Nonenhancing peritumoral hyperintense lesion on diffusion-weighted imaging in glioblastoma: a novel diagnostic and specific prognostic indicator.


Abstract

OBJECTIVE Glioblastoma differentials include intracranial tumors, like malignant lymphomas and metastatic brain tumors with indiscernible radiological characteristics. The purpose of this study was to identify a distinct radiological feature for the preoperative differentiation of glioblastoma from its differentials, which include malignant lymphomas and metastatic brain tumors. METHODS Preoperative MR images, including diffusion-weighted imaging (DWI) studies (b = 1000 and 4000 sec/mm²), obtained in patients with newly diagnosed malignant tumor, were analyzed retrospectively after receiving approval from the institutional review board. Sixty-four patients with histologically confirmed glioblastoma, 32 patients with malignant lymphoma, and 46 patients with brain metastases were included. The presence of a nonenhancing peritumoral DWI high lesion (NePDHL, i.e., hyperintense lesion in a nonenhancing peritumoral area on DWI) was confirmed in both DWI sequences. Gray matter lesions were excluded. Lesions were termed "definite" if present within 3 cm of the hyperintense tumor border with a signal intensity ratio ≥ 30% when compared with the contralateral normal white matter in both sequences. Discriminant analysis between the histological diagnosis and the presence of Definite-NePDHL was performed, as well as Kaplan-Meier survival analysis incorporating the existence of Definite-NePDHL. RESULTS In 25% of glioblastoma patients, Definite-NePDHL was present, while it was conspicuously absent in patients with malignant lymphoma and metastatic brain tumors. The specificity and positive predictive value were 100%. In the glioblastoma subset, a higher preoperative Karnofsky Performance Scale score (p = 0.0028), high recursive partitioning analysis class (p = 0.0006), and total surgical removal (p = 0.0012) were associated with better median overall survival. Patients with Definite-NePDHL had significantly early local (p = 0.0467) and distant/dissemination recurrence (p < 0.0001) and poor prognosis (p = 0.0007). CONCLUSIONS The presence of Definite-NePDHL is very specific for glioblastoma and indicates poor prognosis. Definite-NePDHL is a significant indicator of early local and distant/dissemination recurrence in patients with glioblastoma. Studying peritumoral DWI and high-b-value DWI is useful for tumor differentiation.
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