Yu Sub Sung, Heon-Ju Kwon, Bum-Woo Park, Gyunggoo Cho, Chang Kyung Lee, Kyoun-Sik Cho and Jeong Kon Kim

Prostate Cancer Detection on Dynamic Contrast-Enhanced MRI: Computer-Aided Diagnosis versus Single Perfusion Parameter Maps

OBJECTIVE: The purpose of this article is to assess the value of computer-aided diagnosis (CAD) for prostate cancer detection on dynamic contrast-enhanced MRI (DCE-MRI).

MATERIALS AND METHODS: DCE-MRI examinations of 42 patients with prostate cancer were used to generate perfusion parameters, including baseline and peak signal intensities, initial slope, maximum slope within the initial 50 seconds after the contrast injection (slope50), wash-in rate, washout rate, time to peak, percentage of relative enhancement, percentage enhancement ratio, time of arrival, efflux rate constant from the extravascular extracellular space to the blood plasma (kep), first-order rate constant for eliminating gadopentetate dimeglumine from the blood plasma (kel), and constant depending on the properties of the tissue and represented by the size of the extravascular extracellular space (AH). CAD for cancer detection was established by comprehensive evaluation of parameters using a support vector machine. The diagnostic accuracy of single perfusion parameters was estimated using receiver operating characteristic analysis, which determined threshold and parametric maps for cancer detection. The diagnostic performance of CAD for cancer detection was compared with those of T2-weighted imaging (T2WI) and single perfusion parameter maps, using histologic results as the reference standard.

RESULTS: The accuracy, sensitivity, and specificity of CAD were 83%, 77%, and 77%, respectively, in the entire prostate; 77%, 91%, and 64%, respectively, in the transitional zone; and 89%, 89%, and 89%, respectively, in the peripheral zone. Values for kep, kel, initial slope, slope50, wash-in rate, washout rate, and time to peak showed greater area under the curve values (0.803–0.888) than did the other parameters (0.545–0.665) (p < 0.01) and were compared with values for CAD. In the entire prostate, accuracy was greater for CAD than for all perfusion parameters or T2WI (63–77%); sensitivity was greater for CAD than for T2WI, initial slope, wash-in rate, slope50, and washout rate (38–77%); and specificity was greater for CAD than for T2WI, kep, kel, and time to peak (59–68%) (p < 0.05).

CONCLUSION: CAD can improve the diagnostic performance of DCE-MRI in prostate cancer detection, which may vary according to zonal anatomy.

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