

Combined C-11 Methionine and F-18 FDG PET Imaging in a Case of Neurosarcoidosis

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Purpose: PET scanning of the brain with F-18 FDG and C-11 methionine (MET) is useful for characterizing brain lesions discovered at MRI or CT. Most positive PET scans indicate malignancy. However, this case report demonstrates positive F-18 FDG and C-11 MET PET scans in a patient with a nonmalignant condition, neurosarcoidosis.

Materials and Methods: We detail the history and evaluation of a 59-year-old woman who presented with ataxia. The patient's evaluation included a contrast-enhanced MRI followed by PET scanning of the brain with C-11 MET and of the brain and trunk with F-18 FDG. The patient subsequently underwent biopsy of a lesion as directed by MRI and PET.

Results: The MRI demonstrated multiple enhancing leptomeningeal lesions consistent with metastatic disease. PET with F-18 FDG and C-11 MET demonstrated lesions in both cerebellar hemispheres with F-18 FDG accumulation in the mediastinum and left hilum. Biopsy of a brain lesion directed by MRI and PET revealed sarcoidosis.

Conclusions: In evaluating brain lesions, PET with F-18 FDG and C-11 MET can help localize the lesion best suited for biopsy. However, not all lesions that have increased uptake on C-11 MET or F-18 FDG PET are malignant. Granulomatous inflammatory diseases such as neurosarcoidosis should also be considered in the differential diagnosis.

Key Words: C-11 methionine, F-18 FDG, PET, neurosarcoidosis, brain

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Neurosarcoidosis in the cerebellum has seldom been described in the literature.^{1,2} The authors report the case of a 59-year-old woman with ataxia. Magnetic resonance imaging (MRI) of the brain was interpreted as metastatic brain cancer. As a follow-up study, positron emission tomography (PET) with F-18 fluorodeoxyglucose (F-18 FDG) and with C-11 methionine (C-11 MET) revealed lesions consistent with malignancy. C-11 MET and F-18 FDG PET coregistered

with the MRI guided the neurosurgeon to biopsy a lesion in the cerebellum, the pathology of which turned out to be sarcoidosis.

CASE REPORT

A 59-year-old woman was evaluated for ataxia, double vision, and decreased memory. A lumbar puncture was performed. Cerebrospinal fluid (CSF) cultures, including fungal and acid fast bacilli, were negative. CSF glucose was decreased at 21 mg/dL (normal range, 40–70 mg/dL) and CSF protein was increased at 230 mg/dL (15–45 mg/dL). CSF IgG was normal with no oligoclonal bands. Serum angiotensin converting enzyme was negative. Chest x-ray was normal. An MRI with and without contrast demonstrated enhancing diffuse leptomeningeal lesions mainly involving the basal cisterns and posterior fossa (Fig. 1A). The differential diagnosis included diffuse leptomeningeal carcinomatosis or, less likely, inflammatory disease.

The patient underwent a PET scan of the brain after administration of 20 mCi of C-11 MET. The patient was then given 10 mCi of F-18 FDG and a PET scan of the brain and trunk was done. The C-11 MET and F-18 FDG PET scans demonstrated multiple focal lesions in both cerebellar hemispheres (Fig. 1B, C). The uptake of C-11 MET was less intense than F-18 FDG. The F-18 FDG PET images of the trunk demonstrated focal abnormalities in the mediastinum and left hilum (Fig. 2). The findings on PET were most consistent with malignancy in the chest with metastatic disease to the brain. The C-11 MET and F-18 FDG PET images of the brain were coregistered with the contrast-enhanced MRI. The lesion selected for biopsy demonstrated contrast enhancement on MRI and had the highest C-11 MET and F-18 FDG uptake on PET scanning. The patient then underwent biopsy of the lesion in the cerebellum. The pathology demonstrated noncaseating granulomatous inflammation involving the leptomeninges consistent with sarcoidosis (Fig. 3).

DISCUSSION

The patient was thought to have metastatic disease to the brain based on MRI. C-11 MET and F-18 FDG PET identified focal lesions in the cerebellum consistent with metastatic disease. F-18 FDG PET of the trunk was consistent with malignancy or a granulomatous inflammatory process such as sarcoidosis or an infectious process such as histoplasmosis. The combination of findings in the brain and trunk

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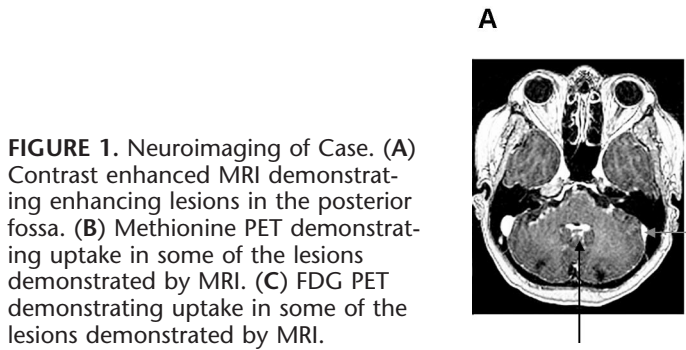


FIGURE 1. Neuroimaging of Case. (A) Contrast enhanced MRI demonstrating enhancing lesions in the posterior fossa. (B) Methionine PET demonstrating uptake in some of the lesions demonstrated by MRI. (C) FDG PET demonstrating uptake in some of the lesions demonstrated by MRI.

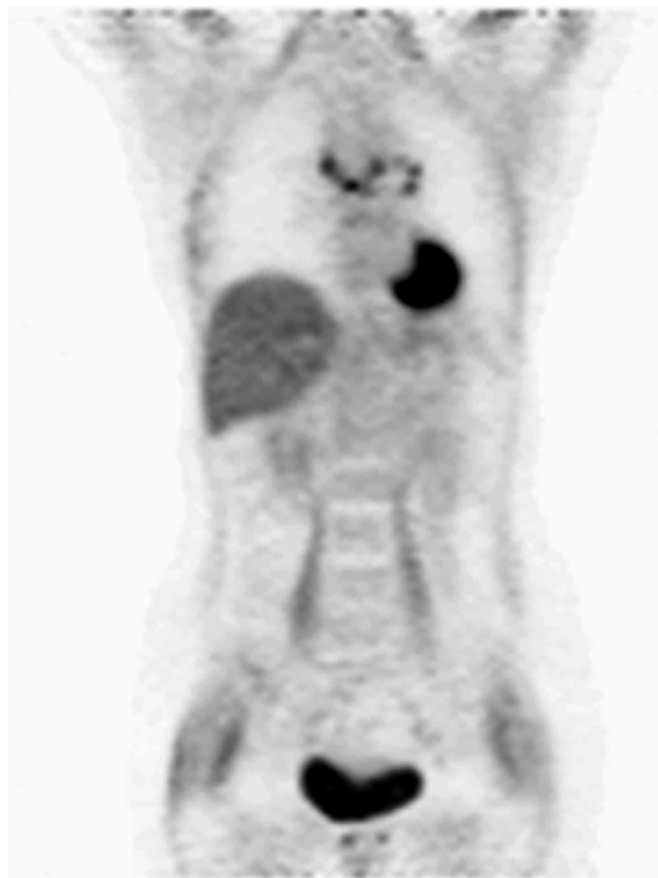


FIGURE 2. FDG PET of Trunk demonstrating uptake in mediastinum and hilum.

were considered most consistent with malignancy. In our experience, most brain tumors demonstrate C-11 MET accumulation at least equal to or greater than F-18 FDG. In retrospect, the greater F-18 FDG than C-11 MET uptake in our patient was a clue that the brain lesions may have been caused by a process other than malignancy. The final diagnosis of sarcoidosis was determined by biopsy of one of the brain lesions.

F-18 FDG PET imaging has become an established method to differentiate between malignant and benign lesions. Its sensitivity is over 90% in most malignancies.³

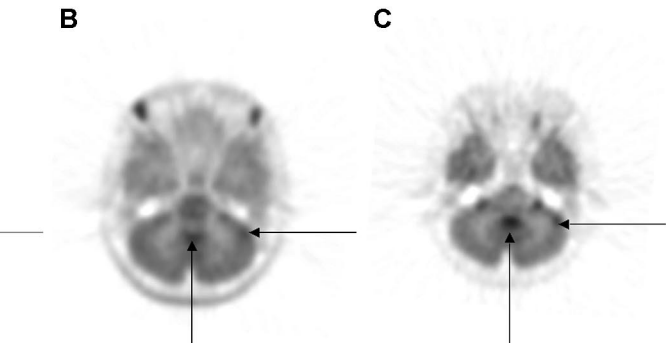


FIGURE 3. Histopathology of Case. Thick arrow indicates granuloma. Thin arrow indicates normal brain tissue.

False-positive results have been attributed to the accumulation of F-18 FDG in inflammatory lesions. Active granulomatous processes are known to have increased glucose uptake.^{4,5} Traditionally, neurosarcoidosis has been diagnosed on the basis of MRI and lumbar puncture results.⁶ There are no pathognomonic neurodiagnostic tests for neurosarcoidosis. Recently, some authors have described intense uptake of F-18 FDG at sites of active sarcoidosis. They suggest that F-18 FDG PET may be the most accurate method to identify the extent of sarcoid involvement.^{7,8} In our case, PET with F-18 FDG and C-11 MET helped localize a lesion in the cerebellum best suited for biopsy. C-11 MET has been known to accumulate in brain tumors and inflammatory diseases and in scanning the brain, has the advantage of low background cortical activity.⁹ In the differential diagnosis of positive PET scans in the brain with either F-18 FDG or C-11 MET, one should consider neurosarcoidosis in addition to malignancy. The distribution of C-11 MET is similar to F-18 FDG in neurosarcoidosis.

CONCLUSION

In patients with perplexing neurologic presentations, brain PET with F-18 FDG and C-11 MET can help localize the lesion most suitable for biopsy. However, not all lesions

that have increased F-18 FDG and C-11 MET uptake are malignant. Inflammatory diseases such as neurosarcoidosis should also be considered.

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