ASSOCIATION OF THE APPARENT DIFFUSION COEFFICIENT OF BLADDER CANCER WITH METASTATIC DISEASE: PRELIMINARY RESULTS

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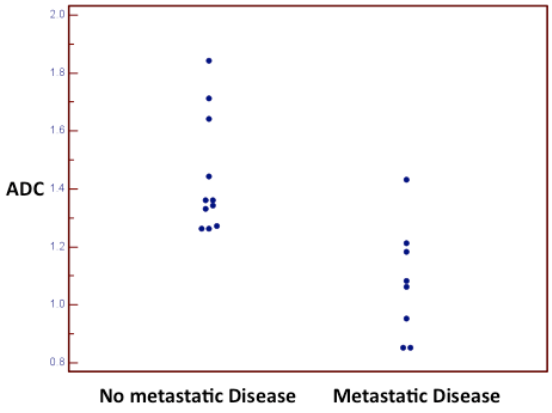
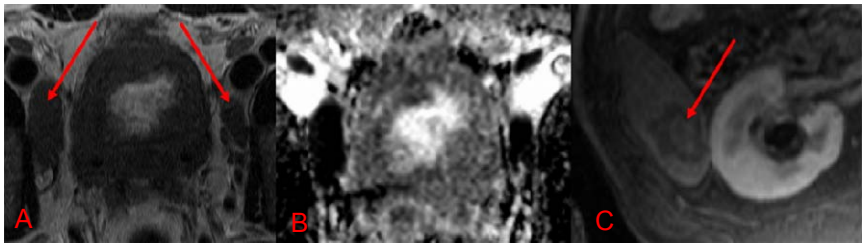
Introduction: Urothelial carcinoma of the urinary bladder is one of the most common malignancies of the urinary tract. Currently, prognosis can be difficult because no single factor can reliably predict outcome in a given patient. However, whereas 5-year survival among all cases is approximately 80%, survival among those with regional or distant spread of disease is 36% and 6% respectively[1]. Recently, diffusion-weighted imaging (DWI) has been used for improved detection and characterization of primary malignancies of the bladder[2-4]. An intriguing possibility would be if the apparent diffusion coefficient (ADC) value obtained from DWI could be used for predicting clinical outcomes. Therefore, our aim in this study was to assess the association of the ADC value of bladder cancer with the occurrence of metastatic disease.

Methods: IRB approval was obtained for this retrospective study, with a waiver of informed consent. We searched institutional databases to identify all patients with histologically confirmed urothelial carcinoma of the bladder who underwent pelvic MRI at 1.5T including DWI with b-values of 0, 400, and 800 s/mm^2 between January 1, 2007 and June 30, 2010. Patients were classified as having either metastatic disease (nodal or distant) based upon a combination of follow-up cross-sectional imaging and pathologic findings, or an absence of metastatic disease based upon negative cross-sectional imaging at least 3 months following the initial MRI. Patients were excluded on the basis of non-standard DWI parameters, artifacts and/or inability to visualize the tumor on DWI, tumor histology other than urothelial carcinoma, or inability to classify the lesion in terms of the presence or absence of metastatic disease. Two radiologists who were unaware of outcomes independently measured ADC for each lesion by placing an ROI as large as possible within the lesion, excluding the outer margin to avoid partial volume averaging. For lesions visible on multiple slices, ROIs were placed on up to three slices and averaged. ADC values obtained by the two readers were averaged. Mann-Whitney U test and ROC analysis were used to assess the accuracy of the ADC value for separating bladder cancer patients with and without metastatic disease.





69 year-old man with urothelial carcinoma of the bladder. T2WI (A) shows extensive irregular thickening of the bladder wall, as well as bilateral pelvic side-wall lymph nodes (arrows). A low ADC (1.08 *10^{-3}mm^2/s) was obtained for the tumor on the ADC map (B). Patient also had biopsy proven liver metastasis, demonstrated on post-contrast T1WI (arrow, C).

Results: 19 patients (17M,2F; mean age 71±12y) met inclusion criteria. Urothelial carcinoma was confirmed by biopsy (n=4), transurethral resection (n=7), or radical cystectomy (n=8). 8 cases were classified as having nodal (n=1) or distant (n=7) metastatic disease, and 11 cases were classified as having an absence of metastatic disease (mean follow-up of 434±173d). ADC was lower among patients with metastatic disease (1.08±0.20 *10^{-3}mm^2/s, range 0.85-1.4 *10^{-3}mm^2/s) than among those without metastatic disease (1.44±0.20 *10^{-3}mm^2/s, range 1.26-1.84 *10^{-3}mm^2/s), with this difference being statistically significant (p=0.0012). At ROC analysis, area under the curve (AUC) was 0.920 (95% CI 0.702-994); optimal ADC threshold for identifying the presence of metastatic disease was 1.21 *10^{-3}mm^2/s, which was associated with sensitivity of 87.5%, specificity of 100%, PPV of 100%, and NPV of 91.7%.

Conclusions: We observed a statistically significant lower ADC among cases of bladder cancer with metastatic disease than among cases with an absence of metastatic disease. Furthermore, the ADC value exhibited a high AUC for separating these two groups, with excellent sensitivity (87.5%) and specificity (100%) in this initial sample. These results suggest that ADC has potential to impact prognosis and treatment decisions for patients with bladder malignancy. Limitations of this study include its retrospective nature, small sample size, and lack of long-term follow-up in some cases without metastatic disease. Future studies with a larger sample size are warranted to validate our preliminary results.

References: [1] ACS Facts and Figures, 2010: 21. [2] Vikram R et al. AJR 2009. [3] El-Assmy A et al. Eur Radiol 2009. [4] Watanabe H et al. AJR 2009.