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¹⁸F-FET PET/CT can aid in diagnosing patients with indeterminate MRI findings for brain tumors: a prospective study

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Abstract

Objective: This prospective study aimed to evaluate the diagnostic value of fluorine-18-labeled fluoroethyltyrosine (¹⁸F-FET) positron emission tomography (PET)/computed tomography (CT) in diagnosing brain tumors within an Asian patient population.

Methods: Patients suspected of having primary or recurrent brain tumors were prospectively recruited. Each patient underwent ¹⁸F-FET and fluorine-18 fluorodeoxyglucose (¹⁸F-FDG) PET/CT on separate days within 1 week. We calculated the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy to compare the diagnostic performance of the two PET scans. The standardized uptake value (SUV) and tumor-to-background ratio (TBR) of the lesions were determined using static images. Additionally, time-activity curves (TACs) and time-to-peak (TTP) were generated from the dynamic PET images.

Results: From September 2019 to December 2023, 33 subjects were enrolled for reasons including suspected brain tumors (n = 20) or suspicious glioma recurrence (n = 8) on magnetic resonance imaging (MRI) and restaging for glioma (n = 5). Among the patients with suspected brain tumors or glioma recurrence on MRI, 25% had false-positive results. ¹⁸F-FET PET/CT accurately identified 86% of these false positives. The sensitivity, specificity, PPV, NPV, and accuracy of visual interpretation of ¹⁸F-FET PET/CT were 96.2%, 85.7%, 96.2%, 85.7%, and 93.9%, respectively. The corresponding ¹⁸F-FDG PET/CT values were 73.1%, 71.4%, 90.5%, 41.7%, and 72.7%. ¹⁸F-FET PET/CT demonstrated significantly higher sensitivity and accuracy than ¹⁸F-FDG PET (p = 0.031 and p = 0.030, respectively). Using TBRmean as an adjunct reference index enhanced the diagnostic accuracy of ¹⁸F-FET PET/CT, achieving a sensitivity and NPV of 100%. Wash-out TAC or TTP < 20 min was associated with a PPV of 100% for brain tumors.

Conclusions: ¹⁸F-FET PET/CT appears to be a valuable tool for assessing brain tumors with indeterminate MRI findings in this Asian cohort. ¹⁸F-FET PET/CT offers benefits over ¹⁸F-FDG PET in differentiating brain tumors from nontumor brain lesions, particularly when using semiquantitative analysis with TBR. This study was registered on ClinicalTrials.gov ([NCT06563024](https://clinicaltrials.gov/ct2/show/study/NCT06563024)).

Keywords: Brain neoplasms; Glioma, O-(2-[18F]-fluoroethyl)-L-tyrosine (FET); Positron emission tomography.

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