Intratumoral heterogeneity of 18F-FLT uptake predicts proliferation and survival in patients with newly diagnosed gliomas.

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Abstract

BACKGROUND: The nucleoside analog 3'-deoxy-3'-18F-fluorothymidine (FLT) has been investigated for evaluating tumor proliferating activity in brain tumors. We evaluated FLT uptake heterogeneity using textural features from the histogram analysis in patients with newly diagnosed gliomas and examined correlation of the results with proliferative activity and patient prognosis, in comparison with the conventional PET parameters.

METHODS: FLT PET was investigated in 37 patients with newly diagnosed gliomas. The conventional parameters [tumor-to-contralateral normal brain tissue (T/N) ratio and metabolic tumor volume (MTV)] and textural parameters (standard deviation, skewness, kurtosis, entropy, and uniformity) were derived from FLT PET images. Linear regression analysis was used to compare PET parameters and the proliferative activity as indicated by the Ki-67 index. The associations between parameters and overall survival (OS) were tested by Cox regression analysis.

RESULTS: Median OS was 662 days. For the conventional parameters, linear regression analysis indicated a significant correlation between T/N ratio and Ki-67 index (p = 0.02) and MTV and Ki-67 index (p = 0.02). Among textural parameters, linear regression analysis indicated a significant correlation for kurtosis (p = 0.003), entropy (p < 0.001), and uniformity (p < 0.001) as compared to Ki-67 index, exceeding those of the conventional parameters. The results of univariate analysis suggested that skewness and kurtosis were associated with OS (p = 0.03 and 0.02, respectively). Mean survival for patients with skewness values less than 0.65 was 1462 days, compared with 917 days for those with values greater than 0.65 (p = 0.02). Mean survival for patients with kurtosis values less than 6.16 was 1616 days, compared with 882 days for those with values greater than 6.16 (p = 0.006).

CONCLUSIONS: Based on the results of this preliminary study in a small patient population, textural features reflecting heterogeneity on FLT PET images seem to be useful for the assessment of proliferation and for the potential prediction of survival in newly diagnosed gliomas.

KEYWORDS: 18F-FLT; Glioma; Heterogeneity; PET; Texture

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