Characterization of T1 hyperintense renal lesions with diffusion-weighted imaging: preliminary experience

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Introduction

T1 hyperintense renal lesions may represent hemorrhagic/proteinaceous cysts or neoplasms. The visual assessment of enhancement of these lesions can be difficult, and signal intensity measurements before/after contrast injection and qualitative analysis of enhancement with image subtraction can be used in that purpose. We wanted to determine the accuracy of apparent diffusion coefficient (ADC) measured with diffusion-weighted imaging (DWI) for the differentiation between hemorrhagic/proteinaceous cysts and T1 hyperintense neoplasms.

Methods

27 patients (20 men-7 women; mean age 68 y) with T1 hyperintense renal lesions $\geq$ 1 cm in greatest dimension were retrospectively evaluated with MRI at 1.5 T. In addition to the routine protocol (coronal T2 HASTE, axial in-phase and out-of-phase T1, and 3D gadolinium-enhanced T1 GRE sequence), SSEPI DWI sequences (b=0-400 sec/mm2) were performed using TR/TE 1300/67-84, FOV 270-400 mm, matrix 192x256, slice thickness/gap 7/1.4 mm, number of acquisitions 2 in the axial or coronal planes. ADC maps were obtained using commercial software. Based on contrast enhancement evaluated on subtraction images, pathologic findings, and prior/follow-up MRI, renal lesions were categorized by two observers in consensus as hemorrhagic/proteinaceous cysts vs. neoplasms. One of the two observers measured the lesion ADC using ROIs encompassing the largest section of the lesion. ADCs of hemorrhagic/proteinaceous cysts were compared with those of neoplasms.

Results

36 T1 hyperintense renal lesions $\geq$ 1 cm (mean size 3.7 cm, range 1.2-12 cm) were evaluated in 27 patients. On consensus reading, 25 lesions were characterized as hemorrhagic/proteinaceous cysts and 11 as neoplasms. ADCs of malignant lesions were significantly lower than those of benign lesions: 2.38 ± 0.41 vs. $1.80 \pm 0.47 \times 10^{-3}$ mm²/sec (p=0.001, Mann-Whitney test) (Fig. 1-2). Using a threshold ADC value $< 1.90 \times 10^{-3}$ mm²/sec for diagnosis of malignancy, we obtained sensitivity, specificity, PPV, NPV and accuracy of 82%, 92%, 82%, 92% and 89%, respectively.

Discussion

Our preliminary experience demonstrates the potential utility of DWI for characterization of T1 hyperintense renal lesions. Malignant lesions have significantly lower ADC values as seen in previously published data, indicating more restricted diffusion, when compared to benign complicated cysts. However, further evaluation of the exact role of DWI in relation to contrast enhancement is warranted.

Fig. 1

Fig. 2
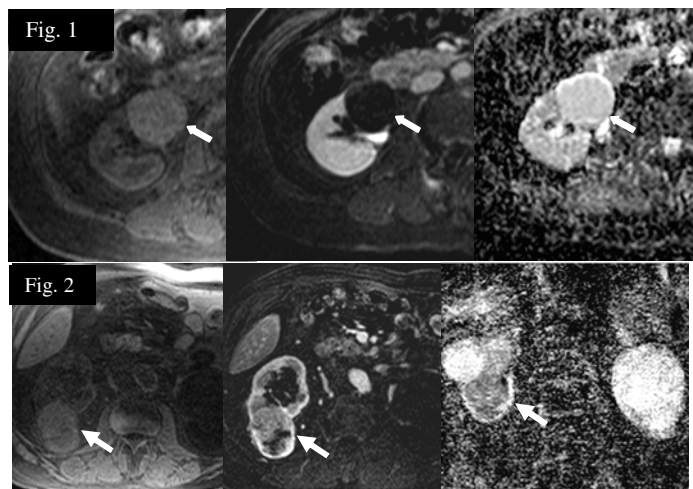
From left to right, unenhanced fat-suppressed T1-weighted and subtracted images (gadolinium-enhanced image minus unenhanced image), ADC map (b=0-400).

Fig. 1: Hemorrhagic cyst of right kidney (arrow). Unenhanced image shows a hyperintense mass. Subtracted image shows no enhancement confirming a diagnosis of a cyst. ADC value is 3.15×10^{-3} mm²/sec.

Fig. 2: Renal cell carcinoma of right kidney (arrow). 6 cm mass hyperintense in signal compared with renal parenchyma on the unenhanced image. Subtracted image shows solid enhancing component diagnostic for renal malignancy. ADC value is 1.49×10^{-3} mm²/sec.

References

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