Prediction of oligodendroglial histology and LOH 1p/19q using dynamic [18F]FET-PET imaging in intracranial WHO grade II and III gliomas.


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Abstract

Oligodendroglial components (OC) and loss of heterozygosity on chromosomes 1p and 19q (LOH 1p/19q) are associated with better outcome in patients with glioma. We aimed to assess the fitness of [(18)F]fluoroethyltyrosine positron-emission-tomography (FET-PET) for noninvasively identifying these important prognostic/predictive factors. One hundred forty-four patients with MRI-suspected WHO grade II and III glioma underwent FET-PET scans prior to histological diagnosis. FET-PET analyses included maximal tumoral uptake (SUV(max)/BG), biological tumor volume (BTV), mean tumoral uptake (SUV(mean)/BG), total tumoral uptake (SUV(total)/BG), and kinetic analysis. Suspicion of OC was based on static and dynamic FET-uptake parameters. PET results were correlated with histology and 1p/19q status. OC tumors exhibited significantly higher uptake values, compared with astrocytomas (AC) (SUV(max)/BG 3.1 vs 2.3, BTV 15.5 mL vs 7.2 mL, SUV(total)/BG 38.5 vs 17.4, P < .01 each; SUV(mean)/BG 2.2 vs 2.1, P < .05). These differences were more pronounced in WHO grade II gliomas. Comparable results were found with respect to 1p/19q status. OC tumors exhibited significantly higher uptake values, compared with astrocytomas (AC) (SUV(max)/BG 3.1 vs 2.3, BTV 15.5 mL vs 7.2 mL, SUV(total)/BG 38.5 vs 17.4, P < .01 each; SUV(mean)/BG 2.2 vs 2.1, P < .05). These differences were more pronounced in WHO grade II gliomas. Comparable results were found with respect to 1p/19q status. Kinetic analysis misclassified 18 of 34 low-grade OC tumors as high-grade glioma but misclassified only 5 of 45 of the low-grade ACs. FET-based suspicion of OC resulted in concordance rates of both 76% for the prediction of OC and LOH 1p/19q. FET-uptake was significantly higher in gliomas with OC, compared with AC, and likewise in 1p/19q codeleted, compared with noncodeleted tumors. However, FET-PET analysis did not reliably predict the presence of OC/LOH 1p/19q in the individual patient, mostly because of an overlap in PET characteristics of OC tumors and high-grade AC. Histological examination is still required for an accurate diagnosis.


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