A Novel PET Index, 18F-FDG-11C-Methionine Uptake Decoupling Score, Reflects Glioma Cell Infiltration.

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Abstract
The linear correlation between (11)C-methionine PET and tumor cell density is not well conserved at the tumor border in glioma. A novel imaging analysis method, voxelwise (18)F-FDG-(11)C-methionine PET decoupling analysis (decoupling score), was evaluated to determine whether it could be used to quantitatively assess glioma cell infiltration in MRI-nonenhancing T2 hyperintense lesions.

METHODS: Data collection was performed in a prospective fashion. Fifty-four MRI-nonenhancing T2 hyperintense specimens were stereotactically obtained from 23 glioma patients by intraoperative navigation guidance. The decoupling score and tumor-to-normal tissue (T/N) ratio of (11)C-methionine PET were calculated at each location. Correlations between the tumor cell density at these lesions, decoupling score, and T/N ratio of (11)C-methionine PET were then evaluated.

RESULTS: Both the decoupling score and the T/N ratio showed a linear correlation with tumor cell density at these specimens (R(2) = 0.52 and 0.53, respectively). Use of the decoupling score (cutoff = 3.0) allowed the detection of specimens with a tumor cell density of more than 1,000/mm(2), with a sensitivity and specificity of 93.5% and 87.5%, respectively, whereas conventional (11)C-methionine PET (cutoff = 1.2 in T/N ratio) was able to detect with a sensitivity and specificity of 87.0% and 87.5%, respectively. Reconstructed images (decoupling map) using the decoupling score enabled the visualization of glioma lesions that were difficult to visualize by (11)C-methionine PET alone.

CONCLUSION: The decoupling score showed better performance in detecting glioma cell infiltration than (11)C-methionine uptake alone, thus suggesting that (18)F-FDG-(11)C-methionine uptake decoupling analysis is a powerful imaging modality for assessing glioma invasion.

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