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CASE STUDY

Consecutive Development of Ependymoma and Glioblastoma in a Single Patient: A Case Report

Jihad Echnin[1,2,*], Mohamed Daghi[1,2], Abdelkouddous Laaidi[1,2], Henri Malaize[1], Aurélien Nouet[1], Alexandre Carpentier[1], and Abdelhakim Lakhdar[2,3]

ABSTRACT

Introduction: **The simultaneous occurrence of ependymoma and glioblastoma in a single patient is an exceptionally rare phenomenon, with limited documented cases in the medical literature.**

Case Report: **This article presents a compelling case study of a 53-year-old female who sequentially developed these two distinct primary brain tumors. The patient initially underwent neurosurgery for a subependymoma in 2010 and later presented with motor and sensory symptoms, leading to the diagnosis of glioblastoma. A diagnostic stereotactic brain biopsy confirmed the presence of a high-grade oligodendroglioma. Despite postoperative complications, the patient's recovery has been favorable with no epileptic recurrence. The discussion highlights the distinct molecular and clinical heterogeneity of ependymoma and glioblastoma and the lack of reported cases featuring their consecutive occurrence. The underlying mechanisms behind such occurrences remain poorly understood and warrant further investigation.**

Conclusion: **This case underscores the importance of deepening our comprehension of consecutive primary brain tumors to optimize diagnosis, treatment planning, and patient outcomes.**

Keywords: Ependymoma, Glioblastoma, Prognosis, Stereotactic biopsy.

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[1] Department of Neurosurgery, Sorbonne University, AP-HP, La Pitié-Salpêtrière Hospital, France.
[2] Research Laboratory of Nervous System Diseases, Neurosensory Disorders & Disability, Faculty of Medicine and Pharmacy, Hassan II University, Morocco.
[3] Department of Neurosurgery, Ibn Rochd University Hospital, Morocco.

**Corresponding Author:*
e-mail: jijiechnin10@gmail.com

I. Introduction

Ependymoma and glioblastoma are distinct types of primary brain tumors, each with its unique characteristics and clinical implications. Ependymomas arise from ependymal cells lining the ventricles or central canal of the spinal cord and can present with a range of neurological symptoms [1]. Glioblastomas, on the other hand, are derived from glial cells and are the most aggressive and malignant form of brain tumors, often associated with a rapid disease progression and poor prognosis [2].

The development of multiple primary brain tumors within a single patient's brain poses a fascinating clinical situation. Encountering a patient who sequentially develops two distinct primary brain tumors, such as glioblastoma followed by ependymoma, presents an exceptionally rare phenomenon. Understanding the significance of such cases and the intricacies of these tumors is crucial for effective diagnosis, treatment planning, and optimizing patient outcomes.

Within this article, we delve into a captivating case study of a patient who sequentially developed ependymoma and glioblastoma and we aim to deepen our comprehension of the intricacies surrounding consecutive primary brain tumors.

II. Case Presentation

A 53-year-old female presented with motor and sensory symptoms (with right hemiparesis) and generalized epileptic seizures since July 2022. In 2010, she had undergone a neurosurgery for a large subependymoma (grade 1) located on the floor of the fourth ventricle. Fig. 1 illustrates the preoperative aspect of the patient's ependymoma within the fourth ventricle, while Fig. 2 displays the postoperative outcome of the same tumor after surgical intervention. Back then, the microscopic examination revealed fragments consistent with a pauci-cellular tumor proliferation composed of round cells with a homogeneous appearance

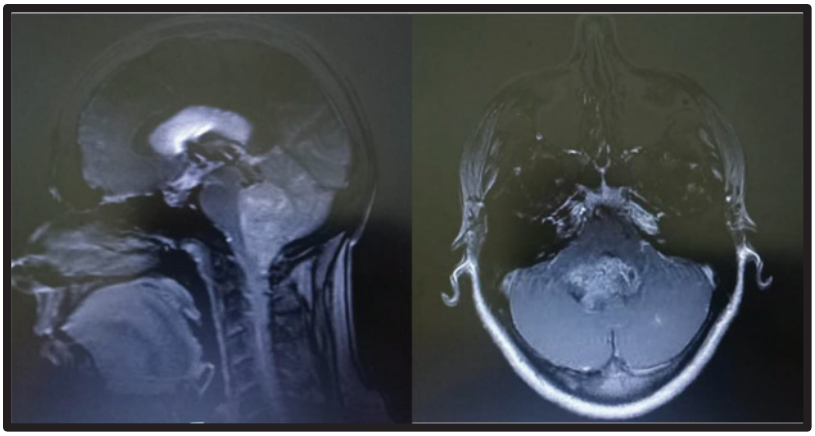

Fig. 1. The preoperative aspect of the ependymoma of the fourth ventricle.

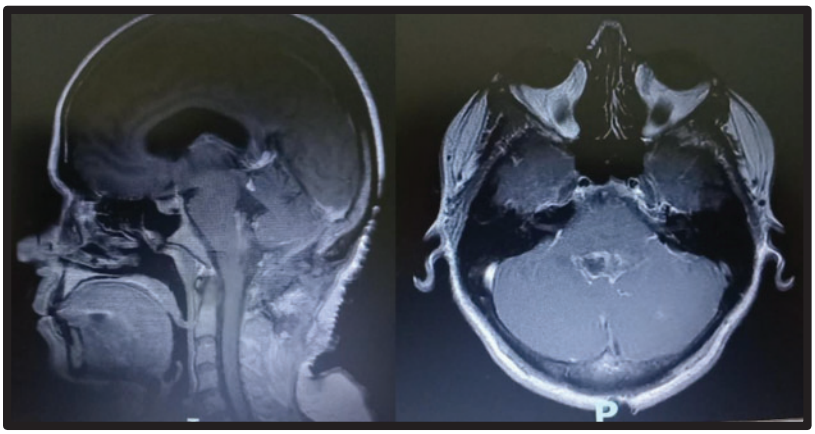

Fig. 2. The postoperative aspect of the ependymoma of the fourth ventricle.

forming cellular clusters. The nuclei were regular and ovoid in shape. Mitotic activity was observed. No ependymal tubules or perivascular arrangement were seen. The tumor exhibited a highly developed vascularity characterized by dilated vascular structures with a pseudo-angiomatous appearance. Some of these structures showed fibrinoid necrosis. Additionally, a few glomeruloid structures were noted. The Ki-67 cellular proliferation index (Agilent; MIB-1; 1/50 dilution) ranged from 0.1% to 5%.

Upon admission, we performed an MRI that showed a small punctate contrast enhancement of the long-known left cingulate brain lesion. Fig. 3 reveals the aspect and the visual representation of the tumor before any surgical procedures have taken place. He has been prescribed KEPPRA: 500 mg in the morning and evening, with a 12-hour interval between each dose, while continuing the URBANYL treatment as needed for prodromal symptoms. We discussed his case, and a stereotactic biopsy of this lesion was proposed. A multimodal MRI was requested prior to the biopsy and confirms the probable transformation of this left paramedian precentral glial lesion. Under these circumstances, a diagnostic stereotactic brain biopsy was highly recommended.

During the microscopic examination, we observed on both specimens a diffuse glial tumor proliferation with high cellular density, consisting of cells with an oligodendroglial phenotype. The mitotic activity reached 7 mitoses per 10 high-power fields. Endotheliocapillary proliferation

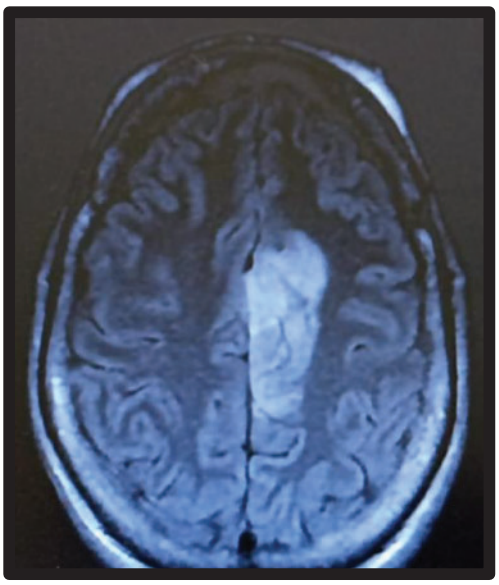

Fig. 3. The preoperative aspect of the glioblastoma.

and focal palisading necrosis were also observed. The conclusion was a high-grade oligodendroglioma (presumably grade 3). The immunohistochemical data showed IDH1 R132H+ expression, ATRX maintenance, and p53-status. Molecular analysis using NGS Dragon and Curie revealed mutations in the IDH1 R132H gene, CIC mutation in

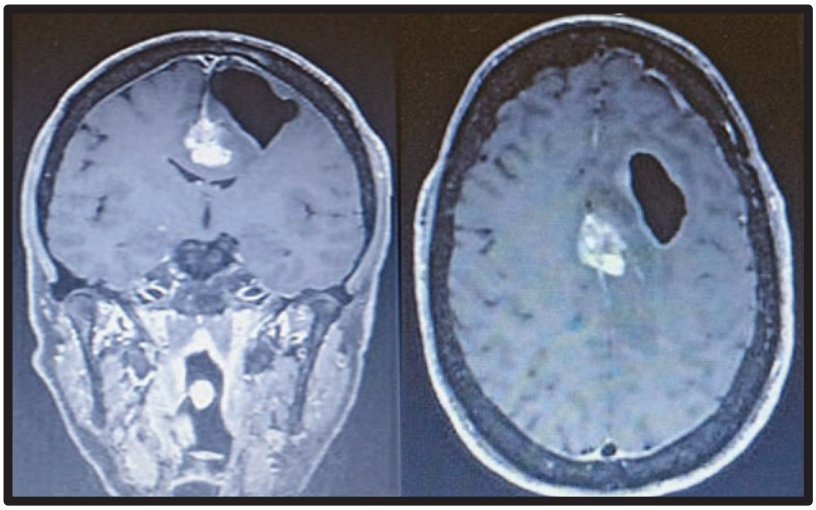

Fig. 4. The post operative aspect after the biopsy of the glioblastoma.

the TERT promoter, and co-deletion of chromosomes 1p and 19q.

On 14 Mars 2023, the stereotactic biopsy was performed and a Leksell frame was placed under local anesthesia, and targeting was determined based on a stereotactic MRI. After confirming the calculated coordinates, we administered a local anesthetic at the puncture site. We introduced the stereotactic guide and probe, and we created a trephine hole. The dura mater was coagulated, and the Sedan needle was inserted. Multiple staged biopsies were taken in various directions, yielding tissue cores with macroscopic pathological features for histological examination. The Sedan needle was then removed, and the Leksell frame was taken out. We closed the skin using a 3.0 rapid Vicryl suture. The procedure lasted for approximately 20 minutes, and there was no significant blood loss. The postoperative course was initially uneventful; however, complications later arose in the form of a hematoma, but more importantly, in form of progressive pneumocephalus that required intervention in the operating room. In Fig. 4, we observe the postoperative aspect of the Glioblastoma following a biopsy, displaying the changes that have occurred at the tumor site after the procedure. However, at this point, her recovery has been very favorable, as she has regained her pre-biopsy clinical state without any epileptic recurrence while taking KEPPRA 1000 mg twice daily.

III. Discussion

Glioblastoma and ependymoma are distinct types of brain tumors that exhibit significant molecular and clinical heterogeneity in both adult and pediatric populations [3], [4]. The simultaneous occurrence of these two distinct tumor types within the same individual is not well understood and, to the best of my knowledge, there are no documented cases in the existing medical literature reporting their concurrent presence. Glioblastoma is the most prevalent primary malignant brain tumor [5]. They account for 16% of all primary brain and central nervous system neoplasms, with an age-adjusted incidence rate of 3.2 per 100,000 population [5]–[7]. While glioblastomas primarily manifest in the brain, they can also occur in the brain stem, cerebellum, and spinal cord. The majority of primary gliomas (61%) are localized in the four lobes of the brain, with varying distribution: frontal (25%), temporal (20%), parietal (13%), and occipital (3%) [8]. Traditionally, glioblastomas were believed to originate solely from glial cells; however, emerging evidence suggests their potential derivation from various cell types possessing neural stem cell-like properties. These cells exhibit a range of differentiation stages, transitioning from stem cells to neurons and glial cells. The phenotypic diversity observed is primarily influenced by molecular alterations in signaling pathways rather than the cell type of origin [9]. It is crucial for neurosurgeons to be aware of these molecular characteristics in order to provide accurate diagnosis and treatment strategies for patients with this condition.

Ependymomas are glial cell tumors commonly found in the lining cells of the ventricular system [10]. While they primarily occur within the central nervous system (CNS), ependymomas can also arise outside the CNS or within the brain parenchyma [11]. These tumors exhibit genetic diversity and affect children more frequently than adults [4], [10]. In fact, they rank as the third most common brain tumor in pediatric patients. Genetic abnormalities found in ependymomas and have been shown to correlate with large genomic regions. Recent studies have highlighted the association of ependymomas with distinct oncogenic products and molecular subgroups, which may provide more accurate insights into clinical outcomes compared to histologic classification alone [4], [12].

The simultaneous occurrence of ependymoma and glioblastoma could potentially be attributed to multifocal tumor development, where two separate tumors arise independently within the brain. This could be due to genetic mutations or other underlying factors that predispose the patient to the development of multiple tumors [13], [14]. Alternatively, it is also possible that the presence of one tumor might influence the microenvironment and promote the development or transformation of the second tumor [15]. However, the precise mechanisms underlying such

occurrences are not yet fully understood and require further research. This particular case may potentially be the first of its kind to be documented in the scientific literature.

IV. Conclusion

There is no doubt that the optimal treatment for ependymoma and glioblastoma is multi-disciplinary, the simultaneous presence of the two tumors is a rare situation. Given the rarity of such cases, more research is needed to better understand the underlying biological mechanisms and potential risk factors associated with the simultaneous occurrence of ependymoma and glioblastoma.

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Provenance and Peer Review

Provenance and peer review not commissioned, externally peer reviewed.

Ethical Approval

Written informed consent for publication of their clinical details and/or clinical images was obtained from the patient. Our institution has exempted ethical approval.

Authorship

Data collection: Jihad Echnin, Mohamed Daghi, Abdelkouddous Laaidi.

Report writing: Jihad Echnin, Mohamed Daghi, Abdelkouddous Laaidi.

Critical manuscript revision: Jihad Echnin, Mohamed Daghi, Abdelkouddous Laaidi, Henri Malaize, Aurélien Nouet, Alexandre Carpentier.

Declaration of Competing Interest

The authors declare having no conflicts of interest for this article.

References

[1] Gerstner ER, Pajtler KW. Ependymoma. *Semin Neurol*. 2018;38(1):104–11.

[2] Wirsching H-G, Galanis E, Weller M. Glioblastoma. *Handb Clin Neurol*. 2016;134:381–97.

[3] Ang C, Guiot M-C, Ramanakumar AV, Roberge D, Kavan P. Clinical significance of molecular biomarkers in glioblastoma. *Can J Neurol Sci J Can Sci Neurol*. 2010;37(5):625–30.

[4] Mack SC, Taylor MD. The genetic and epigenetic basis of ependymoma. *Childs Nerv Syst ChNS Off J Int Soc Pediatr Neurosurg*. 2009;25(10):1195–201.

[5] Thakkar JP, Dolecek TA, Horbinski C, Ostrom QT, Lightner DD, Barnholtz-Sloan JS, *et al.* Epidemiologic and molecular prognostic review of glioblastoma. *Cancer Epidemiol Biomark Prev Publ Am Assoc Cancer Res Cosponsored Am Soc Prev Oncol*. 2014;23(10):1985–96.

[6] Ostrom QT, Bauchet L, Davis FG, Deltour I, Fisher JL, Langer CE, *et al.* The epidemiology of glioma in adults: a "state of the science" review. *Neuro-Oncol*. 2014;16(7):896–913.

[7] Ostrom QT, Gittleman H, Fulop J, Liu M, Blanda R, Kromer C, *et al.* CBTRUS statistical report: primary brain and central nervous system tumors diagnosed in the united states in 2008–2012. *Neuro-Oncol*. 2015;17(Suppl 4):iv1–iv62.

[8] Blissitt PA, American Association of Neuroscience Nurses. Clinical practice guideline series update: care of the adult patient with a brain tumor. *J Neurosci Nurs J Am Assoc Neurosci Nurses*. 2014;46(6):367–68.

[9] Phillips HS, Kharbanda S, Chen R, Forrest WF, Soriano RH, Wu TD, *et al.* Molecular subclasses of high-grade glioma predict prognosis, delineate a pattern of disease progression, and resemble stages in neurogenesis. *Cancer Cell*. 2006;9(3):157–13.

[10] Wu J, Armstrong TS, Gilbert MR. Biology and management of ependymomas. *Neuro-Oncol*. 2016;18(7):902–13.

[11] Taylor MD, Poppleton H, Fuller C, Su X, Liu Y, Jensen P, *et al.* Radial glia cells are candidate stem cells of ependymoma. *Cancer Cell*. 2005;8(4):323–35.

[12] Leeper H, Felicella MM, Walbert T. Recent advances in the classification and treatment of ependymomas. *Curr Treat Options Oncol*. 2017;18(9):55.

[13] Kinzler KW. *The Genetic Basis of Human Cancer*. New York: McGraw Hill; 2002.

[14] Frank SA. Genetic predisposition to cancer—insights from population genetics. *Nat Rev Genet*. 2004;5(10):764–72.

[15] Ungefroren H, Sebens S, Seidl D, Lehnert H, Hass R. Interaction of tumor cells with the microenvironment. *Cell Commun Signal CCS* [Internet]. 2011;9:18. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3180438/.