Clinical note

Primary central nervous system lymphoma with lymphomatosis cerebri in an immunocompetent child: MRI and $^{18}$F-FDG PET-CT findings

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ABSTRACT

Primary central nervous system lymphoma (PCNSL) is extremely rare in immunocompetent children. We present the magnetic resonance imaging (MRI) and $^{18}$F-fluorodeoxyglucose ($^{18}$F-FDG) positron emission tomography-computed tomography (PET-CT) findings of such a case in a 14-year old immunocompetent boy. In this patient, PCNSL was associated with lymphomatosis cerebri. Familiarity with the findings of this rare condition will improve the diagnostic confidence of the nuclear radiologist and avoid misdiagnosis.

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Linfoma primario del sistema nervioso central con linfomatosis cerebri en un niño immunocompetente: hallazgos de la MRI y $^{18}$F-FDG PET-CT

RESUMEN

El linfoma primario del sistema nervioso central (LPSNC) es extremadamente raro en niños immunocompetentes. Presentamos los hallazgos de la imagen de resonancia magnética (MRI) y de tomografía por emisión de positrones-tomografía computarizada (PET-TC) con $^{18}$F-FDG en un niño immunocompetente de 14 años de edad. En este paciente el LPSNC se asoció con linfomatosis cerebri. Estar familiarizado con los hallazgos de esta rara afectación mejorará la confianza diagnóstica del médico nuclear y evitará un diagnóstico erróneo.

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Introduction

Primary central nervous system lymphoma (PCNSL) is a rare tumour accounting for 3–5% of primary brain tumours in adults. They are extremely rare in children. 1 PCNSL most often presents as a solitary, isolated lesion in immunocompetent patients. Rarely, the disease presents as a diffuse, infiltrating condition without formation of a cohesive mass, a pattern called ‘lymphomatosis cerebri’. PCNSL are extranodal malignant lymphomas that arise within the brain, eyes, leptomeninges, or spinal cord in the absence of systemic lymphoma at the time of diagnosis. Epidemiological data have shown a continual increase over past decades in the immunocompetent population, whereas the incidence seems to be decreasing in immunocompromised patients, mainly due to development of highly active anti-retroviral therapies. 2 We here describe a case of PCNSL with lymphomatosis cerebri in an immunocompetent child and discuss the magnetic resonance imaging (MRI) and $^{18}$F-fluorodeoxyglucose ($^{18}$F-FDG) positron emission tomography-computed tomography (PET-CT) features.

Clinical case

A 14-year old male child was admitted with complaints of recurrent rashes, sore throat and fever of 4-month duration. He also had cognitive dysfunction with concomitant gait abnormalities (ataxic gait) and recurrent focal seizures for the last 2 months. His routine blood parameters including electrolytes, urea, creatinine, CRP, transaminases, ESR were within normal range. Serology for human immunodeficiency virus (HIV) was negative. Cerebrospinal fluid (CSF) examination results were also normal with few lymphocytes.

MRI of the brain revealed enhancing confluent mass lesions in the bilateral thalami and corpus callosum (Fig. 1). In addition, also noted were diffuse hyperintense lesions in the white matter of both cerebral hemispheres. There was no evidence of restricted diffusion. The differential diagnoses on MRI were malignant glioma and PCNSL. For further evaluation of the lesions $^{18}$F-FDG PET-CT was done. PET-CT showed ill-defined hyperdense lesions involving predominantly the periventricular white matter and the corpus callosum with mass effect (midline shift towards left side) and...
Fig. 1. MRI of the patient showing multiple, ill marginated, lobulated, heterogeneous lesions involving the basal ganglion, thalami and corpus callosum; the lesions are appearing hypointense on axial T1-weighted images (A, arrowhead) and hyperintense on axial FLAIR (B, arrowhead) and axial T2-weighted images (C, arrow). The lesions are showing intense contrast enhancement and are seen involving the splenium and genu of corpus callosum (arrowheads) on post contrast axial image (D); bilateral thalami (arrows) on post contrast coronal image (E) and thalamus (arrow) with splenium of corpus callosum (arrowheads) on post contrast sagittal image (F). The diffuse infiltration of the white matter (lymphomatosis) also demonstrates similar features (A–C, arrows), but no contrast enhancement (D).

intense 18F-FDG uptake (Fig. 2). 18F-FDG avid hyperdense lesions were also noted in bilateral thalami, basal ganglia and right cerebellum. In addition, diffusely increased 18F-FDG uptake was noted in periventricular white matter (higher than normal grey matter) with no definite CT abnormality, suggesting diffuse infiltration. Due to intense 18F-FDG uptake, lack of perilesional edema and characteristic involvement of corpus callosum a diagnosis of PCNSL with 'lymphomatosis cerebri' was favoured on PET-CT. PET-CT also ruled out lymphomatous involvement of any other site. A repeat CSF examination revealed hoardes of lymphocytes with flow cytometry

Fig. 2. 18F-FDG PET-CT images of the patient demonstrated multiple hypermetabolic lesions in the brain (A–F). On transaxial PET (A) and PET-CT (D) images of the brain the hypermetabolic lesions were seen involving the splenium and genu of corpus callosum (arrowhead); bilateral thalami (bold arrows) on coronal images (B, E) and thalamus (bold arrow) with splenium of corpus callosum (arrowheads) on sagittal image (C, F). Also noted was diffusely increased 18F-FDG uptake in the periventricular white matter (A–F, arrows), which was higher than normal gray matter and suggested lymphomatosis cerebri. Whole body maximum intensity projection PET image (G) ruled out any other site of lymphomatous involvement.
positive for CD-20 +ve B lymphocytes cells. Based on these findings a diagnosis of PCNSL was made. The patient was started on steroids and was planned for radiotherapy, but he died three days later due to respiratory failure.

Discussion

‘Lymphomatosis cerebri’ is a rare diffusely infiltrating form variant of PCNSL. It is poorly recognized and frequently misdiagnosed. Clinically, the disease typically presents with a rapidly progressive dementia, unsteadiness of gait, focal weakness and severe weight loss. Our patient also presented with fever with similar neurological symptoms of cognitive dysfunction with concomitant gait abnormalities (ataxic gait) and focal seizures. Lymphomatosis cerebri is associated with a poor prognosis; optimal treatment is unknown. Since lymphomatosis cerebri is histologically identical to typical PCNSL, treatment is similar. Literature supports high-dose methotrexate based chemotherapy followed by whole-brain radiation as an initial treatment strategy, achieves a response rate of 90% and median survival of 60 months. The present patient was also planned for similar management but he unfortunately died.

MRI findings of PCNSLs are different in immunocompetent and immunocompromised patients. Immunocompetent patients typically present with a single enhancing lesion, located primarily in frontal and parietal lobes and less commonly in corpus callosum, majority of which are larger than 2 cm in diameter. In contrast immunocompromised patients have multiple ring enhancing foci, majority of which are less than 2 cm in diameter, and are located commonly in the basal ganglia and frontal lobes. So, when these characteristic findings of PCNSLs are not seen in their classic form, the diagnosis is often confused. Typical MRI features of lymphomatosis cerebri are diffuse non-enhancing T2 hyperintense lesions of subcortical white matter reflecting widespread infiltration of the cerebral white matter by lymphoma cells. Lymphomatosis cerebri are often mistaken on MRI for other, more common, conditions that cause white matter damage, including those due to infectious, inflammatory, vascular, toxic, or neurodegenerative etiologies. Lymphomatosis cerebri should be considered in the differential diagnosis of any patient presenting with multiple neurologic complaints or rapid onset dementia and diffuse, non-enhancing, white matter lesions on brain MRI. The present patient also presented with similar MRI features. However, he also had additional mass lesions.

18F-FDG PET has shown a potential role in management of patients with PCNSL, including prognosis. However, only one report has presented the 18F-FDG PET changes in lymphomatosis cerebri. The characteristic finding is regional hypermetabolism corresponding to MRI abnormalities detailed above. These 18F-FDG PET characteristics are of diagnostic value to differentiate lymphomatosis cerebri from Binswanger’s disease, where scattered areas of hypometabolism are found. Given the limitation of MRI, 18F-FDG PET-CT can help in making the diagnosis. In the present case 18F-FDG PET-CT showed diffusely increased 18F-FDG white matter suggesting ‘lymphomatosis cerebri’. Also hypermetabolism was noted in the mass lesions. An added advantage of 18F-FDG PET-CT was its ability to rule out lymphomatous involvement of other sites as in the present case.

The present report detailed the MRI and 18F-FDG PET-CT findings of lymphomatosis cerebri in an immunocompetent child with PCNSL. Familiarity with the findings of this rare condition will improve the diagnostic confidence of radiologist.

Conflicts of interest

The authors declare that they have no conflict of interest.

References