MRgRT and Delta Radiomics: Early Prediction of Survival in Pancreatic Cancer

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Cancers and treatments are very diverse, often resulting in mixed patient outcomes: predicting survival early may improve prognosis. MRI is favorable for evaluating treatment efficacy, but current MRI-based evaluations are primitive. Radiomics thoroughly characterizes the tumor by analyzing complex relationships among voxels. This study determined the use of radiomics-based prediction using MRI-guided radiotherapy (MRgRT) while 1) evaluating the added value of delta radiomics, 2) characterizing optimal features, and 3) identifying optimal imaging times, to predict survival in pancreatic cancer (PC). TrueFISP MRI was previously acquired for 31 PC cases before five treatment fractions (T1-5) on a 0.35T MRgRT system. In total, 1,590 delta and static radiomics features were extracted for each case. 10-fold cross-validation with 11 repetitions was conducted to evaluate the stability of the model, and sequential forward selection was used to identify the most predictive features for support vector machine (SVM) in three scenarios: using all features, features from individual fractions, and delta baseline-1 features. On average, SVMs trained on all features, T5, T5-1, and T2-1 (mean-AUC=.68, .70, .77, .72) outperformed the remaining features (mean-AUC<.60), suggesting the added value of delta radiomics. When using all features, first-order and gray-level co-occurrence matrix features (24%, 35%) were most frequently selected, indicating greater predictive ability. The vast majority of features were delta (81%), and features involving T1 and T2 (51%, 44%), further suggesting imaging at the beginning of treatment to be most useful for survival classification. Future works should investigate the underlying biology of radiomics and the initial effects of radiotherapy.

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