed via anterior transcallosal approach. Intraoperatively, the cystic portions of tumor was opened and then yellowish cystic fluid was drained. The solid portion of tumor was friable and highly vascularized. Subtotal removal was performed due to massive bleeding and to avoid hypothalamic injury (Fig. 1B).

Histopathologic findings showed highly cellular mass consisting of uniform tumor cells. The tumor cells contained a clear or eosinophilic cytoplasm with delicate fibrillary cytoplasmic process (Fig. 3A). Immunohistochemical findings showed the positivity for synaptophysin (Fig. 3B), the negativity for glial fibrillary acidic protein (GFAP) (Fig. 3C) and neurofilament protein.

Postoperatively mild motor weakness was noticed, which was relieved spontaneously after several days. Postoperatively, the patient received conventional external beam radiation therapy to tumor bed (total 6000cGy / 30 fractions). One year after completion of the radiation therapy, brain MRI identified no interval change comparing with postoperative MRI findings (Fig. 1C).

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Case 2

A 20-year-old woman presented with the history of visual field defect and headache for two months. Brain MRI with enhancement showed a heterogeneously enhanced solid mass

with cystic components, measured by $6 \times 5 \times 5$ cm in diameter, located at the bilateral lateral ventricles and third ventricle, accompanying with severe obstructive hydrocephalus (Fig. 2A). The mass was removed with transcortical approach via the

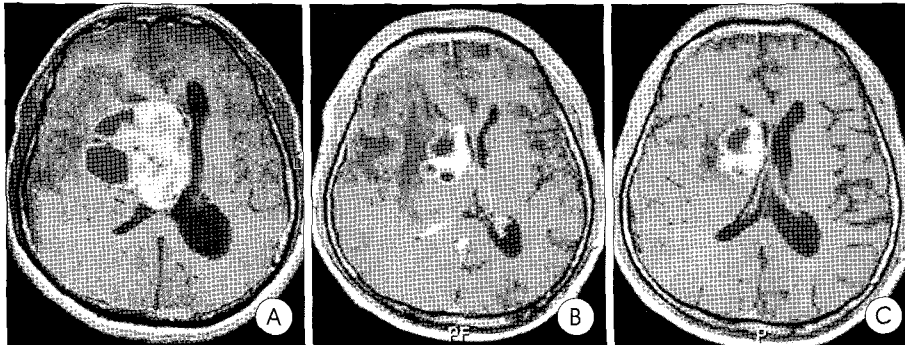


Fig. 1. A : Axial T1-weighted enhanced magnetic resonance(MR) image showing a round heterogeneous "bubbly" appearance in the right lateral ventricle and third ventricle with peritumoral edema and hydrocephalus. B : Post-operative axial T1-weighted enhanced MR image demonstrating a small sized, residual mass around the right lateral ventricle with peritumoral edema. C : Axial T1-weighted enhanced MR image demonstrating no change in the size of residual mass 1 year after surgery and adjuvant radiation therapy.

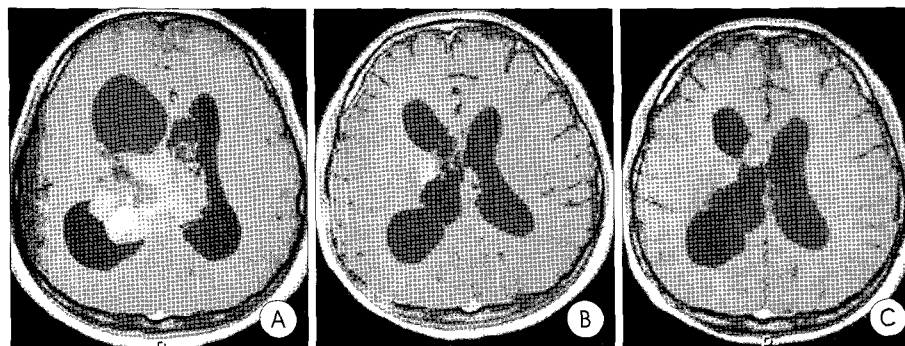


Fig. 2. A : Axial T1-weighted enhanced magnetic resonance(MR) image showing an isointense heterogeneous mass in the bilateral lateral ventricles and third ventricle with obstructive hydrocephalus. B : Post-operative axial T1-weighted enhanced MR image demonstrating a small sized, residual mass in the right lateral ventricle. C : Axial T1-weighted enhanced MR image demonstrating no change in the size of residual mass 5 years after surgery and adjuvant radiation therapy.

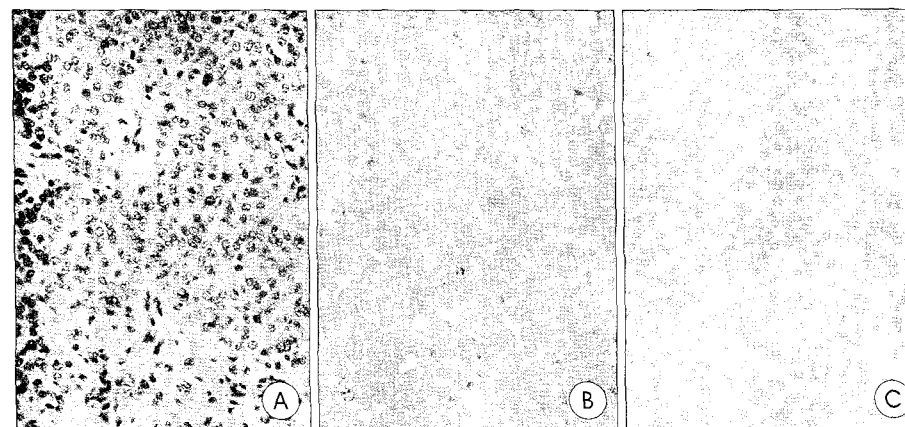


Fig. 3. A : Microscopical findings showing hypercellularity consisting of uniform tumor cells and clear or eosinophilic cytoplasm with delicate fibrillary cytoplasmic process, suggestive of central neurocytoma, oligodendroglioma, ependymoma. No mitosis or necrosis is seen (H&E, $\times 200$). B : Synaptophysin staining showing positive reaction, suggestive of central neurocytoma (synaptophysin, $\times 200$). C : Immunohistochemical stainings revealing negative reaction for glial fibrillary acidic protein (GFAP, $\times 200$).

right superior parietal lobule. The tumor was red-brownish, highly vascularized and adhesive to periventricular wall. Subtotal removal was performed due to massive bleeding. Post-operative MRI showed the residual mass in the right lateral ventricle (Fig. 2B).

Histopathologic findings showed highly cellular mass consisted of uniform tumor cells. The tumor cells contained a clear or eosinophilic cytoplasm with delicate fibrillary cytoplasmic process. Immunohistochemical study revealed negative for glial fibrillary acidic protein(GFAP), epithelial membrane antigen(EMA), Vimentin, and P53 protein. But, synaptophysin was strongly immunoreactive.

Postoperatively left hemiparesis was noticed, which was nearly improved in several years. Radiation therapy was performed (total 5580 cGy / 31 fractions). Follow-up brain MRI five years after surgery showed favorable outcome, which was no interval change in tumor size (Fig. 2C).

Discussion

Central neurocytomas are differentiated neuronal lesions, with ventricular location and benign biological behavior⁵. It affects mainly young patients in the second and third decade of life and is believed to arise from the neuronal cells of the septum pellucidum and the subependymal plate of the lateral ventricles⁷.

The presenting symptoms are usually related to intracranial hypertension, such as headache, nausea and vomiting^{5,6}. Visual symptoms,

papilledema, are often found⁵. Other symptoms and signs, including hemiparesis, ataxia, dizziness and epileptic seizures, are less frequent⁵.

In magnetic resonance imaging, central neurocytoma is usually isointense with the brain cortex in T1-weighted images^{5,6}. The presence of a cystic component and small signal-void areas due to calcification may be noticed as heterogenous and hypereintense “bubbly” appearance in T2-weighted images^{5,6}. Our cases also showed the presence of multiple cystic components, heterogenous enhancement in solid portion, and displacement of the septum pellucidum to the left.

Histopathologic findings of central neurocytomas are typically monomorphous, consisting of uniform round cells with stippled nuclei, perinuclear halos and scanty cytoplasm^{5,6}. Synaptophysin and neuron-specific enolase(NSE) have been found in almost all tested neurocytomas^{5,6}. Glial fibrillary acidic protein(GFAP) and neurofilament protein(NF) are negative^{5,6}. In our case, synaptophysin was positive and glial fibrillary acidic protein(GFAP) was negative. On the basis of these light microscopic features and immunohistochemical studies, our cases were correctly diagnosed as central neurocytomas. To confirm the neuronal origin, the electron microscopic examination showing neuronal differentiation associated with synapse formation, should be done additionally^{5,6}.

The surgical approach can be done via transcortical and transcallosal, depending on the site of the tumor within the ventricular system. The complete tumor mass removal is the gold standard treatment and the adjuvant radiation therapy is effective for malignant variants¹. In cases with difficulty in the complete removal, the subtotal removal should be done to avoid massive bleeding, neurological complications such as hemiparesis, dysarthria¹. Postoperatively left hemiparesis in both cases was noticed, which was nearly improved in several days or years.

Many studies have reported that the radiation therapy for residual tumor is clinically effective in patients with central neurocytoma showing malignancy or recurrence^{3,5,8}. In cases of recurrence of small tumors, radiosurgery can replace open surgery and is a safe and initially effective approach⁶. The clinical course of subtotally removed tumors which do not perform adjuvant radiation therapy has been found to be benign in some cases⁴. Therefore, it should be carefully decided whether to use radiation therapy for a residual tumor⁴. The role of radiation therapy remains to be controversial, but it seems to be advisable in subtotally removed tumors^{3,5}.

The prognosis of patients with central neurocytoma is good. The five year survival rate is eighty one per cent⁶. Regrowth after incomplete removal is rather slow and recurrence rate after complete removal is very low^{1,5}. Some studies had reported that central neurocytoma showed malignancy in rare cases, and its incidence accounts for five per cent of total central neuro-

cytoma¹. Malignant variants and extraventricular extension of central neurocytoma have poorer clinical outcome^{1,6}.

Conclusion

We experienced two cases of central neurocytomas with typical radiological and histopathological findings. We performed subtotal removal of the tumor to avoid postoperative neurologic deficit and adjuvant radiation therapy. During follow up period, the patients did not show tumor regrowth or symptom aggravation.

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Commentary

The authors reported two cases of central neurocytoma which were resected subtotally in order to avoid postoperative neurological morbidity and followed by conventional radiotherapy(5,580~6,000cGy). The follow-up MR 1 and 5 years after treatment respectively did not show tumor recurrence and any clinical aggravation.

Central neurocytomas are believed to arise from the neuronal precursors in the periventricular germinal matrix, which persists throughout whole life even though some of unusual ones arising from cerebral hemisphere and spinal cord were reported and considered benign tumors with low proliferative potential. However, von Deimling et al reported a case of central neurocytoma showing malignant features at biopsy and Mrak et al reported two cases of malignant variant of this tumor with rapid progression to death. Choi et al also experienced a case of malignant variant with high proliferative index (Ki-67 labeling index >30%) which should recurred immediately after surgery and died within 3 months in our country. Notwithstanding this malignant variant central

neurocytomas are considered benign tumors and radiation therapy is not theoretically necessary because these are based only on histologic findings, not on the clinical course; the histologic features of anaplasia are indeed not associated with an unfavorable outcome.

Some authors have reported recurrence even if the tumor was grossly total resected. It has been attempted in patients whose tumor was subtotally resected and radiation-induced tumor shrinkage and disappearance have been reported even though disease-free intervals in patients who did not receive radiation also considerably long.

The complete resection is the gold standard treatment and the post-operative radiotherapy is effective for the residual tumor mass, but post-operative radiation therapy must be carefully decided because conventional radiation can cause delayed complication, especially intellectual impairment for young children.

I experienced 2 cases of relatively small-sized central neurocytoma which diagnosed only by stereotactic biopsy and treated by Gamma knife radiosurgery. They were followed-up over 4 years and both of them showed tumor shrinkage (from 34.5cc to 18.0cc, from 16.3cc to 6.0cc respectively). Because the central neurocytoma is well-demarcated and located in lateral ventricle without critical structures around tumor mass, relatively large amount of radiation dose can be given at a once. So, I would like to recommend Gamma knife radiosurgery which is a non-invasive, focal, high-dose, single radiation instead of conventional radiotherapy for the post-operative residual tumor mass and as a primary treatment in cases of small size.

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