

Burkitt lymphoma and cavernous sinus syndrome with breast uptake on ¹⁸F-FDG-PET/CT

A case report

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Abstract

Rationale: Burkitt lymphoma (BL) is a type of non-Hodgkin lymphoma that arises in the B-cells. Cavernous sinus involvement is rare, especially in adults. Here we report an unusual case of a 30-year-old HIV-positive woman with BL and cavernous sinus syndrome who also had intense bilateral breast uptake, related to menstrual cycle. Fluorine-18 2-fluoro-2-deoxyglucose (¹⁸F-FDG) positron emission tomography/computed tomography (PET/CT) has been found to be useful in the management of BL.

Patient concerns: A 30-year old female patient presented with a history of diplopia and headache.

Diagnoses: Magnetic resonance imaging revealed a large cavernous sinus mass. A bone marrow biopsy was done and demonstrated extensive marrow infiltration by Burkitt lymphoma. Further investigation detected the Epstein–Barr virus in her cerebrospinal fluid using qualitative polymerase chain reaction. ¹⁸F-FDG PET/CT imaging done revealed a hypermetabolic cavernous sinus mass, conglomerates of enlarged pelvic and para-aortic lymph nodes as well as diffuse bone marrow uptake. Intense bilateral breast uptake was noted coinciding with the start of menses.

Interventions: She was started on chemotherapy with adjuvant radiotherapy.

Outcomes: After her first cycle of chemotherapy, repeat ¹⁸F-FDG PET/CT imaging revealed a marked reduction in the metabolic activity and size of the cavernous sinus mass and conglomerates of lymph nodes. The bone marrow activity was still visualized but less intense compared to the staging PET/CT.

Lessons: A cavernous sinus mass will rarely be the primary lesion in Burkitt's Lymphoma. Our case demonstrates the role of ¹⁸F-FDG PET/CT in the assessment of such cases to detect other primary areas of disease involvement. It is useful in accurate initial staging and monitoring of treatment response in patients with Burkitt's Lymphoma.

Abbreviations: BL = Burkitt lymphoma, CNS = central nervous system, CT = computed tomography, EBV = Epstein–Barr virus, ¹⁸F-FDG = fluorine-18 2-fluoro-2-deoxyglucose, HIV = human immunodeficiency virus, MRI = magnetic resonance imaging, PCR = polymerase chain reaction, PET = positron emission tomography, SUV = standardized uptake value.

Keywords: ¹⁸F-FDG-PET/CT, breast uptake, Burkitt's Lymphoma, cavernous sinus syndrome, menstrual cycle

1. Introduction

The role of fluorine-18 2-fluoro-2-deoxyglucose (¹⁸F-FDG) positron emission tomography/computed tomography (PET/CT) in staging and response evaluation of patients with Burkitt lymphoma (BL) continues to grow and more-so in extranodal involvement. Cavernous sinus syndrome is rare in BL, and as the initial presentation of BL is in adults extremely rare.^[1,2]

Editor: Orazio Schillaci.

The authors report no conflicts of interest.

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Medicine (2017) 96:46(e8687)

Received: 25 January 2017 / Received in final form: 21 July 2017 / Accepted: 19 October 2017

<http://dx.doi.org/10.1097/MD.0000000000008687>

BL in the immunodeficiency-associated clinical form has an intimate relationship with Epstein–Barr viral infection. The latter is seen in the setting of the human immunodeficiency virus (HIV).^[3–5] Although extranodal origin of BL is seen in 10% to 34% of cases, it is unusual at initial presentation. To this effect, ¹⁸F-FDG PET/CT have been successfully used in AIDS-related BL for accurate staging and monitoring response to treatment.^[6,7] Furthermore, ¹⁸F-FDG PET/CT can be used to evaluate breast uptake in fertile women based on the different phases of the menstrual cycle.^[8,9]

2. Case report

A 30-year-old HIV-positive woman presented with a 2-week history of diplopia and headache. Her CD4 count at the time was 440 cells/μL. On examination, she had a right-sided cranial nerve III and VI palsy. Magnetic resonance imaging (MRI) revealed a large cavernous sinus mass (Fig. 1). A bone marrow biopsy was done and demonstrated extensive marrow infiltration by Burkitt lymphoma. Further investigation detected the Epstein–Barr virus (EBV) in her cerebrospinal fluid using qualitative polymerase chain reaction. ¹⁸F-FDG PET/CT imaging revealed a hypermetabolic cavernous sinus mass, conglomerates of enlarged pelvic and para-aortic lymph nodes as well as diffuse bone marrow uptake.



Figure 1. Magnetic resonance imaging image showing cavernous sinus mass (as indicated by the red arrow).

Intense bilateral breast uptake was noted coinciding with the start of menses (Fig. 2). ¹⁸F-FDG PET/CT imaging done 3 weeks after her first cycle of chemotherapy and adjuvant radiotherapy for the CNS involvement revealed a marked reduction in the metabolic

activity and size of the cavernous sinus mass and conglomerates of pelvic and para-aortic lymph nodes (Fig. 2). The bone marrow activity was still visualized but less intense compared to the staging PET/CT. There was reduced breast uptake bilaterally as the patient was in the proliferative phase of her menstrual cycle at the time of the repeat study.

The ethics committee of the University of Pretoria did not require ethical approval for reporting individual cases. Written informed consent was obtained from the patient for the publication of this case report.

3. Discussion

Burkitt lymphoma, a form of Non-Hodgkin lymphoma, is a high-grade tumor of B-cell origin.^[1,3] BL can be divided into 3 forms based on the geographical distribution and EBV association namely endemic, sporadic, and HIV-associated BL. Approximately, 30% to 40% of HIV-associated tumors are EBV-positive as seen in this case and frequent sites of occurrence include lymph nodes, the abdomen, bone marrow, and central nervous system (CNS).^[3-5] However, extranodal involvement as the initial presentation is uncommon and a cavernous sinus syndrome related to BL in an adult is even less common.^[2]

¹⁸F-FDG PET/CT imaging plays an important role in the management of patients with BL and was critical in evaluating the extent of disease in our patient. Owing to its high-growth fraction and overexpression of the *c-Myc*³ gene that turns on glycolysis, BL is a glucose-avid tumor that demonstrates high ¹⁸F-FDG uptake with a high standardized uptake value (SUV), which enables more reliable initial staging.^[5,6] ¹⁸F-FDG PET/CT can identify suspected and unexpected sites of disease and can help to

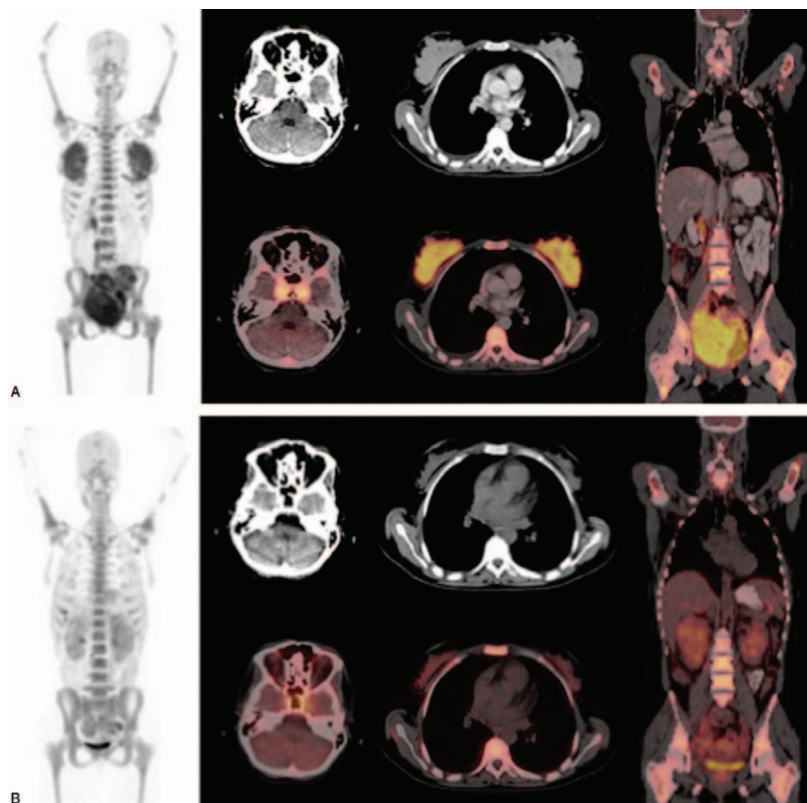


Figure 2. Comparison between the positron emission tomography/computed tomography images at initial staging (top row) and following the first cycle of chemotherapy (bottom row).

differentiate between HIV-associated lymphadenopathy and Burkitt lymphomatous involvement as was seen in our case with detection of multiple para-aortic and pelvic lymph nodes and bone marrow involvement in addition to the cavernous sinus mass. HIV-involved lymph nodes commonly demonstrate moderate ^{18}F -FDG uptake compared to the high SUV of BL nodes.^[6]

Interim and post-therapy ^{18}F -FDG PET/CT imaging plays an important role in predicting disease progression and also has therapeutic implications.^[5,6] Persistent FDG uptake after initiation or completion of therapy could be associated with both favorable and unfavorable outcomes.^[5-7] The marked reduction in metabolic activity and size of the cavernous sinus mass and conglomerates of pelvic and para-aortic lymph nodes signified a favorable outcome for our patient.

An incidental finding in this case was the bilateral breast uptake on her initial ^{18}F -FDG PET/CT. Factors that influence FDG uptake of normal breast tissue include age, density, and the various phases of the menstrual cycle. Breast tissue tends to show higher FDG uptake in the secretory, flow, and ovulatory phases compared to the proliferative phase, which is clearly evident when comparing the pre and posttherapy ^{18}F -FDG PET/CT studies of our patient.^[8,9] This should remind physicians that intense breast FDG uptake is not limited to malignancy only and correlation with the patient's menstrual cycle should also be considered.

In conclusion, we describe a patient with an unusual presentation of Burkitt lymphoma. Our case demonstrates the

value of ^{18}F -FDG PET/CT imaging in the initial staging of BL with its ability to identify extranodal disease including bone marrow involvement which may be missed with conventional anatomical imaging. It also shows that ^{18}F -FDG PET/CT imaging can be used to monitor response to treatment during a short time period.

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