OFFICIAL ABSTRACT and CERTIFICATION

Longitudinal MRI-based Radiomics: Estimation of Rectal Cancer to Chemoradiation

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Up to 27% of rectal cancer (RC) patients achieve pathological complete response through neoadjuvant chemoradiation (NAC) alone, increasing the importance of estimating RC response to NAC to avoid unnecessary surgery. While apparent diffusion coefficients (ADC) reflect tumor cellularity, its correlation with RC response to NAC remains unclear; radiomics features may be advantageous instead. This study aimed to compare mean ADC and radiomics features and characterize the most estimative features for this purpose.

The area under the receiver operating characteristic curve (AUC) was used to compare mean ADC values and 1,380 delta and single-time radiomics features extracted from longitudinal ADC maps and true fast imaging with steady-state precession MRI (TrueFISP). Testing and training accuracies of the radiomics features were calculated with two "leave-one-out" methods. High-accuracy features were characterized by calculating frequencies of feature categories, times, and delta features.

TrueFISP-based features yielded the highest AUCs (AUC=1) and testing and training accuracies, indicating superior estimative abilities to mean ADC (max-AUC=0.63) and ADC-based features (max-AUC = 0.88). Times 1 and 3, delta, first-order and gray level co-occurrence matrix (GLCM) features were most prevalent among high-accuracy features, indicating images from the beginning and middle of NAC and these features to be optimal for radiomics-based RC response estimation to NAC.

While the estimative ability of these features can be exploited in clinical decision support systems, future studies ought to evaluate additional radiomics features, MRI parameters, and clinical information from multi-center facilities to construct a portable patient response estimation model for RC.

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