Predictive role of magnetic resonance imaging in the distinction of isocitrate dehydrogenase (IDH) mutant grade 4 astrocytomas versus glioblastomas

Ahmet Mesrur Halefoglu [1] [2], Eyup Camurcuoglu [1] [2], Canan Tanik [1] [3], Orhan Kizilkaya [1] [4], Adem Yilmaz [1] [5]

Abstract

Background: Isocitrate dehydrogenase (IDH) mutation status is a crucial prognostic factor in high-grade glial tumors.

Purpose: To investigate whether magnetic resonance imaging (MRI) features can display a diagnostic performance in the determination of IDH mutation in high-grade gliomas.

Material and methods: A total of 170 patients including 24 IDH mutant grade 4 astrocytomas and 146 glioblastomas (GBM) were retrospectively examined via contrast-enhanced (CE) MRI before surgery. Immunohistochemistry and genomic sequence analyses were performed on specimen materials for the determination of IDH mutational status. Certain morphological and diffusion-weighted imaging (DWI) parameters were utilized to see if they could play a role to be non-invasive potential imaging predictors in the discrimination of IDH mutant versus wild-type (WT) high-grade gliomas.

Results: On histopathological examination, IDH mutation was detected in 24 patients with high-grade glioma and 146 of the patients were found to be WT. Certain morphological criteria of tumor location and involvement, tumor margins, visual detection of diffusion restriction on DWI, and quantitative apparent diffusion coefficient (ADC) parameters consisting of ADC_{mean}, ADC_{min}, and ADC_r could be used as imaging predictors in the discrimination of high-grade IDH mutant versus WT tumors.

Conclusion: Certain MRI morphologic features and visual detection of diffusion restriction on DWI and quantitative ADC parameters consisting of ADC_{mean}, ADC_{min}, and ADC_r can be considered non-invasive, significant independent imaging predictors in the discrimination and can obviate invasive procedures for histopathological diagnosis.

Keywords: Apparent diffusion coefficient; diffusion; glioma; isocitrate dehydrogenase mutation; magnetic resonance imaging.