Introduction/Purpose

For early stages of localized prostate cancer (PCa), active surveillance is an alternative option to radical treatment assuming that these tumors progress relatively slowly [1]. Such an approach requires an accurate identification of low-risk cancers and a reproducible, non-invasive technique to follow up patients. Transrectal ultrasound-guided biopsies (TRUS bx) are the current gold standard but also have a substantial sampling error that results in an undergrading in 40% of the lesions. Therefore, tissue parameters derived from diffusion-weighted MR imaging (DWI) and MR spectroscopy (MRS) have been considered to refine the information from TRUS bx. The purpose of this study was to identify the most appropriate set of functional MR parameters to differentiate indolent from aggressive cancer.

Materials and Methods

Thirteen patients with histopathologically confirmed PCa have yet undergone multiparametric, endorectal MRI diagnostics at 3 T (Magnetom Tim Trio, Siemens) prior to radical prostatectomy. The protocol included DWI in transverse planes (in-plane resolution: 1.0 × 1.0 mm², TR/TE: 3000/85 ms, slice thickness: 3 mm, FOV: 250 × 250 mm²) using b-values of 50, 500, 800 and 1,500 sec/mm² as well as spectroscopic chemical-shift imaging (CSI) following an established prostate protocol (PRESS volume localization, 8 slices covering the whole prostate) [2]. Tumors were classified as low, intermediate or high grade (corresponding to Gleason scores GS of ≤6, 7, and ≥8, respectively) and the least differentiated areas were highlighted in whole-mount step sections by the pathologist. Apparent diffusion coefficient (ADC), normalized ADC (tumor ADC over ADC in healthy mirror region), choline/citrate (CC) and (choline+creatine)/citrate (CCC) ratios were measured in corresponding regions of the MR acquisitions. Accuracies of these parameters in differentiating indolent from aggressive cancers.

Results and Discussion

A total of 22 lesions with primary and secondary Gleason grades of 2+3 in 1 case, 3+3 in 11 cases, 3+4 in 7 cases and 4+3 in 3 cases were included for ROC analysis. The resulting AUC values were 0.80 for absolute tumor ADC, 0.94 for normalized ADC, 0.78 for CC ratio and 0.81 for CCC ratio. A normalized ADC below 0.45 and/or a CCC ratio above 1.3 were chosen as thresholds for the prospective discrimination of aggressive cancers. Using the combination of both MRI criteria, 11 out of 13 patients were correctly assigned to low and intermediate/high risk groups; one patient with a GS of 5 and one with a GS of 6 were overgraded. In comparison, the use of TRUS bx findings resulted in the undergrading of two patients with intermediate aggressive cancers.

Conclusion

These preliminary results suggest that a combination of two functional MR parameters is well suited to discriminate low-grade from higher-grade prostate cancers.

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References