Multiparametric Magnetic Resonance Imaging Markers of Clinically Significant Prostate Cancer

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Aim and objectives:

to assess the correlation between the apparent diffusion coefficient (ADC of the tumor, ADC ratio) and final grade group (GG) after radical prostatectomy (RP), and to determine the threshold values of ADC for detecting clinically significant prostate cancer (PC) with subsequent evaluation in a prospective group

Materials and methods:

118 patients with PC were included in the retrospective group. These patients underwent RP from 2012 to 2017 with preoperative 3 Tesla multiparametric MRI (mpMRT) with contrast enhancement in a single center. After analyzing all the MRI studies, the average values of tumor ADC and benign tissue ADC were calculated using the maps of ADC. The prospective part of the study included 60 patients with completed pre-biopsy mpMRI and subsequent RP from January 2018 to March 2019

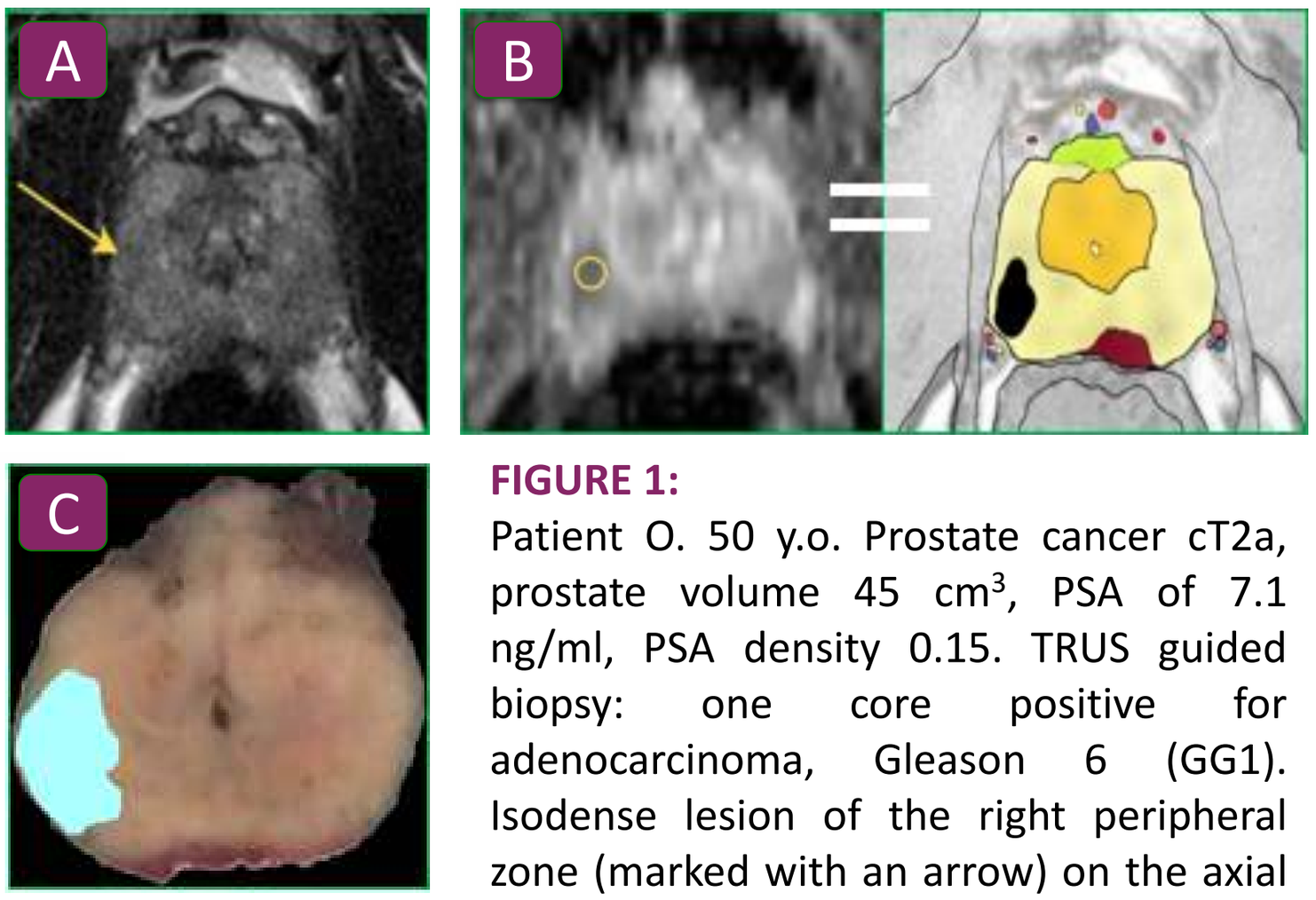

FIGURE 1:

Patient O. 50 y.o. Prostate cancer cT2a, prostate volume 45 cm^3, PSA of 7.1 ng/ml, PSA density 0.15. TRUS guided biopsy: one core positive for adenocarcinoma, Gleason 6 (GG1). Isodense lesion of the right peripheral zone (marked with an arrow) on the axial T2WI view **(A)**, corresponding to the ADC map **(B)** with the ROI at the lesion area (ADC value of the lesion of 720 * 10^{-6} mm^2/s). ADC ratio of 0.41. An axial section of the prostate during post-operative biopsy **(C)** showing the area of PC growth, corresponding to the Gleason Score of 3+4 (GG2), resulting in a Gleason score upgrade from 6 to 7 that was predicted using tumor ADC and the ADC ratio.

Results:

Tumor ADC and postoperative GG had a statistically significant negative correlation of moderate strength (Spearman's correlation coefficient = -0.733, p=0.0001). Similar correlation was found for the ADC ratio with a slightly higher Spearman ratio (p = -0.802, p=0.0001). In the ROC-analysis of potential for discrimination between GG 1 and GG 2, the area under curve (AUC) was 0.898 (95%, CI 0.835-0.961) for tumor ADC and 0.950 for ADC ratio (95%, CI 0.909-0.992). When used as a criterion for determining GG 1 tumor, ADC values ≥ 0.78 shown sensitivity of 78% and specificity of 98%. When using ADC ratio ≥0.4501, the sensitivity and specificity were 92 and 93% respectively. The prospective part of the study demonstrated the effectiveness of applying the obtained diffusion coefficient thresholds. When used as a criterion for determining clinically significant prostate cancer (GG > 1), threshold value of tumor ADC had sensitivity, specificity, accuracy, positive predictive value and negative predictive value were 81%, 61%, 73%, 77 % and 67% respectively. For the ADC ratio sensitivity, specificity, accuracy, positive predictive value and negative predictive value were 84%, 91%, 87%, 94% and 78% respectively (**Figure 1**)

Conclusion:

ADC of the tumor had a statistically significant negative correlation with the final PC grade group. ADC ratio had a slightly stronger correlation, which is more accurate when separating grade group 1 from grade group 2. In a prospective analysis, the ADC ratio showed high predictive value. In determining the diffusion coefficients, it is possible to obtain important information about the histopathological aggressiveness of PC. Integration of non-invasive markers in the diagnostic process helps to personalize the patient's treatment plan and avoid unnecessary risks

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