Correlation of [Cit/(Cho+Cr)] ratio with ADC values in Prostate Cancer Patients with PSA level in the range 4 to 20 ng/mL

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INTRODUCTION

MRI has limited utility in distinguishing benign versus malignant prostate tissue in patients with prostate cancer. Therefore new MR methodologies are being worked out to improve the sensitivity and specificity of tumor detection, localization and staging. Results of 3D-MRSI have demonstrated that [Cit/(Cho+Cr)] ratio show improved sensitivity and specificity in detecting prostate cancer (1). Diffusion weighted imaging (DWI), which provides assessment of tissue structure and water micro-environment, may also have diagnostic potential in prostate cancer. This study attempts to evaluate the utility of ADC values obtained from DWI for detection of prostate cancer in patients with increased PSA levels especially in the range 4 to 20 ng/mL and these results were correlated with the [Cit/(Cho+Cr)] ratio for the same ROI obtained from MRSI.

METHODS

The MR investigations were carried at 1.5 T (Sonata, Siemens) and the images were obtained using pelvic phased array coil in combination with endorectal surface coil. Both MRSI and diffusion weighted imaging (DWI) were carried out prior to sextant biopsy of prostate. A total of 12 patients were studied and they were divided in two groups. Group I comprises of patients with PSA level more than 20 ng/mL (n=4), while group II consists of patients whose PSA level ranges from 4 – 20 ng/mL (n=8). DW images were acquired using a single shot echo planar (EPI) sequence. Three different b-values i.e. 0, 500, and 1000 s/mm^2, were used to get different diffusion weighted images. ADCs were calculated from the signal intensities of images obtained from different diffusion weightings at different location in the peripheral zone (PZ). MRSI was carried out with an endorectal surface coil using PRESS localization scheme with fat/water spectral suppression. MRSI was planned on T2- weighted images covering the entire PZ with outer volume suppression. The following parameters were used: TR = 1300, TE = 120 and a total acquisition time of 17 min. ADC values were calculated from different ROIs in the selected region where MRSI showed decreased [Cit/(Cho+Cr)] levels.

RESULTS

Patients for whom PSA was more than 20 ng/mL (group I), the [Cit/(Cho+Cr)] ratio was less than 0.7 in PZ while the corresponding ADC values were in the range 0.6 to 0.7 mm2/s. Interestingly, the [Cit/(Cho+Cr)] ratio was also less than 0.7 for different locations in the peripheral zone of patients whose PSA level was in the range 4 – 20 ng/mL. The ADC calculated for the identical locations showed value 1.2 $\pm$ 0.09 x 10-3 mm2/s, compared to a value of 1.7 $\pm$ 0.25 x 10-3 mm2/s for the normal tissues of PZ.

DISCUSSION

The reduction in ADC observed for the malignant tissues of patients of Group I, is due to the altered tissue structure due to cell proliferation. ADC values have been found to be inversely correlated to cellularity of the tumors (2). Increased cell proliferation in malignant tumors results in loss of the normal glandular histology in the peripheral zone. Consequently, interstitial space is decreased which restricts the diffusion. Since DWI is sensitive to diffusion properties, this change is manifested as a reduction in the ADC value. For the patients of Group II, certain locations of PZ showed low value of [Cit/(Cho+Cr)] suspicious of malignancy, and their corresponding ADC showed intermediate values between that obtained for malignant and normal tissues, probably indicating that these areas show changes associated with malignancy. Our results suggest that the combined use of MRSI and DWI may have greater utility for diagnosis of prostate cancer in the patients whose PSA level is in the borderline level 4 to 20 ng/mL. Further work is in progress.

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