Comparison of three different MR perfusion techniques and MR spectroscopy for multiparametric assessment in distinguishing recurrent high-grade gliomas from stable disease.

Seeger A, Braun C, Skardelly M, Paulsen F, Schittenhelm J, Ernemann U, Bisdas S.

Abstract

RATIONALE AND OBJECTIVES: Magnetic resonance (MR) perfusion techniques and MR spectroscopy (MRS) provide specific physiological information that may allow distinction between recurrent glioma and progression from stable disease.

MATERIALS AND METHODS: Forty patients underwent conventional MR imaging, dynamic contrast-enhanced T1-weighted perfusion imaging, dynamic susceptibility contrast-enhanced perfusion imaging (DSC), and multivoxel MRS. Arterial spin labeling was available in 26 of these patients. Quantitative parameters were calculated in tumor recurrences and stable disease, which were retrospectively verified on clinical and radiological follow-up. Receiver operating characteristic curves for each parameter were generated for the differentiation between recurrent glioma and stable disease. A forward discriminant analysis was undertaken to assess the power of the conjunction of MR perfusion techniques and MRS.

RESULTS: Of the 40 patients, 23 were determined to have recurrent gliomas. Differences in arterial spin labeling between the two groups were not statistically significant (P = .063). Sensitivities and specificities for the detection of recurrent lesions in dynamic contrast-enhanced T1-weighted perfusion imaging and DSC were 61.9% and 80% transfer constant k(trans), 77.3% and 84.6% for cerebral blood flow, and 81% and 76.9% for cerebral blood volume, respectively. Among the parameters in MRS, the ratio of choline to normalized creatine showed the best diagnostic accuracy (P = .014; sensitivity 70%, specificity 78.6%). When considering all perfusion modalities, diagnostic accuracy could be increased to 82.5%, adding MRS to the multiparametric approach resulted in a diagnostic accuracy of 90.0%.

CONCLUSIONS: MR perfusion techniques and MRS are useful tools that enable improved differentiation between recurrent glioma and stable disease. Among the single parameters, DSC showed the best diagnostic performance. Multiparametric assessment substantially improved the ability to differentiate the two entities.

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KEYWORDS: Glioma, arterial spin labeling, cerebral blood flow, cerebral blood volume, dynamic contrast-enhanced imaging, dynamic susceptibility contrast-enhanced imaging, k(trans), spectroscopy

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