MRI Scoring Systems for Predicting Isocitrate Dehydrogenase Mutation and Chromosome 1p/19q Codeletion in Adult-type Diffuse Glioma Lacking Contrast Enhancement

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Abstract

Background According to 2021 World Health Organization criteria, adult-type diffuse gliomas include glioblastoma, isocitrate dehydrogenase (IDH)-wildtype; oligodendroglioma, IDH-mutant and 1p/19q-codeleted; and astrocytoma, IDH-mutant, even when contrast enhancement is lacking. Purpose To develop and validate simple scoring systems for predicting IDH and subsequent 1p/19q codeletion status in gliomas without contrast enhancement using standard clinical MRI sequences. Materials and Methods This retrospective study included adult-type diffuse gliomas lacking contrast at contrast-enhanced MRI from two tertiary referral hospitals between January 2012 and April 2022 with diagnoses confirmed at pathology. IDH status was predicted primarily by using T2-fluid-attenuated inversion recovery (FLAIR) mismatch sign, followed by 1p/19q codeletion prediction. A visual rating of MRI features, apparent diffusion coefficient (ADC) ratio, and relative cerebral blood volume was measured. Scoring systems were developed through univariable and multivariable logistic regressions and underwent calibration and discrimination, including internal and external validation. Results For the internal validation cohort, 237 patients were included (mean age, 44.4 years ± 14.4 [SD]; 136 male patients; 193 patients in IDH prediction and 163 patients in 1p/19q prediction). For the external validation cohort, 35 patients were included (46.1 years ± 15.3; 20 male patients; 28 patients in IDH prediction and 24 patients in 1p/19q prediction). The T2-FLAIR mismatch sign demonstrated 100% specificity and 100% positive predictive value for IDH mutation. IDH status prediction scoring system for tumors without mismatch sign included age, ADC ratio, and morphologic characteristics, whereas 1p/19q codeletion prediction for IDH-mutant gliomas included ADC ratio, cortical involvement, and mismatch sign. For IDH status and 1p/19q codeletion prediction, bootstrap-corrected areas under the receiver operating characteristic curve were 0.86 (95% CI: 0.81, 0.90) and 0.73 (95% CI: 0.65, 0.81), respectively, whereas at external validation they were 0.99 (95% CI: 0.98, 1.0) and 0.88 (95% CI: 0.63, 1.0). Conclusion The T2-FLAIR mismatch sign and scoring systems using standard clinical MRI predicted IDH and 1p/19q codeletion status in gliomas lacking contrast enhancement. © RSNA, 2024 *Supplemental material is available for this article.* See also the editorial by Badve and Hodges in this issue.