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# Evaluation of 18F-FDG PET and MRI Associations in Pediatric Diffuse Intrinsic Brain Stem Glioma: A Report from the Pediatric Brain Tumor Consortium.

Zukotynski KA, Fahey FH, Kocak M, Alavi A, Wong TZ, Treves ST, Shulkin BL, Haas-Kogan DA, Geyer JR, Vajapeyam S, Boyett JM, Kun LE, Poussaint TY.

Department of Imaging, Dana-Farber Cancer Institute, Boston, Massachusetts.

### Abstract

The purpose of this study was to assess (18)F-FDG uptake in children with a newly diagnosed diffuse intrinsic brain stem glioma (BSG) and to investigate associations with progression-free survival (PFS), overall survival (OS), and MRI indices.

**METHODS:** Two Pediatric Brain Tumor Consortium (PBTC) therapeutic trials in children with newly diagnosed BSG were designed to test radiation therapy combined with molecularly targeted agents (PBTC-007: phase I/II study of gefitinib; PBTC-014: phase I/II study of tipifarnib). Baseline brain (18)F-FDG PET scans were obtained in 40 children in these trials. Images were evaluated by consensus between 2 PET experts for intensity and uniformity of tracer uptake. Associations of (18)F-FDG uptake intensity and uniformity with both PFS and OS, as well as associations with tumor MRI indices at baseline (tumor volume on fluid-attenuated inversion recovery, baseline intratumoral enhancement, diffusion and perfusion values), were evaluated.

**RESULTS:** In most of the children, BSG (18)F-FDG uptake was less than gray-matter uptake. Survival was poor, irrespective of intensity of (18)F-FDG uptake, with no association between intensity of (18)F-FDG uptake and PFS or OS. However, hyperintense (18)F-FDG uptake in the tumor, compared with gray matter, suggested poorer survival rates. Patients with (18)F-FDG uptake in 50% or more of the tumor had shorter PFS and OS than did patients with (18)F-FDG uptake in less than 50% of the tumor. There was some evidence that tumors with higher (18)F-FDG uptake were more likely to show enhancement, and when the diffusion ratio was lower, the uniformity of (18)F-FDG uptake appeared higher.

**CONCLUSION:** Children with BSG for which (18)F-FDG uptake involves at least half the tumor appear to have poorer survival than children with uptake in less than 50% of the tumor. A larger independent study is needed to verify this hypothesis. Intense tracer uptake in the tumors, compared with gray matter, suggests decreased survival. Higher (18)F-FDG uptake within the tumor was associated with enhancement on MR images. Increased tumor cellularity as reflected by restricted MRI diffusion may be associated with increased (18)F-FDG uniformity throughout the tumor.

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