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Diagnostic Accuracy of Arterial Spin-Labeling, Dynamic Contrast-Enhanced, and DSC Perfusion Imaging in the Diagnosis of Recurrent High-Grade Gliomas: A Prospective Study

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Abstract

Background and purpose: For patients with high-grade gliomas, the appearance of a new, enhancing lesion after surgery and chemoradiation represents a diagnostic dilemma. We hypothesized that MR perfusion without and with contrast can differentiate tumor recurrence from radiation necrosis.

Materials and methods: In this prospective study, we performed 3 MR perfusion methods: arterial spin-labeling, DSC, and dynamic contrast enhancement. For each lesion, we measured CBF from arterial spin-labeling, uncorrected relative CBV, and leakage-corrected relative CBV from DSC imaging. The volume transfer constant and plasma volume were obtained from dynamic contrast-enhanced imaging without and with T1 mapping using modified Look-Locker inversion recovery (MOLLI). The diagnosis of tumor recurrence or radiation necrosis was determined by either histopathology for patients who underwent re-resection or radiologic follow-up for patients who did not have re-resection.

Results: There were 26 patients with 32 lesions, 19 lesions with tumor recurrence and 13 lesions with radiation necrosis. Compared with radiation necrosis, lesions with tumor recurrence had higher CBF (P = .033), leakage-corrected relative CBV (P = .048), and plasma volume using MOLLI T1 mapping (P = .012). For differentiating tumor recurrence from radiation necrosis, the areas under the curve were 0.81 for CBF, 0.80 for plasma volume using MOLLI T1 mapping, and 0.71 for leakage-corrected relative CBV. A correlation was found between CBF and leakage-corrected relative CBV (r_s = 0.54), volume transfer constant, and plasma volume (0.50 < r_s< 0.77) but not with uncorrected relative CBV (r_s = 0.20, P = .29).

Conclusions: In the differentiation of tumor recurrence from radiation necrosis in a newly enhancing lesion, the diagnostic value of arterial spin-labeling-derived CBF is similar to that of DSC and dynamic contrast-enhancement-derived blood volume.

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