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Cystic Renal Masses: characterization with Diffusion- Weighted Imaging Versus Contrast-Enhanced Magnetic Resonance Imaging

Thesis

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ABSTRACT

Purpose: To compare the diagnostic performance of magnetic resonance imaging (MRI), and MRI with diffusion-weighted imaging (DWI) in the characterization of cystic renal lesions.

Materials and Methods: Thirty-six adult patients underwent MRI (at 1.5 T), and DWI (at b-values of 0, 400 and 800 s/mm2) for characterization of 63 cystic renal lesions. There were 16 malignant renal cystic lesions (9 cystic clear cell RCC, 4 cystic papillary RCC, 3 massively necrotic RCC) opposite to 37 benign renal cystic lesions, 6 renal abscesses and 4 renal hemorrhagic cysts. A composite reference standards including histology, typical imaging criteria, and follow-up imaging was employed. To determine the diagnostic performance of imaging modalities, area-under-curve (AUC) was calculated by receiver-operating-characteristic analysis and compared. Fisher's exact test was used to compare the diagnostic accuracies and confidence levels with MRI, and MRI + DWI. Furthermore, DWI-ADC cutoff point to detect malignant cystic renal lesions, had been estimated and its diagnostic performance had been tested in term of sensitivity and specificity, PPD and NPV as compared to that of CE-MRI

Results: AUC for CE-MRI (0.915) and DW-MRI (0.834) in the differentiation between benign and malignant lesions (among all study cases) were within corresponding 95% confidence interval (CI) (P >0.5), furthermore A cutoff ADC point of ≤ 2.26 x10−3 mm2/s can be considered as diagnostic threshold for malignant cystic renal lesion lesions (among all study cases) with 87.5% sensitivity, 87.2% specificity, 70.0% PPV, 95.3% NPV, opposite to 100% sensitivity, 82.9% specificity, 66.7% PPV, 100% NPV for the CE-MRI. AUC for CE-MRI (0.976) and DW-MRI (0.917) in the differentiation between benign and malignant lesions (after exclusion of renal abscess and renal hemorrhagic cysts from study cases) were within corresponding 95% confidence interval (CI) (P = >0.5), A cutoff ADC point of ≤ 2.84 x10−3 mm2/s could be considered as diagnostic threshold for malignant cystic renal lesion lesions (after exclusion of renal abscess and renal hemorrhagic cysts from study cases) with 93.7% sensitivity, 91.9% specificity, 83.3 PPV, 97.1 NPV, opposite to 100% sensitivity, 95.12% specificity, 88.9% PPV, 100% NPV for the CE-MRI.

Conclusions: Our study showed that malignant cystic renal masses had tendency toward restricted diffusivity and significant lower ADCs in comparison to benign ones, and diagnostic performance of DWI-ADC at b-value of 0-400-800 s/mm2 appeared as efficient as that of CE-MRI in differential between benign and malignant cystic lesions, especially when usage of contrast medium is contraindicated, however there is noticeable ADC overlapping among some malignant and benign lesions, specifically for renal carcinomas versus renal abscesses as well as for renal cell carcinoma versus renal hemorrhagic cysts, For such situation we need to consider clinical data, follow up notes, and correlates with findings of conventional MRI to optimize the characterization of cystic renal lesion before establishment of proper management plan.

Keywords: Diffusion-weighted imaging, magnetic resonance imaging

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List of Abbreviations

Abb.	Full term
2D	2-dimensional
ACKD	Acquired cystic kidney disease
ACR	American College of Radiology
ADC	Apparent diffusion coefficient
ADPKD	Autosomal dominant polycystic kidney disease
AKI	Acute kidney injury
AML	Angiomyolipoma
AUC	Area under the curve
CE-MRI	Contrast Enhanced T1 WI
CEUS	Contrast-enhanced ultrasound
CKD	Chronic kidney disease
CM	Contrast medium
CRM	Cystic renal masses
CSF	Cerebrospinal fluid
CT	Computed tomography
DCE 3D GE	Dynamic Contrast Enhanced MRI
DWI	Diffusion-Weighted Imaging
DW-MRI	Diffusion-weighted MRI
EPI	Echoplanar imaging
EPI	Echo-planar imaging
Gd-DTPA	Gadolinium diethylenetriamine penta-acetic acid
GRE	Gradient-echo
IP	In-phase
IVC	Inferior vena cava
MEST	Mixed epithelial and stromal tumors
MR	Magnetic resonance

List of Abbreviations Cont...

Abb.	Full term
MRA	Magnetic resonance angiography
MRI	Magnetic resonance imaging
MRU	MR urography
NSF	Nephrogenic systemic fibrosis
OP	Opposed-phase
RA	Renal abscess
RCC	Renal cell carcinoma
ROC	Receiver operator characteristics
ROIs	Regions of interest
SS TSE	T2-weighted single shot turbo spin echo
T2W imaging	T2 weighted image
TCC	Transitional cell carcinoma

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