DIFFUSION-WEIGHTED MR IMAGING (DWI) IN ADRENAL LESIONS: CLINICAL APPLICATIONS

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Introduction:
Adrenal masses are usually detected incidentally on radiologic examinations and the majority of them are nonhypersecretory adenomas. In an oncologic setting, definitive diagnosis of adrenal metastasis will affect treatment of the primary malignancy [1]. DWI has been proposed to characterize tumors based on measurement of thermally induced random molecular motion in biological tissues associated with tissue cellularity and cell membrane integrity [2]. As a result of technologic advances, DWI has been used throughout the body, including brain, liver, pancreas, renal and other organs. However, there has been no study regarding DWI of common adrenal lesions. We reviewed our experience to a) evaluate the ADC values for characterization of adrenal gland lesions in a large case series and with a variety of adrenal gland pathologies; b) find threshold of ADCs to separate benign and malignant lesions; c) determine the correlation between the ADC values of adrenal gland lesions and percentage of signal intensity (SI) decrease on chemical shift MR imaging.

Material and methods:
One hundred and fifty-eight adrenal gland lesions in 154 patients from September 2005 to August 2008 were evaluated using routine abdominal magnetic resonance imaging (MRI) and DWI with B value of 0 or 50 and 500 sec/mm². Apparent diffusion coefficient (ADC) values were measured in 118 adenomas, 9 myelolipomas, 9 cysts, 9 metastases, 4 adrenal cortical carcinomas, 4 adrenal hemorrhages, 3 pheochromocytomas, 1 angiolipoma, and 1 neuroblastoma. Signal intensity (SI) decrease between in-phase and out-phase MR images was measured for all lesions. ADC values of 1.5×10⁻³ mm²/sec[3], 1.6, 1.7, and 1.8 were designed as threshold to separate benign and malignant lesions. Sensitivity, specificity, positive predictive value and negative predictive value were calculated separately. Comparisons were carried out using the studentized range test and correlation coefficients were used to assess ADCs versus percentage SI decrease.

Results:
Mean ADC value of adrenal malignancies (1.86±0.92×10⁻³ mm²/sec) was higher than that of benign lesions (1.69±0.59) and there was no statistical difference (p>0.05). For malignant masses, mean ADC value of metastases was 2.02, carcinoma 1.47, pheochromocytomas 1.91, and neuroblastoma 1.84. For benign adrenal lesions, mean ADC value of adenomas was 1.62, angiolipoma 3.03, cysts 2.83, hemorrhages 1.61, and myelolipomas 1.36. Based on the 95% confidence interval for mean ADC value, considerable overlap between benign and malignant adrenal lesions was detected. Using 1.5 as threshold of ADC values, the sensitivity and specificity of diagnosis of adrenal malignant were 35.3% and 58.2%, and positive predictive value and negative predictive value were 9.2% and 88.2%, respectively. When threshold ADC values for malignancy was increased from 1.5 to 1.8, sensitivity and specificity were still low. When 1.8 was chosen as threshold, the sensitivity and specificity were 64.7% and 36.2%. For adrenal gland lesions, there was no relationship between ADCs and percentage SI decrease at chemical shift MR imaging.

Discussion and conclusions:
In conclusion, our results indicated that solid adrenal lesions cannot be characterized based on ADC values due to considerable overlap. Malignant lesions did not have more restricted diffusion. Chemical shift in and opposed phase images to assess microscopic fat within adrenal adenomas were still required to differentiate incidental adrenal adenomas from metastases. In addition, follow-up imaging examinations may be required for identification of adrenal metastases. Biopsy or surgical pathological validation was needed for rare cases which lack classic imaging features and clinical findings.

Reference: