Cellular and Molecular Biology
E-ISSN : 1165-158X / P-ISSN : 0145-5680
www.cellmolbiol.org

Case Report

Atypical extraventricular neurocytoma: A case report

Peng Zhang[1,#], Cui-Ying Wu[1,#], Jia-Zhen Qin[1], Ru-Xiang Xu[1], Miao-Chun Bai[1], Lu-Ping Wang[1], Yi-Wu Dai[1*], Xue-Zhen Li[2,*]

[1] Department of Neurosurgery, the Seventh Medical Center of PLA General Hospital, Beijing, China
[2] Department of Neurosurgery, Beijing Tiantan Hospital, Capital Medical University, Beijing, China

*Correspondence to: uzdgc3@163.com

Received November 25, 2019; **Accepted** May 6, 2020; **Published** May 15, 2020

[#] These authors contributed equally to this work.

Doi: http://dx.doi.org/10.14715/cmb/2020.66.2.25

Abstract: Atypical extraventricular neurocytoma (EVN) is a rare condition characterized by diffuse tumor cell hyperplasia, increased neovascularization, increased necrosis, and aggressive characteristics. A case of a 25-year old man who presented with atypical EVN in his left parietal - occipital flaps is reported. Magnetic resonance imaging (MRI) revealed a well-defined globular mass with heterogeneous signals in the left parietal lobe, and mild perilesional edema. After left parietal craniotomy and tumor excision, pathologic examination of the resected tissue revealed that the lesion was localized mainly in the white matter and imbued with tumor cells possessing round hyperchromatic nuclei with perinuclear halos and increased microvascular proliferation. The patient underwent radiotherapy at 21st postoperative day. Over the past 26 months, the patient has been regularly followed up, and so far no neurologic deficits have been observed. The latest MRI showed that the tumor bed was stable with slight peritumoral edema. The results of clinical, histopathological and immunohistochemical examinations indicate that atypical EVN is a rare neoplasm with unique radiographic and pathologic characteristics. It possesses more aggressive properties than typical EVN.

Key words: Extraventricular neurocytoma; Central neurocytomas; Left parietal craniotomy; Magnetic resonance imaging; Intensity modulated radiotherapy.

Introduction

Central neurocytoma (CNC) is an extremely rare, ordinarily benign intraventricular brain tumor that typically forms from the neuronal cells of the septum pellucidum. Majority of CNCs grow inwards into the ventricular system forming interventricular neurocytomas (1). Central neurocytoma (CNC) accounts for less than 1 % of all intracranial neoplasms, and it occurs mainly in young people. Central neurocytoma (CNC) is usually located in the lateral ventricles. Extraventricular neurocytoma (EVN) is histopathologically, immunohistochemically and ultrastructurally similar to CNC. The only difference is that EVN is localized in the brain parenchyma outside the ventricular system. In 2007, EVN was classified as a grade II tumor according to the World Health Organization (WHO) classification of brain tumors (1). Only a few EVNs show atypical features such as diffuse tumor cell hyperplasia, increased neovascularization, increased necrosis, and aggressive characteristics (2). The new 2016 WHO classification for brain tumors did not recognize EVN as a grade II tumor (3). In order to aid the clarification of the spectrum of such lesions and their biological behavior, this case report presents the clinicopathological features of atypical EVN in a 25-year old man. The patient was diagnosed with atypical EVN in his left parietal - occipital flaps. The imaging and pathological characteristics were described. This report presents an analysis of the imaging features, histology, treatment and prognosis of the reported rare lesions. Written informed consent was obtained from the patient.

Case Report

A 25-year old, previously healthy man presented with sudden unconsciousness accompanied by physical convulsion which lasted 1 week, and was admitted to the hospital. The man suffered associated gentle postural dizziness in the previous 6 months. Clinical examination revealed bilateral hypopsia and left hemianopia. The vital signs were normal, and no focal neurological deficits were observed. There were no obvious abnormities in blood tests. Craniocerebral magnetic resonance imaging (MRI) examination revealed a well-defined globular mass with heterogeneous signals in the left parietal lobe, and mild perilesional edema. The tumor measured 28 mm × 35 mm × 24 mm in craniosacral and craniocaudal dimensions (Figures 1A-1C). On axial T1-weighted and sagittal contrast-enhanced T1 FLAIR imaging, the mass showed high signal changes (Figures 1A and 1C). On axial T2-weighted imaging, the lesion showed heterogeneous long signal intensity (Figure 1B). The solid part of the mass showed diffusion restriction. No obvious colliquative necrosis was detected in the lesion. There was obvious compression in posterior horn of the left lateral ventricle (Figure 1 B). However, there were no obvious abnormal signals in other cerebral substances (Figures 1A-1C). The patient underwent left parietal craniotomy and tumor excision.

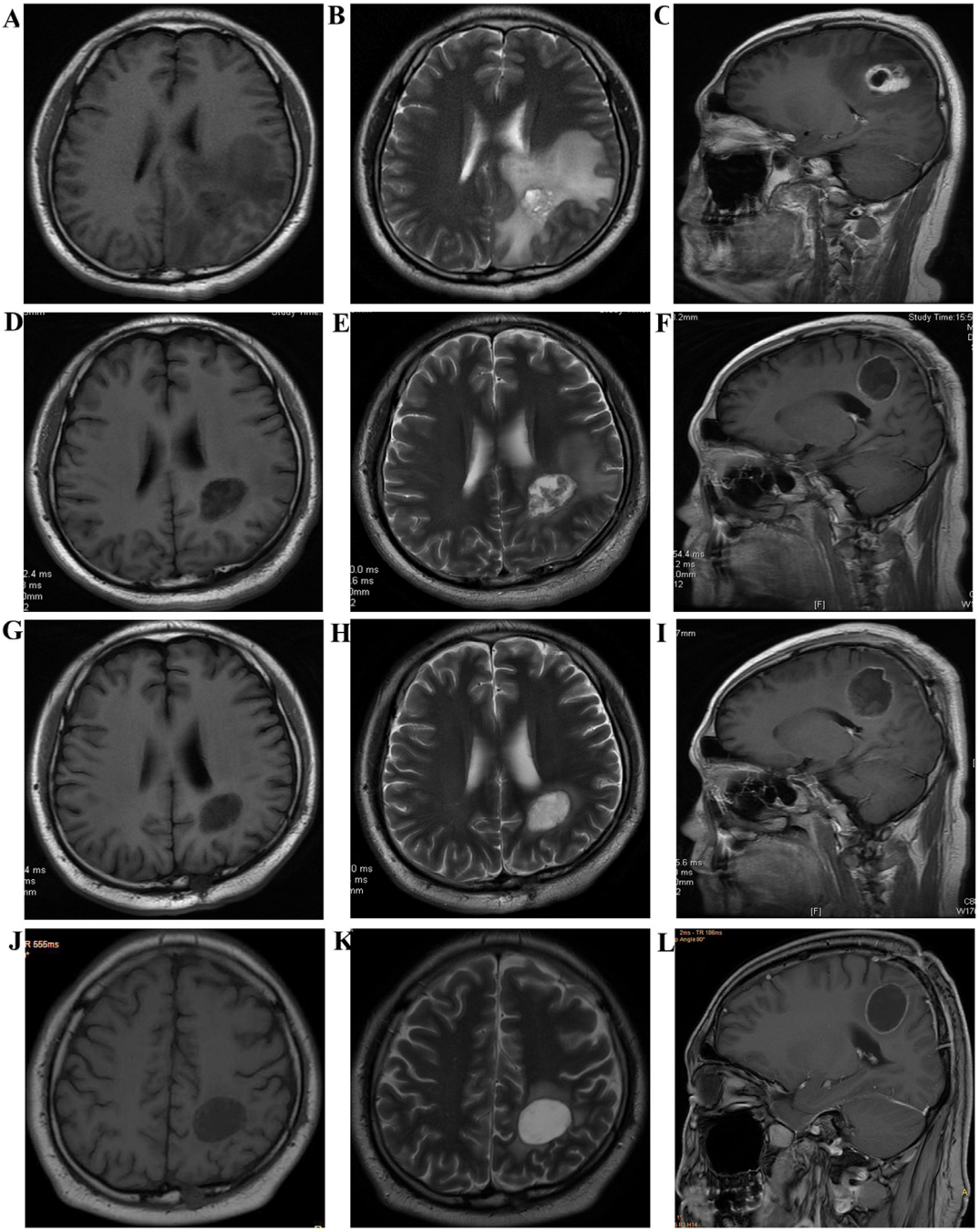

Figure 1. Pre- and post-operative brain MRI results. (A): Preoperative axial T1; (B): Preoperative axial T2; (C): Preoperative axial and sagittal contrast-enhanced T1 FLAIR. Weighted images show a well-defined globular mass with mixed intensity in the left parietal lobe; (D): Postoperative axial T1; (E): Postoperative axial T2 (F): Postoperative axial and sagittal contrast-enhanced T1 FLAIR. Weighted images show postoperative images taken 9 days after the surgery; (G-I): The follow up taken 1 month after intensity modulated radiotherapy (IMRT); (J-K): The last follow up taken 26 month after IMRT.

Osteotomy was used to incise the left parietal - occipital flaps in whole-layer, and the neighboring sulcus was carefully separated from the tumor guided by neuronavigation. During the operation, the tumor appeared globular, grayish-white and soft, with moderate vascularity and a distinct boundary about 1.5 cm below the cortex. Postoperative MRI showed that the tumor was completely removed (Figures 1D-1F). The tumor sample was subsequently examined histopathologically and immunohistochemically.

Pathologic examination of the resected tissue revealed that the lesion was localized mainly in the white matter imbued with closely-packed tumor cells possessing round hyperchromatic nuclei with perinuclear halos and increased microvascular proliferation (Figure 2). Hematoxylin and eosin staining showed that the tumor exhibited mitotic figures along with consistent medium-sized cells and high neovascularization (Figures 2A and 2B). Neuropil islands were occasionally present (Figure 2B). Immunohistochemical staining revealed an MIB-1/Ki-67 labeling index of 15 %, with brisk mitotic activity (Figure 2C). Nestin (Figure 2D), CD34 (Figure 2E), synaptophysin (Figure 2F), and microtubule-associated protein 2 (MAP-2) (Figure 2G) were positive. Progesterone receptor (PR) and p53 were focally positive, while isocitrate dehydrogenase 1 (IDH1-R132H) was negative. In addition, the tumor cells were negative for glial fibrillary acidic protein (GFAP), S-100, CgA, NeuN,

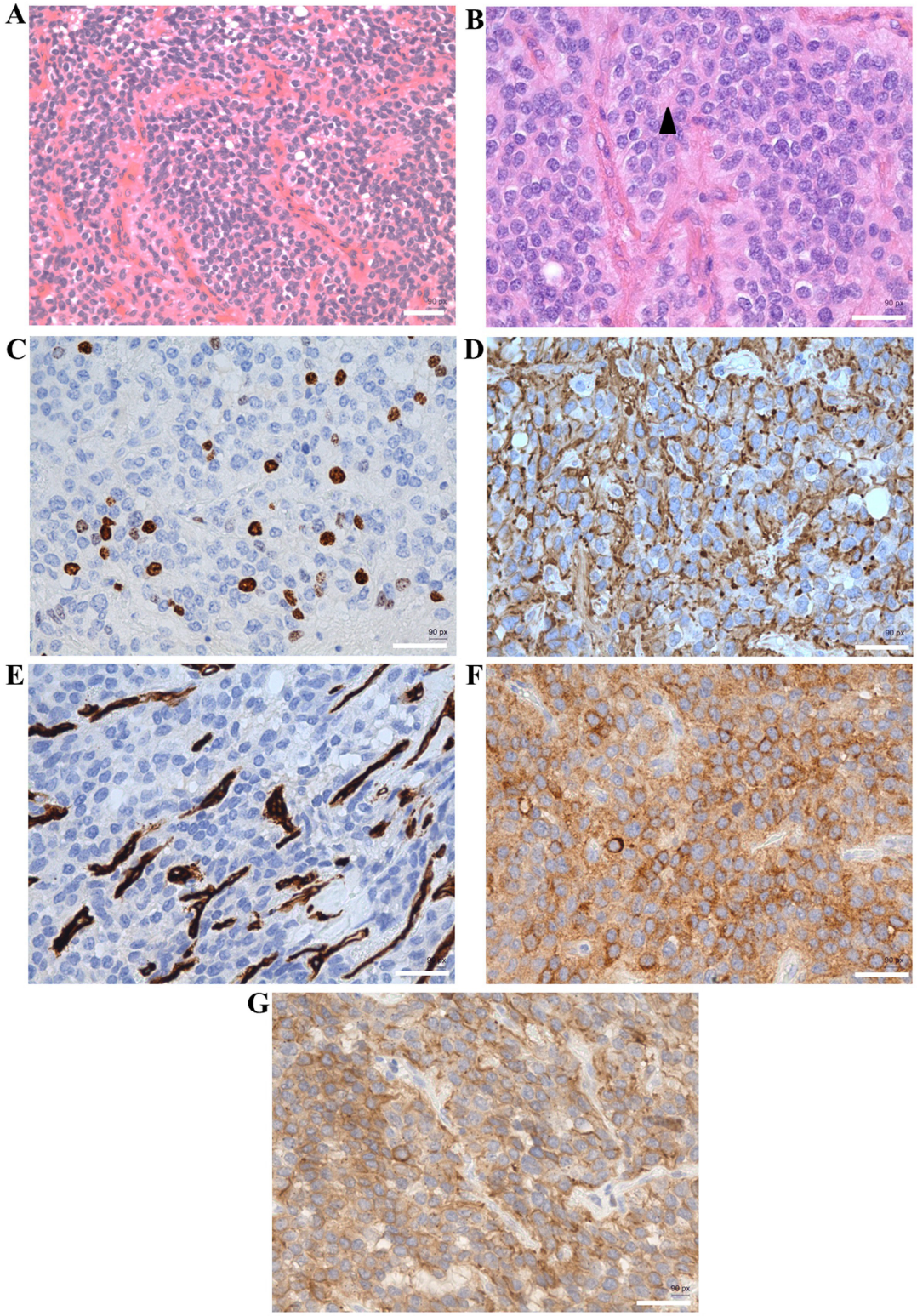

Figure 2. Results of histopathological examination of the lesion resected after the left occupied parietal lobectomy. (A-B): Hematoxylin and eosin staining indicated that the tumor possessed mitotic figures along with consistent medium-sized cells and high neovascularization. Neuropil islands (arrowheads) were occasionally present. Immunohistochemical staining showed neoplastic cells exhibiting strong and diffuse immunoreactivity for (C): Ki67; (D): nestin; (E): CD34 (F): synaptophysin; (G): MAP-2 (scale bars = 30 μm (A) and 20 μm (B-G).

AE1/AE3, NSE, Oligo-2, vimentin, epithelial membrane antigen (EMA) and CD99. Fluorescence *in situ* hybridization showed that the tumor tissue had 1p/19q chromosomal co-deletion. A diagnosis of atypical EVN was established based on results of all the pathological and clinical examinations.

The patient received radiotherapy beginning from the 21st postoperative day. Intensity modulated radiotherapy (IMRT) to the brain was administered at a dose of 60Gy/30F to the 95 % planning gross tumor volume (pGTVtb), and 54Gy/30F to the planning target volume (PTV). The patient was discharged without any neurological deficits on the 32nd postoperative day. A follow-up MRI was performed 10 days after the IMRT, which confirmed that the tumor bed was stable (Figures 1G-1I). Over the past 26 months, the patient has been regularly followed up and so far, no neurologic deficits have been observed. The latest MRI showed that the tumor

bed was stable with slight peritumoral edema (Figures 1J-1L).

Discussion

Central neurocytoma (CNC) accounts for 0.2 % of all adult brain tumors, and about 0.7 % of all central nervous system (CNS) neoplasms. Since the first case was reported in 1982, a total of 500 cases have been so far documented (4). Tumors are classified as typical or atypical. Histological criteria for atypical tumors are MIB-1 LI > 3 % or features consistent with higher grade tumors. The condition is not readily diagnosed since it shares some clinical, radiological, and histological features with other primary brain tumors. Information about the treatment strategy for atypical EVN is scarce, since the condition does not occur frequently. Complete resection remains the preferred choice, because it produces good prognosis. Although radiation therapy has its own setback, it remains a good treatment option for atypical tumors (2, 5). Chemotherapy was only as an adjuvant treatment after surgery or radiotherapy in a few case reports (6,7). At present, there is no recommended chemotherapy regimens. Some doctors use temozolomide, but more clinical samples and follow-up are needed to verify the efficacy (8). In consideration of pathological grade of the case was II-III, chemotherapy was excluded. Beyond that, Gamma Knife stereotactic radiosurgery (GKSR), as a form of radiation therapy that focuses high-power energy on a small area of the body, achieves good tumor control rates (9). However, the tumor cavity of the case was larger than 30mm, so GKSR therapy was not performed (10). Of course, the GKSR treatment method could be carried out if reappeared. This case report illustrates the fact that atypical EVN must be included as a possibility for a non-calcified and microcystic parenchymal lesion in the pediatric population.

Atypical EVN is a rare neoplasm with unique radiographic and pathologic characteristics. It possesses more aggressive properties than typical EVN.

Acknowledgement

This work was supported with grants from the National Natural Science Foundation of China (Nos 81401031 and 81601085).

Conflict of interest

No conflict of interest is associated with this work.

Contributions of Authors

All work was done by the authors named in this article and the authors accept all liability resulting from claims which relate to this article and its contents. The study was conceived and designed by Yi-Wu Dai and Xue-Zhen Li; Peng Zhang, Cui-Ying Wu, Jia-Zhen Qin, Ru-Xiang Xu, Miao-Chun Bai, Lu-Ping Wang, Yi-Wu Dai, Xue-Zhen Li collected and analysed the data; Peng Zhang and Cui-Ying Wu wrote the text and all authors have read and approved the text prior to publication.
Peng Zhang and Cui-Ying Wu contributed equally to this work and should be considered as co-first authors.

Yi-Wu Dai and Xue-Zhen Li are co-corresponding author.

References

1. Rousseau A, Mokhtari K, Duyckaerts C. The 2007 WHO classification of tumors of the central nervous system - what has changed? Curr Opin Neurol 2008; 21: 720-727.
2. Brat DJ, Scheithauer BW, Eberhart CG, Burger PC. Extraventricular neurocytomas: pathologic features and clinical outcome. Am J Surg Pathol 2001; 25: 1252-1260.
3. Louis DN, Perry A, Reifenberger G, von Deimling A, Figarella-Branger D, Cavenee WK, et al. The 2016 World Health Organization Classification of Tumors of the Central Nervous System: a summary. Acta Neuropathol 2016; 131: 803-820.
4. Choudhari KA, Kaliaperumal C, Jain A, Sarkar C, Soo MY, Rades D, et al. Central neurocytoma: a multi-disciplinary review. Br J Neurosurg 2009; 23: 585-595.
5. Sharma MC, Deb P, Sharma S, Sarkar C. Neurocytoma: a comprehensive review. Neurosurg Rev 2006; 29: 270-285.
6. Kamboj M, Gandhi JS, Mehta A, Sharma A. Atypical extraventricular neurocytoma: A report of two cases. J Can Res Ther 2015; 11:1022.
7. Daniel R, Boleslaw L, Branavan M, Adam F, Olufemi A, Sheila KS. Progression of Atypical Extraventricular Neurocytoma to Anaplastic Ganglioglioma. Hum Pathol. 2017; 59:125-130.
8. Hyunho C, Sung-Hye P, Dong GK, Sun HP. Atypical Extraventricular Neurocytoma. J Korean Neurosurg Soc 50 2011; 381-384.
9. Hung YC, Lee CC, Yang HC, Nasser M, Kathryn NK, Sun SB, et al. Stereotactic Radiosurgery for Central Neurocytomas: An International Multicenter Retrospective Cohort Study. J Neurosurg. 2020;1-10.
10. Edward AM, Ramesh G, Ajay N, L DL. The past, present and future of Gamma Knife radiosurgery for brain tumors: the Pittsburgh experience, Expert Review of Neurotherapeutics, 2012;12:4, 437-445.