ABSTRACT

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MRI-based radiomics signature and clinical factor for predicting H3K27M mutation in pediatric high-grade gliomas located in the midline of the brain.

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OBJECTIVE: To develop a nomogram based on MRI radiomics and clinical features for preoperatively predicting H3K27M mutation in pediatric high-grade gliomas (pHGGs) with a midline location of the brain.

METHODS: The institutional database was reviewed to identify patients with pHGGs with a midline location of the brain who underwent tumor biopsy with preoperative MRI scans between June 2016 and June 2021. A total of 107 patients with pHGGs, including 79 patients with H3K27M mutation, were consecutively included and randomly divided into training and test sets. Radiomics features were extracted from fluid-attenuated inversion recovery (FLAIR), diffusion-weighted (DW) and post-contrast T1-weighted images, and apparent diffusion coefficient (ADC) maps. The minimum redundancy maximum relevance (MRMR) and least absolute shrinkage and selection operator (LASSO) logistic regression were performed for radiomics signature construction. Clinical and radiological features were analyzed to select clinical predictors. A nomogram was then developed by incorporating the radiomics signature and selected clinical predictors.

RESULTS: Nine radiomics features were selected to construct the radiomics signature, which showed a favorable discriminatory ability in training and test sets with an area under the curve (AUC) of 0.95 and 0.92, respectively. Ring enhancement was identified as an independent clinical predictor ($p < 0.01$). The nomogram, constructed with radiomics signature and ring enhancement, showed good calibration and discrimination in training and testing sets (AUC: 0.95 and 0.90 respectively).

CONCLUSIONS: The nomogram which combined radiomics signature and ring enhancement had a satisfactory ability to predict H3K27M mutation in pHGGs with a midline of the brain.

KEY POINTS: • Conventional MRI features were not powerful enough to predict H3K27M mutation status in pediatric high-grade gliomas (pHGGs) with a midline location of the brain. • An MRI-based radiomics signature showed satisfactory ability to predict H3K27M mutation status of pHGGs located in the midline of the brain. • Associating the radiomics signature with clinical factors improved predictive performance.

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