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CLINICAL STUDY - PATIENT STUDY

Relationship of pre-surgery metabolic and physiological MR imaging parameters to survival for patients with untreated GBM

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Abstract Glioblastoma Multiforme (GBM) are heterogeneous lesions, both in terms of their appearance on anatomic images and their response to therapy. The goal of this study was to evaluate the prognostic value of parameters derived from physiological and metabolic images of these lesions. Fifty-six patients with GBM were scanned immediately before surgical resection using conventional anatomical MR imaging and, where possible, perfusion-weighted imaging, diffusion-weighted imaging, and proton MR spectroscopic imaging. The median survival time was 517 days, with 15 patients censored. Absolute anatomic lesion volumes were not associated with survival but patients for whom the combined volume of contrast enhancement and necrosis was a large percentage of the T2 hyperintense lesion had relatively poor survival. Other volumetric parameters linked with less favorable survival were the volume of the region with elevated choline to *N*-acetylaspartate index (CNI) and the volume within the T2 lesion that had apparent diffusion coefficient (ADC) less than 1.5 times that in white matter. Intensity parameters associated with survival were the maximum and the sum of levels of lactate and of lipid within the CNI lesion, as well as the magnitude of the 10th percentile of the normalized ADC within the contrast-enhancing lesion. Patients whose imaging parameters indicating that lesions with a relatively large percentage with breakdown of the blood brain barrier or necrosis, large regions with abnormal metabolism or areas with restricted diffusion have relatively poor survival. These parameters may provide useful information for predicting outcome and for the stratification of patients into high or low risk groups for clinical trials.

Keywords Newly diagnosed glioblastoma multiforme · MRSI · DWI · PWI · Survival

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Introduction

Even with aggressive resection and the use of state-of-the-art therapies, survival for patients who are diagnosed with Glioblastoma Multiforme (GBM) is relatively short and there is great interest in developing new treatment strategies that are likely to be more effective [1–3]. There is considerable variability for individual patients, with the median survival from the time of diagnosis being from 1 to 2 years [1, 4–6] and a recent analysis of 766 patients reporting that only 2% were alive after 5 years [7]. Given such a bleak prognosis and the need to determine which patients might benefit from new therapies, it is important to identify non-invasive biomarkers that can be used to characterize individual lesions and to predict outcome [1, 6, 8, 9].

Although contrast-enhancing regions give valuable information regarding the location of different tumors [9, 10], there is considerable evidence to demonstrate that