Metabolic imaging in recurrent gliomas: comparative performance of 18F-FDOPA, 18F-fluorocholine and 18F-FDG PET/CT

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PMID: 38095139   DOI: 10.1097/MNM.0000000000001795

Abstract

Purpose: The aim of this study was to directly evaluate glucose, amino-acid and membrane metabolism in tumor cells for diagnosis and prognostication of recurrent gliomas.

Methods: Fifty-five patients (median age = 36 years; 33 men) with histologically proven gliomas and suspected recurrence were prospectively recruited and underwent 18F-FDG (Fluorodeoxyglucose), 18F-FDOPA (fluorodopa) and 18F-Fluorocholine-PET/CT. Images were evaluated by two physicians visually and quantitatively [lesion-SUVmax, tumor (T) to gray-matter (G) and metabolically-active tumor volumes (MTV)]. After median follow-up of 51.5 months, recurrence was diagnosed in 49 patients. Thirty-one patients died with a median survival of 14 months.

Results: Diagnostic-accuracies for 18F-FDOPA, 18F-Fluorocholine,18F-FDG and contrast-enhanced-MRI were 92.7% (95% CI 82.7-97.1), 81.8% (69.7-89.8), 45.5% (33.0-58.5) and 44.7% (30.2-60.3), respectively. Among the 20 lesions, missed by MRI; 18F-FDOPA, 18F-Fluorocholine and 18F-FDG were able to detect 19, 14 and 4 lesions. Corresponding area-under-the-curves (T/G ratios) were 0.817 (0.615-1.000), 0.850 (0.736-0.963) and 0.814 (0.658-0.969), when differentiating recurrence from treatment-induced changes. In univariate-survival-analysis, 18F-FDOPA-T/G, visually detectable recurrence in 18F-FDG, 18F-FDOPA-MTV, cell-lineage and treatment-type were significant parameters. In Multivariate-Cox-regression analysis, 18F-FDOPA-MTV [HR = 1.009 (1.001-1.017); P = 0.024 (~0.9% increase in hazard for every mL increase of MTV)] and cell-lineage [3.578 (1.447-8.846); P = 0.006] remained significant. 18F-FDOPA-MTV cutoff <29.59 mL predicted survival higher than 2 years. At cutoff ≥29.59 mL, HR at 2 years was 2.759 (1.310-5.810).

Conclusion: 18F-FDOPA-PET/CT can diagnose recurrence with high accuracy and MTV predicts survival. 18F-Fluorocholine is a good alternative. Higher 18F-FDG uptake is an adverse prognostic indicator.

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