ABSTRACT

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Diffusion-weighted imaging and arterial spin labeling radiomics features may improve differentiation between radiation-induced brain injury and glioma recurrence.

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OBJECTIVES: To determine whether radiomics features derived from diffusion-weighted imaging (DWI) and arterial spin labeling (ASL) can improve the differentiation between radiation-induced brain injury (RIBI) and tumor recurrence (TR) in glioma patients.

METHODS: A total of 4199 radiomics features were extracted from conventional MRI, apparent diffusion coefficient (ADC), and cerebral blood flow (CBF) maps, obtained from 96 pathologically confirmed WHO grade 2~4 gliomas with enhancement after standard treatment. The intraclass correlation coefficient (ICC) was used to test segmentation stability between two doctors. Radiomics features were selected using the Mann-Whitney U test, LASSO regression, and RFE algorithms. Four machine learning classifiers were adopted to establish radiomics models. The diagnostic performance of multiparameter, conventional, and single-parameter MRI radiomics models was compared using the area under the curve (AUC). The models were evaluated in the subsequent independent validation set (n = 30).

RESULTS: Eight important radiomics features (3 from conventional MRI, 1 from ADC, and 4 from CBF) were selected. Support vector machine (SVM) was chosen as the optimal classifier. The diagnostic performance of the multiparameter MRI radiomics model (AUC 0.96) was higher than that of the conventional MRI (AUC 0.88), ADC (AUC 0.91), and CBF (AUC 0.95) radiomics models. For subgroup analysis, the multiparameter MRI radiomics model showed similar performance, with AUCs of 0.98 in WHO grade 2~3 and 0.96 in WHO grade 4.

CONCLUSION: The incorporation of noninvasive DWI and ASL into the MRI radiomics model improved the diagnostic performance in differentiating RIBI from TR; ASL, especially, played a significant role.

KEY POINTS:
• The multiparameter MRI radiomics model was superior to the conventional MRI radiomics model in differentiating glioma recurrence from radiation-induced brain injury.
• Diffusion and perfusion MRI could improve the

ability of the radiomics model in predicting the progression in patients with glioma.
• Arterial spin labeling played an important role in predicting glioma progression using radiomics models.

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