Primary dural-based parafalcine diffuse large b-cell lymphoma mimicking meningioma

Amr El Mohamad1*, Ahmed Shaaban1, Kazim Mohammed1, Rayan M. Sibira2, Einas A. Alkuwari3,3, Ali Raza1,3
1 Department of Neurosurgery, Hamad Medical Corporation, Doha, Qatar
2 Department of Laboratory Medicine and Pathology, Hamad Medical Corporation, Doha, Qatar
3 Weill Cornell Medical College, Doha, Qatar

Abstract

Background: Primary dural-based diffuse large B-cell lymphoma is very rare. Only few cases were reported in the literature.

Case presentation: Herein, we present a case of an immunocompetent patient with primary dural-based diffuse large B-cell lymphomas mimicking meningioma associated with ghost tumor phenomenon without any evidence of a systemic lymphoma.

Conclusion: Primary central nervous system lymphomas are rare. Clinicians should always consider this lesion as a differential diagnosis if radiological findings are not indicative of typical one meningiomas.

Introduction

Primary central nervous system lymphomas (CNSLs) (PCNSLs) are rare and account for 2%–5% of all brain tumor cases, whereas secondary CNSLs are more common [1,2]. One study has shown that the most common intraparenchymal histological type is diffuse large B-cell lymphoma, as among 26 patients with PCNSL, 25 had diffuse large B-cell lymphoma [3]. Although primary dural-based lymphomas are rare, the most common area of involvement is the cerebral hemispheres. Most dural-based lymphomas are secondary and present as extra-nodal systemic diffuse large B-cell lymphomas. Primary dural-based lymphomas are usually histologically marginal-zone lymphomas, representing a group of lymphomas that have been historically classified together because they appear to arise from post-germinal center and marginal-zone B cells and share a similar immunophenotype, and few cases were reported to be diffuse large B lymphomas [4]. Here, we present a case of an immunocompetent patient with primary dural-based diffuse large B-cell lymphomas mimicking meningioma associated with ghost tumor phenomenon without any evidence of systemic disease.

Case presentation

A 58-year-old male individual previously healthy and immunocompetent presented with headache, recurrent vomiting, and memory problems lasting for 3 days. No loss of consciousness, seizure, subjective weakness, or fever was observed. On physical examination, the patient’s Glasgow coma scale score was 15; his pupils were 3 mm in diameter, equal, and reactive; and the patient had nominal aphasia without motor and sensory deficit. He had normal cerebellar functions, and cranial nerve exams revealed no deficit. Head computed tomography (CT) (Fig. 1) showed a 2.2 × 3.8 cm (transverse × anteroposterior) iso-dense lesion with internal hypodensity in the left parasagittal frontal region extending to the right frontal region. Extensive perilesional edema was observed with effacement of the sulci and mass effect on bilateral frontal horns, associated with 3-mm midline shift. Head magnetic resonance imaging (MRI) showed an isointense parasagittal lesion on T1...
and heterogeneous intense on T2, with redemonstration of perifocal edema (Fig. 2). Head T1-weighted imaging with contrast enhancement (Fig. 3) showed a large, left frontal, parafalcine, irregular-shaped mass located below the superior sagittal sinus level. It measured $4 \times 3 \times 3.3$ cm in anteroposterior, mediolateral, and craniocaudal, respectively. It showed diffusion restriction (Fig. 4). There was central hyperintensity on T2-weighted imaging, without post-contrast enhancement area representing cyst formation. It exerts a mass effect characterized by effacement of the adjacent sulci, compression of the left lateral ventricle, and a 3-mm shift of the midline structures to the right side, and the impression of our neuroradiologist was atypical meningioma. Regarding extensive edema, dexamethasone was started at a dose of 4 mg, thrice a day, and the patient was planned for craniotomy and resection of the tumor. Initially, the patient was reluctant to undergo surgery; however, subsequently, the patient...
agreed to undergo surgery after approximately 10 days. During surgery, parasagittal craniotomy was performed; however, to our surprise, no definite mass lesion was found at the proposed site, in contrast to the findings described on imaging. The falx was thinned out and partly deficient. A biopsy sample was obtained from this abnormally appearing falx. Moreover, we obtained biopsy samples under neuronavigation guidance from abnormally appearing tissue, which was completely intra-axial, deep down in the lesion visualized on navigation. On postoperative day 1, MRI head with contrast enhancement (Fig. 5) showed that the previously seen lesion had a significant regression in size. Its

---

**Figure 7:** First brain biopsy showing focal large atypical lymphocytes.

**Figure 8:** Second brain biopsy: Tumor cells showing perivascular spread.

**Figure 9:** Second brain biopsy: Tumor cells showing perivascular spread.

**Figure 10:** Second brain biopsy, Immunohistochemistry; Tumor cells are positive for E. BCL2, F. BCL6, G. MUM1, and H. C-MYC

**Figure 11:** MRI head with contrast after second cycle chemotherapy A) T1 with contrast axial B) T2 Axial

right frontal extension and adjacent enhanced meningeal tail showed size reduction. Moreover, some regression in the perilesional vasogenic edema was observed. A significant regression in the previously described enhancement was noted at the left-side lentiform nucleus and external capsule. The MR spectroscopy study showed an increased choline/N-acetyl aspartate ratio and elevated lactate level within the lesion.

The histopathology results of the first brain biopsy samples (Figs.6–7) obtained from the falx cerebri showed meningothelial hyperplasia with calcification and focal perivascular lymphocytic infiltrate composed of small and large, atypical lymphocytes. Immunohistochemical staining was performed; however, the area of interest disappeared. The pathology team recommended another fresh biopsy to have the final diagnosis and flowmetry studies. So, the patient underwent redo craniotomy using the same incision, and multiple biopsy samples were taken. The second fresh brain biopsy (Figs. 8–9) showed multiple brain fragments with predominant perivascular atypical lymphoid infiltrates. Most cells were medium to large with moderate cytoplasm, atypical irregular nuclei having vesicular chromatin, variably prominent nucleoli, and several mitoses, including atypical one. Necrotic areas were also seen. Immunohistochemistry of the second biopsy (Fig.10 A-D) showed that atypical perivascular cells were positive for CD45, CD20, CD79a, BC12, BC16, MUM1, OCT2, and C-MYC, and negative for CD10, CD21, TDT, ALK1, EBV-LMP1, CD3, and CD5; however, few reactive/residual lymphocytes were positive for these enzymes. Moreover, 80% of lymphoid cellular nuclei were positive for Ki67. These findings were consistent with diffuse large B-cell lymphoma, not otherwise specified.

Whole-body positron emission tomography (PET) showed intense fluorodeoxyglucose (FDG) uptake higher than that in the healthy brain cortex, without evidence of coexisting systemic disease. In addition to PET scan, contrast-enhanced chest, abdomen, pelvis CT did not show any other lesions in the body; furthermore, workup for viral markers and autoimmune conditions were all unremarkable, thus confirming the diagnosis of “primary dural-based diffuse large B-cell lymphoma,” distinguishing it from secondary CNSL. The patient was transferred to the Oncology Department and started on three cycles of the methotrexate, cytarabine, thiotepa, and rituximab (MATRIX) protocol, which is the current standard treatment regimen for PCNSLs [5]. Three months after the diagnosis and after receiving two cycles of the MATRIX protocol, brain MRI with contrast enhancement (Fig. 11A, B) showed regression of the lesion, and PET scan showed complete metabolic resolution in terms of decreased FDG activity of the previously seen PCNSL without signs of lymphoma activity elsewhere. Subsequently, the patient received the third cycle of the MATRIX protocol without specific complications. Two weeks later, autologous stem cell transplantation (50 × 106/kg) was performed as part of the consolidation phase of treatment. Six weeks later, conditioning chemotherapy with carmustine–thiotepa was administered, followed by stem cell infusion (CD34 = 12 million/kg). The post-transplant course was complicated with mucositis, folliculitis, diarrhea, febrile neutropenia, and prolonged thrombocytopenia. Two months after transplantation, PET scan was repeated and showed complete metabolic resolution of initially seen PCNSL involvement. Currently, the patient is being followed by the hematology team; the patient is in good health and remission. The last outpatient follow-up was 8 months after the first surgery. The patient was seen by the vascular surgery (for permcath removal) and oncology teams. At this time, the patient was stable with complete remission; then, the patient was lost to follow-up. Another head MRI was performed and showed almost total regression of the lesion (Fig. 12A, B).

Discussion

Lymphomas in CNS are classified as primary, arising de novo from brain parenchyma, leptomeninges, eye, and spinal cord and as secondary to systemic lymphoma, which can be dural-based lesions. Secondary CNSLs are more common than PCNSLs. Most PCNSLs are intraparenchymal diffuse large B-cell lymphomas with a predilection to occur in the frontal lobe and then deep nucleic and periventricular locations; the infratentorial cerebellum is the most common location. However, primary dural-based lymphomas are rare, and even when found, they are histologically marginal-zone lymphomas. Few cases of primary dural-based diffuse large B-cell lymphoma have been reported in the literature [4,6]. Furthermore, PCNSLs are more common in immunocompromised patients with a mean age of 34.
years, and they occur in immunocompetent individuals at an older age with a mean of 52 years [7]. The patient in this case report was 58 years old and immunocompetent without significant previous medical conditions. The latest review of the literature on primary dural-based lymphoma has been conducted by Quinn et al., who have found only 24 reported cases of primary dural-based diffuse large B-cell lymphoma, which confirms the rarity of the disease and subsequently the limited knowledge regarding this disease entity [8]. CNSLs have rapid response to steroids with shrinkage in size and initial remission [9]. Moreover, the initial response to steroids is associated with a better response to chemoradiotherapy and good prognosis [9]. In the patient in this case report, there was an unintentional delay of surgery for approximately 10 days, and the patient was on steroids (dexamethasone). In this case report, the failure to identify a discrete lesion of the size expected as perceived on initial imaging, despite proper surgical planning using neuronavigation, was probably due to the rapid regression of the tumor in response to steroids. This phenomenon agrees with the scientific literature reporting about the disappearance of lymphomas in response to steroids (ghost tumors) [10,11]. The pathogenesis of primary dural-based lymphoma remains unknown as there is no lymphoid tissue in the dura. It is hypothesized that it is related to chronic infection, autoimmune disease, or chronic inflammatory condition, which recruits polyclonal lymphocytes resulting in monoclonal lymphomas [6]. In contrast, the patient in this case report did not have any chronic conditions. All workups were negative, including the entire viral panel and autoimmune markers. Basic research is needed to determine the etiology of PCNSL, especially dural-based lymphomas. In the patient in this case report, the initial radiological findings were mimicking those of a meningioma: dural-based and uniformly enhanced. There was significant surrounding edema, significant diffusion restriction, and blooming in susceptibility-weighted image, which goes more with higher-grade meningioma or another high-grade lesion. One review has shown that primary dural-based lymphomas can display the “dural tail “sign, further confusing the preoperative diagnosis with meningioma [12], which did happen in the patient in this case report. Therefore, we suggest that in case of a dural-based lesion that has non-typical features of grade 1 meningioma, clinicians should consider lymphoma in the differential diagnosis and avoid steroids unless necessary due to edema and mass effect keeping in mind the ghost tumor phenomena of lymphoma.

The role of surgery in PCNSLs is limited mainly to histological diagnosis through biopsy or tumor debulking in case of increased intracranial pressure or impending brain herniation. Some studies have shown no benefit of complete surgical resection of PCNSLs; however, a recent systematic review of 244 articles has shown evidence in support of cytoreductive surgery [13]. Previously, whole-brain radiotherapy (WBRT) was the recommended treatment; however, this treatment modality resulted in a high rate of relapse and a decrease in performance status and cognitive impairment, and with the improvement in survival with high-dose methotrexate, WBRT is no longer recommended. Currently, newly diagnosed PCNSLs are initially treated with induction chemotherapy until complete radiological response, followed by consolidation therapy, to prolong the overall survival [14]. The International Extra Nodal Lymphoma Study Group-32 trial has shown that a methotrexate-based MATRIX regimen results in a good outcome and control rate in PCNSL [5], and it is the standard induction chemotherapy. Ferreri AJM, in his article “The role of autologous stem cell transplantation in PCNSL” has compared various consolidation phase treatment modalities, including beam radiation, carmustine–thiotepa regimens, and autologous stem cell transplantation, and the results showed that autologous stem cell transplantation resulted in good outcomes [15]. The patient in this case report showed a good response to treatment with almost total resolution of PCNSL with three cycles of MATRIX chemotherapy, followed by conditioning chemotherapy with stem cell infusion.

**Conclusion**

PCNSL is a rare entity. Clinicians should always consider it in differential diagnosis of meningioma if the radiological findings are not typical for meningioma. When there is a high index of suspicion of lymphoma, repeating neuroimaging, particularly MRI, before surgery, especially if the surgery is delayed while the patient is on steroids, may help develop a better management plan while dealing with this rare lesion. In case of lesion disappearance, falx biopsy can be an option. The aim of surgery in PCNSL is mainly biopsy or debulking to decrease intracranial pressure in case of significant mass effect.

**Conflict of interest:** The authors have no conflict of interest to declare.

**Author contributions:**
Amr Rida El Mohamad: Conceptualization, Methodology, Validation, Investigation, Writing-Original Draft, Writing - Review & Editing.
Ahmed Shaaban: Conceptualization, Investigation, Visualization, Writing - Review & Editing.
Kazim Mohammed: Term, Resources, Visualization, Writing - Review & Editing.
Rayan M. Sibira: Conceptualization, Draft revision.
Einas A. Alkuwari: Investigation, Resources, Supervision,

Citation: Amr El Mohamad, Primary dural-based parafalcine diffuse large b-cell lymphoma mimicking meningioma. Jour of Clin Cas Rep, Med Imag and Heal Sci 1(4)-2022.
Draft revision.

Ali Raza Hussain Ali: Methodology, Validation, Visualization, Supervision.

All authors read and approved the final manuscript.

References


Citation: *Amr El Mohamad, Primary dural-based parafalcine diffuse large b-cell lymphoma mimicking meningioma. Jour of Clin Cas Rep, Med Imag and Heal Sci 1(4)-2022.

DOI: 10.55920/JCRMHS.2022.01.001036