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Diagnostic value and efficacy of multimodal magnetic resonance imaging in differentiating radiation necrosis from tumor recurrence in glioblastomas

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Abstract

Background: Distinguishing radiation necrosis (RN) from recurrent tumor (RT) in patients with gliomas treated with radiation therapy presents an important clinical dilemma.

Purpose: To evaluate the diagnostic performance of multiparametric magnetic resonance imaging (MRI) techniques in distinguishing RN from RT in patients with histologically confirmed glioma treated previously with radiotherapy and chemotherapy or without chemotherapy using a combination of dynamic susceptibility-weighted contrast-enhanced (DSC) perfusion MRI, diffusion tensor imaging (DTI), and MR spectroscopy (MRS).

Material and methods: Patients with glioma who developed a new enhancing mass after standard treatment were retrospectively evaluated. Conventional MRI, DTI, DSC, and MRS were performed. The region of interest (ROI) was manually drawn in the enhancing lesions, peri-lesional white matter edema, and the contralateral normal-appearing white matter. Apparent diffusion coefficient (ADC), fractional anisotropy (FA), relative cerebral blood volume (rCBV), relative cerebral blood flow (rCBF), N-acetylaspartate (NAA), choline (Cho), creatine (Cr), NAA/Cr, Cho/NAA, and Cho/Cr were calculated. Two-tailed *t*-test and receiver operating characteristic (ROC) curve analysis were performed.

Results: In total, 34 patients with RT and 25 with RN met our inclusion criteria. FA, rCBF, rCBV, Cho/NAA, Cho/Cr were statistically significant between the two groups ($P < 0.05$). The sensitivity and specificity of FA, rCBF, rCBV, Cho/NAA, and Cho/Cr in the diagnosis of RT were 70.6%, 97.1%, 91.2%, 91.2%, and 82.4% and 64%, 100%, 100%, 96%, and 72% respectively.

Conclusion: DTI, DSC, and MRS are of great value in the differential diagnosis of RN and RT of glioma. The diagnostic performance of DSC is better than DTI and MRS.

Keywords: Glioma tumor recurrence; diffusion-weighted imaging; magnetic resonance spectroscopy; perfusion magnetic resonance imaging; radiation necrosis.

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