

IMAGING

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Utility of diffusion-weighted MRI in characterization of adrenal lesions

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Objective: The purpose of our study was to evaluate the utility of apparent diffusion coefficient (ADC) values for characterizing adrenal lesions and determine if diffusion-weighted imaging (DWI) can distinguish lipid-rich from lipid-poor adenomas.

Materials and Methods: We retrospectively evaluated 160 adrenal lesions in 156 patients (96 women and 60 men; mean age, 63 years). ADCs and signal intensity (SI) decrease on chemical shift imaging were measured in adrenal lesions with a wide variety of pathologies. Lipid-rich and lipid-poor adenomas were identified by unenhanced CT. The overall predictive power of ADC, SI decrease, and lesion size were determined by receiver operating characteristic (ROC) analysis. Areas under the ROC curve (AUC) were compared for equivalence using nonparametric methods. Sensitivity, specificity, and positive and negative predictive values were calculated. Correlation coefficients were used to assess ADCs versus percentage SI decrease and ADCs versus CT attenuation.

Results: ADCs of adrenal malignancies (median, 1.67×10^{-3} mm²/s; interquartile range, 1.41 - 1.84×10^{-3} mm²/s) were not different compared with those of benign lesions (1.61×10^{-3} mm²/s; 1.27 - 1.96×10^{-3} mm²/s; $p > 0.05$). Cysts (2.93×10^{-3} mm²/s; 2.70 - 3.09×10^{-3} mm²/s) showed higher ADCs than the remaining adrenal lesions ($p < 0.05$). The median ADCs of lipid-rich adenomas did not differ from those of lipid-poor ones ($p > 0.05$). The CT attenuation had no negative or positive correlation with the ADCs of adrenal adenomas ($r = -0.05$, $p = 0.97$).

Conclusion: Unlike lesion size and percentage decrease in SI, the ADCs were not useful in distinguishing benign from malignant adrenal lesions. Lipid-poor adenomas could not be distinguished from lipid-rich adenomas and all other nonfatty lesions of the adrenal gland with DWI.

Editorial Comment

Diffusion-Weighted MRI (DWI), is a technique used to detect the state of molecular translational motion of water in the tissue. In some tumors, densely packed malignant cells, causes restricted diffusion of water relative to that of normal tissue. DWI is quantified by the apparent diffusion coefficient map-ADC. Since apparent diffusion coefficient (ADC) reflects primarily diffusion coefficient of extra-cellular water, ADC values tend to be lower for tumors compared to normal tissue. Contrary to cancer, in benign lesions, extra-cellular space volume is higher, thus ADC values are higher as well. For this reason, DWI is an important complementary tool in the evaluation of pathologic conditions in the abdomen and is increasingly used in routine imaging. The authors of this study showed that lipid-poor adenomas could not be distinguished from lipid-rich adenomas and all other non-fatty lesions of the adrenal gland with DWI. They showed that ADCs were not useful in distinguishing benign from malignant adrenal lesions. Similarly recent report has been shown that this technique has also limitation in other abdominal organs since a lesion with restricted diffusion was found to be benign in about 22% of the lesions (1). Fortunately, radiological characterization of an adrenal incidentaloma can be done with high sensitivity and specificity using well established techniques such, CT attenuation without contrast enhancement, wash-out CT technique and chemical-shift MR imaging. Thus, further evaluation with diffusion-weighted MRI is not essential.

Reference

1. Sebastian Feuerlein S, Pauls S, Markus S, Juchems MS, et al, Pitfalls in Abdominal Diffusion-Weighted Imaging: How Predictive is Restricted Water Diffusion for Malignancy. *AJR* 2009; 193:1070-1076

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Split-bolus MDCT urography: Upper tract opacification and performance for upper tract tumors in patients with hematuria

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Objective: Our purpose was to assess upper urinary tract opacification and the performance of split-bolus MDCT urography for upper tract tumors in patients with hematuria.

Materials and Methods: Between January 2004 and December 2006, we identified 200 patients (119 men, 81 women; median age, 58 years, age range, 18-89 years) who underwent MDCT urography for hematuria. MDCT urography included unenhanced and combined nephrographic and excretory phase imaging of the urinary tract. Images were independently reviewed by two radiologists blinded to the final diagnosis. The degree of upper urinary tract opacification and the diagnosis were recorded. Prospective interpretations were also reviewed. The standard of reference included all available clinical, imaging, and laboratory data for up to 12 months after MDCT urography. Sensitivity, specificity, accuracy, and positive and negative predictive values were calculated for upper tract tumors for prospective and retrospective interpretations.

Results: For reviewers 1 and 2, 85.1% and 84.5% of segments were at least 50% opacified, respectively. Final diagnoses for hematuria were no cause, 123 (61.5%); urothelial cancer, 27 (13.5%); nonmalignant, 46 (23%) and indeterminate, four patients (2%). There were nine upper tract cancers. Sensitivity, specificity, and accuracy for upper tract cancers for prospective interpretation, reviewer 1 and reviewer 2, were 100%, 99%, 99%; 100%, 99.5%, 99.5%; and 88.9%, 99.0%, 98.5%, respectively.

Conclusion: Split-bolus MDCT urography provided at least 50% opacification of the majority of upper urinary tract segments and had high sensitivity, specificity, and accuracy for the detection of upper urinary tract tumors.

Editorial Comment

Multidetector CT-urography (MDCT-urography) has been shown to be an effective single comprehensive examination in the evaluation of patients with hematuria or with risk for the development of urothelial malignancies. Since protocols for MDCT urography varies from each institution, most MDCT-urography images are obtained in the unenhanced phase (detection of calculi), nephrographic-phase (detection of renal masses) and excretory-phase (detection of urothelial lesions). The authors present their results with a protocol called split-bolus MDCT- urography where the unenhanced phase is followed only by a combined nephrographic and excretory phase. During split-bolus, CT-urography the intravenous injection of contrast material is performed in two steps. First, 40 ml is injected at 2 ml/s and after 120 second from the beginning of the first injection, the