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Correlation of 6-18F-fluoro-L-Dopa PET Uptake with Proliferation and Tumor Grade in Newly Diagnosed and Recurrent Gliomas.

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Abstract

6-(18)F-fluoro-L-dopa ((18)F-FDOPA) measured with PET as a biomarker of amino acid uptake has been investigated in brain tumor imaging. The aims of the current study were to determine whether the degree of (18)F-FDOPA uptake in brain tumors predicted tumor grade and was associated with tumor proliferative activity in newly diagnosed and recurrent gliomas.

METHODS: Fifty-nine patients (40 men, 19 women; mean age \pm SD, 44.4 ± 12.3 y) with newly diagnosed ($n = 22$) or recurrent ($n = 37$) gliomas underwent (18)F-FDOPA PET perioperatively. Tumor tissue was obtained by resection or biopsy in all patients. The tumor grade and Ki-67 proliferation index were obtained by standard pathology assays. Tumor (18)F-FDOPA uptake was quantified by determining various standardized uptake value (SUV) parameters (mean SUV, maximum SUV [SUVmax], mean values of voxels with top 20% SUVs, and tumor-to-normal-brain tissue ratios) that were then correlated with histopathologic grade and Ki-67 proliferation index.

RESULTS: Fifty-nine lesions in 59 patients were analyzed. (18)F-FDOPA uptake was significantly higher in high-grade than in low-grade tumors for newly diagnosed tumors (SUVmax, 4.22 ± 1.30 vs. 2.34 ± 1.35 , $P = 0.005$) but not for recurrent tumors that had gone through treatment previously (SUVmax, 3.36 ± 1.26 vs. 2.67 ± 1.18 , $P = 0.22$). An SUVmax threshold of 2.72 differentiated low-grade from high-grade tumors, with a sensitivity and specificity of 85% and 89%, respectively, using receiver-operating-characteristic curve analysis (area under the curve, 0.86). (18)F-FDOPA PET uptake correlated significantly with Ki-67 tumor proliferation index in newly diagnosed tumors ($r = 0.66$, $P = 0.001$) but not in recurrent tumors ($r = 0.14$, $P = 0.41$).

CONCLUSION: (18)F-FDOPA uptake is significantly higher in high-grade than in low-grade tumors in newly diagnosed but not recurrent tumors that had been treated previously. A significant correlation between (18)F-FDOPA uptake and tumor proliferation in newly diagnosed tumors was observed, whereas this correlation was not identified for recurrent tumors. Thus, (18)F-FDOPA PET might serve as a noninvasive marker of tumor grading and might provide a useful surrogate of tumor proliferative activity in newly diagnosed gliomas.

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