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Pseudoprogression versus true progression in patients with glioblastoma: A multiapproach analysis

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Abstract

Background and purpose: To investigate the feasibility of using a multiapproach analysis combining clinical data, diffusion- and perfusion-weighted imaging, and 3D magnetic resonance spectroscopic imaging to distinguish true tumor progression (TP) from pseudoprogression (PSP) in patients with glioblastoma.

Materials and methods: Progression was suspected within 6 months of radiotherapy in 46 of the 180 patients included in the Phase-III SpectroGlio trial (NCT01507506). Choline/creatine (Cho/Cr), choline/N-acetyl aspartate (Cho/NAA) and lactate/N-acetyl aspartate (Lac/NAA) ratios were extracted. Apparent diffusion coefficient (ADC) and cerebral blood volume (CBV) maps were calculated. ADC, relative CBV values and tumor volume (TV) were collected at relapse. Differences between TP and PSP were evaluated using Mann-Whitney tests, and p values were adjusted with Bonferroni correction.

Results: Patients with suspected progression underwent a new MRI scan 1 month after the first one. Of these, 28 were classified as PSP, and 18 as TP. After a median follow-up of 41 months, median overall survival was higher in PSP than in TP (25.2 vs. 20.3 months; p = 0.0092). Lac/NAA and Cho/Cr ratios were higher in TP than in PSP (1.2 vs. 0.5; p = 0.006; and 3 vs. 2.2; p = 0.021). After multivariate regression analysis, TV was the most significant predictor of TP vs. PSP, and the only one retained in the model (p = 0.028).

Conclusion: Three spectroscopic ratios could be used to differentiate PSP from TP. TV at relapse was the most predictive factor in the multivariate analysis, and overall survival was higher in PSP than in TP.

Keywords: diffusion-perfusion; glioblastoma; pseudoprogression; spectroscopy; true progression.

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