

Renal Cell Carcinoma: 3.0-T Diffusion-Weighted MR Imaging for Subtypes Differentiation

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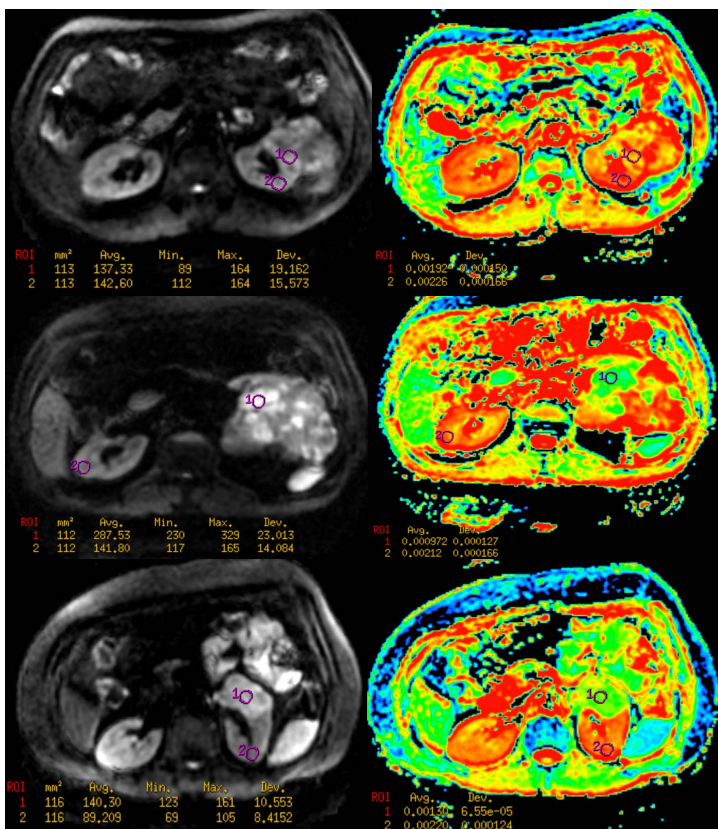
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Purpose: To assess the usefulness of apparent diffusion coefficients (ADCs) for characterizing RCC subtypes on 3.0-T MR diffusion-weighted imaging.

Materials and Methods: 83 patients (54 men, 29 women; age range, 23–75 years; mean age, 49.4 years) underwent diffusion-weighted MR imaging (DWI) of 85 renal masses (median diameter, 4.4 cm) with pathologic diagnoses of clear cell (n=49), papillary (n=22), or chromophobe RCC (n=14). Precontrast single-shot spin-echo echo-planar DWI was performed with b values of 500 and 800 s/mm² at 3.0 T. Differences in ADC values between RCC and uninvolved renal cortex were tested using paired-samples t-test. One-way ANOVA was used to compare ADC values of the various RCC subtypes. Receiver operating characteristic (ROC) curve analysis was used to compare clear and non-clear cell RCCs.

Results: With a b value of 500 s/mm², clear cell RCCs showed a significantly higher mean ADC value (1.849×10^{-3} mm²/s) compared to papillary (1.087×10^{-3} mm²/s) and chromophobe (1.307×10^{-3} mm²/s) RCCs (p<0.01); however, the difference between papillary and chromophobe RCCs was not significant (p=0.068). With b values of 800 s/mm², clear cell RCCs showed the largest mean ADC values (1.698×10^{-3} mm²/s) of the three subtypes, and the difference between each pair of subtypes demonstrated marked statistical significance (p<0.01). ADC values obtained with a b of value of 800 s/mm² were more effective for distinguishing clear from non-clear cell RCC (area under ROC curve, 0.973): a threshold value of 1.281×10^{-3} mm²/s permitted distinction with high sensitivity (95.9%) and specificity (94.4%).

Conclusions: DWI with a b value of 800 s/mm² allow sensitive and specific differentiation of clear cell, papillary, and chromophobe RCCs, which renders DWI an additional tool to improve preoperative characterization



Male, 46 years old. Pathologically-proved left-sided clear cell renal cell carcinoma. Diffusion-weighted image (2500/50; flip angle, 90°; field of view, 36 cm; matrix, 128×128; section thickness, 5 mm; intersection gap, 1 mm) with a b value of 800 s/mm²; region-of-interest (ROI) 1 indicates tumor and ROI 2 indicates uninvolved renal cortex. Apparent diffusion coefficient (ADC) map shows the ADC of the tumor 1.92×10^{-3} mm²/s and the ADC of uninvolved renal cortex 2.26×10^{-3} mm²/s.

Male, 49 years old. Pathologically-proved left-sided papillary renal cell carcinoma. Diffusion-weighted image (2500/50; flip angle, 90°; field of view, 36 cm; matrix, 128×128; section thickness, 5 mm; intersection gap, 1 mm) with a b value of 800 s/mm²; region-of-interest (ROI) indicates tumor and ROI 2 indicates uninvolved renal cortex. Apparent diffusion coefficient (ADC) map shows the ADC of the tumor 0.972×10^{-3} mm²/s and the ADC of uninvolved renal cortex 2.12×10^{-3} mm²/s.

Female, 50 years old. Pathologically-proved left-sided chromophobe renal cell carcinoma. Diffusion-weighted image (2500/50; flip angle, 90°; field of view, 36 cm; matrix, 128×128; section thickness, 5 mm; intersection gap, 1 mm) with a b value of 800 s/mm²; region-of-interest (ROI) 1 indicates tumor and ROI 2 indicates uninvolved renal cortex. Apparent diffusion coefficient (ADC) map shows the ADC of the tumor 1.30×10^{-3} mm²/s and the ADC of uninvolved renal cortex 2.20×10^{-3} mm²/s.