

Breath-hold, respiratory-triggered, and Free-breathing Diffusion-Weighted MR Imaging of Renal Lesions: Comparison of Imaging Quality and Apparent Diffusion Coefficient Values

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Purpose: To compare breath-hold, respiratory-triggered and free-breathing diffusion-weighted MR imaging of renal lesions and to assess the agreement in the apparent diffusion coefficient (ADC) values between the three sequences.

Materials and Methods: 53 patients (37 men, 16 women; age range, 20–75 years; mean age, 53.8 years) were enrolled into this study

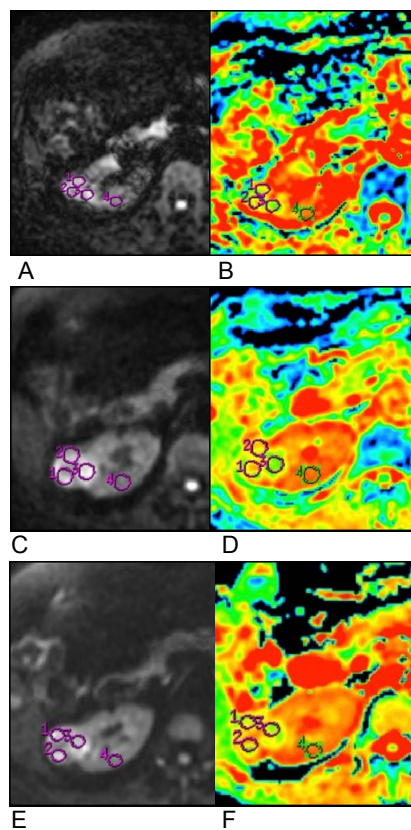


Figure A–F, a 50 years-old female patients with right-sided renal cell clear cell carcinoma (CCRCC).

Figure A, B, Breath-hold DW image and ADC map, the mean ADC value of CCRCC and ADC value of renal parenchyma were $1.57 \times 10^{-3} \text{ mm}^2/\text{s}$ and $2.11 \times 10^{-3} \text{ mm}^2/\text{s}$ respectively;

Figure C, D, Free-breathing DWI image and ADC map, the mean ADC value of CCRCC and ADC value of renal parenchyma were $1.54 \times 10^{-3} \text{ mm}^2/\text{s}$ and $2.14 \times 10^{-3} \text{ mm}^2/\text{s}$, respectively;

Figure E, F, Respiratory triggered DW image and ADC map, the mean ADC value of CCRCC and ADC value of renal parenchyma were $1.59 \times 10^{-3} \text{ mm}^2/\text{s}$ and $2.14 \times 10^{-3} \text{ mm}^2/\text{s}$, respectively.

with 53 renal masses (mean diameter, 4.2 cm) confirmed by histopathologic results or follow-up. All patients underwent breath-hold, respiratory-triggered and free-breathing diffusion-weighted MR imaging (DWI) on a 1.5 T MR system with b values of 0, 800 s/mm². Signal-to-noise ratio (SNR) of the kidney, contrast-to-noise ratio (CNR), and relative contrast ratio of the lesions were measured in each DWI sequence and were statistically compared using the nonparametric test. The ADC values of uninvolved renal parenchyma and renal lesions in the three sequences were compared for agreement using Intraclass Correlation Coefficient (ICC) and reliability analysis scale.

Results: The SNR of the kidney and the CNR of the renal

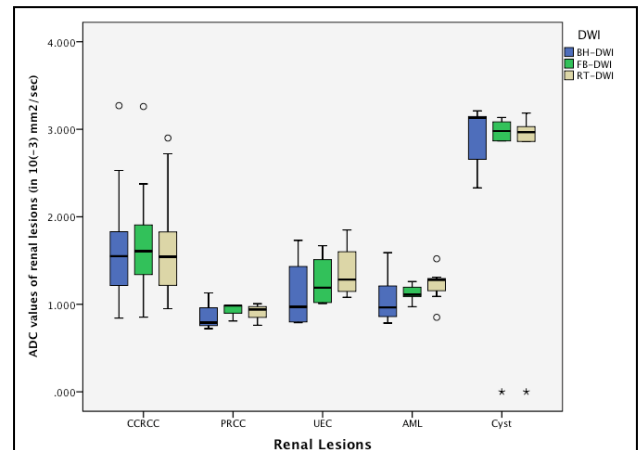


Figure G Box plot shows apparent diffusion coefficient (ADC) values of each type of renal lesion. ADC values and their scatter are similar in three DWI sequences. CCRCC=clear cell renal cell carcinoma, PRCC=papillary renal cell carcinoma, UEC=uroepithelial carcinoma, AML=angiomyolipoma

lesions were both significantly better on free-breathing DWI than on breath-hold and breath-hold DWI ($p < 0.001$). However, relative contrast ratio of the lesions did not show significant difference between these three sequences ($p = 0.231$). The ADC values of renal lesions measured by the three techniques showed good agreement (ICC, 0.914; standardized item α on the reliability analysis scale, 0.916;) and so did ADC values of the uninvolved renal parenchyma (ICC, 0.480; standardized item α on the reliability analysis scale, 489).

Conclusions: Both respiratory and free-breathing DWI can be appropriate sequences for evaluation of renal lesions without any compromise in the calculated ADC values, and free-breathing DWI can display better image quality.

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