ABSTRACT

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Glioblastoma Recurrence Versus Radiotherapy Injury: Combined Model of Diffusion Kurtosis Imaging and 11C-MET Using PET/MRI May Increase Accuracy of Differentiation.

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PURPOSE: To evaluate the diagnostic potential of decision-tree model of diffusion kurtosis imaging (DKI) and 11C-methionine (11C-MET) PET, for the differentiation of radiotherapy (RT) injury from glioblastoma recurrence.

METHODS: Eighty-six glioblastoma cases with suspected lesions after RT were retrospectively enrolled. Based on histopathology or follow-up, 48 patients were diagnosed with local glioblastoma recurrence, and 38 patients had RT injury between April 2014 and December 2019. All the patients underwent PET/MRI examinations. Multiple parameters were derived based on the ratio of tumor to normal control (TNR), including SUVmax and SUVmean, mean value of kurtosis and diffusivity (MK, MD) from DKI, and histogram parameters. The diagnostic models were established by decision trees. Receiver operating characteristic analysis was used for evaluating the diagnostic accuracy of each independent parameter and all the diagnostic models.

RESULTS: The intercluster correlations of DKI, PET, and texture parameters were relatively weak, whereas the intracluster correlations were strong. Compared with models of DKI alone (sensitivity =1.00, specificity = 0.70, area under the curve [AUC] = 0.85) and PET alone (sensitivity = 0.83, specificity = 0.90, AUC = 0.89), the combined model demonstrated the best diagnostic accuracy (sensitivity = 1.00, specificity = 0.90, AUC = 0.95).

CONCLUSIONS: Diffusion kurtosis imaging, 11C-MET PET, and histogram parameters provide complementary information about tissue. The decision-tree model combined with these parameters has the potential to further increase diagnostic accuracy for the discrimination between RT injury and glioblastoma recurrence over the standard Response Assessment in Neuro-Oncology criteria. 11C-MET PET/MRI may thus contribute to the management of glioblastoma patients with suspected lesions after RT.

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