Letter to the Editor

Nuclear Medicine Communications 2013, 34:1237–1239

Ring-enhancing brain lesions, clinical presentation of focal seizures, and inconclusive anatomical neuroimaging features: can ^{18}F -FDG-PET/CT play an adjunct role in bettering diagnosis in this setting?

Sandip Basu, Radiation Medicine Centre, Bhabha Atomic Research Centre, Tata Memorial Centre Annexe, Mumbai, India

Correspondence to Sandip Basu, MBBS(Hons), DRM, DNB, MNAMS, Radiation Medicine Centre, Bhabha Atomic Research Centre, Tata Memorial Centre Annexe, Jeebhai Wadia Road, Parel, Mumbai 400012, India
Tel: +91 22 24146059/+91 22 24135232/+91 22 24149428;
fax: +91 22 24157098; e-mail: drsanb@yahoo.com

Received 18 June 2013 Revised 2 September 2013 Accepted 5 September 2013

'Ring-enhancing brain lesions with clinical presentation of focal seizures and inconclusive diagnostic features on anatomical neuroimaging modalities' is an area that continues to challenge attending neurologists with regard to the definitive etiologic diagnosis; therapeutic approaches are clearly different and an accurate diagnosis is of great importance in each of these settings; in addition, some of the conditions are potentially treatable. The common differentials in the general population include neurocysticercosis, tuberculomas, brain abscesses, and metastatic lesions. In AIDS patients, the major differential diagnosis is between central nervous system (CNS) lymphoma and CNS toxoplasmosis. How can one envisage the role of ^{18}F -FDG-PET/CT in this scenario as a valuable adjunct to further a definitive diagnosis? For the purpose of systematic discussion, we would approach the problem by considering each of the differential diagnoses separately in this clinical setting.

In a recent study, Jolepalem and Wong [1] have observed a relatively low-grade/absent ^{18}F -FDG uptake in lesions of neurocysticercosis. This finding is relatively consistent with that in a few published case reports by other authors [2] and we have also made a similar observation in our practice (Fig. 1). This low uptake of ^{18}F -FDG-PET in neurocysticercosis is noteworthy, especially as there is now substantial evidence in the literature on infective-inflammatory lesions demonstrating avid ^{18}F -FDG uptake commensurate with their inflammatory activity.

Although the low ^{18}F -FDG uptake in neurocysticercosis is uniform in all the published reports, there has been conflicting results and an overlap of ^{18}F -FDG uptake reported with intracerebral tuberculomas. One of the earlier studies in this domain documented low-grade ^{18}F -FDG uptake in CNS tuberculomas and toxoplasmosis [3].

In this study [3], the standardized uptake value ratio (lesion to contralateral brain area) in both of these conditions was significantly lower (range: 0.3–0.7) than that noted in patients with lymphoma (range: 1.7–3.1) with virtually no overlap of the uptake values. Contrary to this [3], in a recently reported case series studying intracranial tuberculomas [4], a relatively high lesion-to-normal gray matter uptake ratio was observed on both ^{11}C -methionine (1.8 ± 0.38) and ^{18}F -FDG scans (1.64 ± 0.26) in all newly diagnosed cases. The investigators concluded that ^{11}C -methionine, similar to ^{18}F -FDG, has limited specificity in distinguishing tuberculoma from neoplastic lesions [4].

Brain abscess is another differential diagnosis in which there is typically high uptake in the periphery of the lesion with reduced metabolic activity in the center. A similar pattern has been noted in a comparative study with both fluoroethyl tyrosine and ^{18}F -FDG, which showed false-positive results in abscesses and in a case of acute demyelinating lesion [5]. Such an uptake pattern in brain abscesses has also been documented in another comparative study with ^{11}C -methionine, and the possible role of PET with both tracers in assessing response to antibiotic therapy was highlighted [6]. A high uptake of ^{18}F -FDG has also been documented in a solitary case of tuberculous brain abscess on ^{18}F -FDG-PET/CT [7].

Thus, from an analysis of the published literature [1–7], one can infer that the positive predictive value of ^{18}F -FDG-PET is relatively limited (a biopsy is indicated), but the negative predictive value of ^{18}F -FDG-PET could prove beneficial in this setting especially if appropriately correlated with MRI interpretation to the positive predictive value. We have observed that malignant/metastatic lesions could be excluded with a high degree of certainty when there is absent/minimal ^{18}F -FDG uptake in the CT/MRI-depicted lesion sites (Fig. 1). In contrast, in the presence of intense ^{18}F -FDG uptake in the described lesions, it is imperative to undertake a whole-body PET/CT study in the same sitting. Quite often, this would also detect the site of primary tumor (usually in the lung) and aid in whole-body disease staging in the same diagnostic examination (Fig. 2). This will have important therapeutic implications from the point of view of patient management. Primary CNS lymphoma (an important differential in patients with HIV infection) demonstrates substantially increased metabolic activity on ^{18}F -FDG-PET.

Fig. 1

A 48-year-old man who presented with a recent history of left-sided focal seizure that started a month ago. (a) Plain and postcontrast MRI demonstrating a thick irregular peripherally enhancing lesion in the right frontal parafalcine region. This appeared hyperintense on T2-weighted images and hypointense on T1-weighted images. Associated surrounding edema was observed. (b) The ^{18}F -FDG-PET/CT-fused images demonstrating no appreciable ^{18}F -FDG uptake in the mentioned region.

Fig. 2

In conclusion, in the setting of ring-enhancing lesions of uncertain etiology on conventional anatomical imaging, a positive ¹⁸F-FDG-PET/CT has limited value in

Fig. 2

A 58-year-old man who presented with tonic-clonic seizure predominantly on the right side. He had a history of pulmonary Koch's with treatment completed 2 years ago. (a) CT scan of the brain with contrast demonstrating multiple ring-enhancing lesions noted in the left frontal and right posterior parietal region. (b) Brain ¹⁸F-FDG-PET/CT showing multiple foci of ¹⁸F-FDG uptake in the brain in the left frontal lobe (SUV_{max} 7.81 increasing to 10.62 on delayed ¹⁸F-FDG-PET), in the right medial temporal cortex (SUV_{max} 8.51 increasing to 14.20 on delayed imaging), and in the right occipital lobe (SUV_{max} 6.64 increasing to 10.58 on delayed imaging). (c) Whole-body ¹⁸F-FDG-PET/CT demonstrating intense ¹⁸F-FDG uptake in the right upper lobe (SUV_{max} 8.96). Focal ¹⁸F-FDG uptake was also noted in the abdominal (precaval and aortocaval) lymph nodes (SUV_{max} 7.96 and 5.46, respectively). The final histopathology of the pulmonary mass was suggestive of moderately differentiated adenocarcinoma of the lung. SUV, standardized uptake value.

differentiating between the various causes (especially when the differential lies between malignancy and abscess/tuberculoma) and would warrant a biopsy; however, in the absence of discernible uptake in the lesions, the probability of malignancy (including lymphoma) is substantially low. In the presence of intense ¹⁸F-FDG uptake indicating a malignant/metastatic lesion, a whole-body imaging is of potential help in detecting the site of primary tumor, thus providing an opportunity for whole-body disease staging and thereby influencing the subsequent clinical management of the patient. It needs to be determined whether the newly developed combined simultaneous PET/MRI has additional advantage and whether this modality can be translated into a 'one-stop shop' procedure in this setting.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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