Role of 3D 1H MR Spectroscopy for prospective detection of prostate cancer in men with prior negative biopsies

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Introduction: Patients with elevated PSA levels and one or more negative prostate biopsies create a clinical dilemma. These patients are monitored using PSA density (ratio of serum PSA concentration to prostate volume) and PSA velocity (rate of change of PSA) and often have repeat prostate biopsies to exclude cancer. There is limited data on the use of MRS for detection of cancer foci in men with prior negative biopsies (1-4). We wanted to determine the accuracy of 3D ^{1}H MR spectroscopy (MRS) in prospectively detecting prostate cancer in patients with high PSA and prior negative prostate biopsies.

Methods: Endorectal MRI with 3D MRS was performed in 30 men with at least one previous negative prostate biopsy (range, 1-5) using a 1.5T 32 channel system (Magnetom Avanto, Siemens Medical Systems). Mean PSA was 15 ng/mL (range, 1-50). 3D PRESS-CSI MRS sequence was performed using TR/TE 1040/130, 10 averages, voxel size 8 x 8 x 5 mm, acquisition time 14 min. Prospective MRS interpretation by an expert radiologist was performed on a 3-point scale (0: normal; 1: probable tumor; 2: tumor) based on Choline + Creatine / Citrate (Ch+Cr/Ci) ratios in the peripheral and transition zones. All patients subsequently had a repeat prostate biopsy (n=22) and/or repeat PSA (n=30). In patients with a repeat biopsy, mean delay between MRI/MRS and post-MR biopsy was 60 d. A true positive finding was defined as positive MRS (1-2) and positive post-MR biopsy; true negative was defined as negative MRS (0) and negative post-MR biopsy and/or stable PSA; false positive was defined as positive MRS and negative post-MR biopsy; false negative was defined as negative MRS and positive post-MR biopsy.

Results: 5 patients had prostate cancer on post-MR biopsy, these were prospectively detected in 3 of these patients, where tumor was located in the peripheral zone and transition zone (n =2) or transition zone only (n=1, Fig.). In the 2 other patients, tumor was not detected even in retrospect. There were 3 false positive cases. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of MRS for prostate cancer detection were 60%, 88%, 50%, 91.6%, and 83.3%.

Conclusion: Recent papers have demonstrated the potential role of MRS to detect occult cancers, and redirect subsequent biopsies (1-4). In our preliminary experience, MRS can exclude prostate cancer with a high negative predictive in men with prior negative prostate biopsies, which can potentially decrease the number of repeat biopsies.
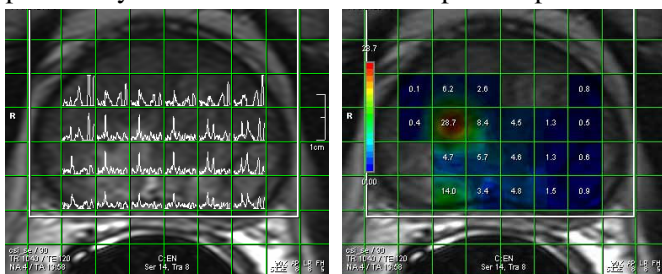
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Fig.: Patient with extensive transition zone cancer diagnosed with MRS and missed by prior biopsy. Spectral and color maps show extensive choline elevation, consistent with tumor. Post-MRS saturation biopsy showed adenocarcinoma Gleason 8.