

Potential of 3D ¹H MRSI localization of prostate cancer to direct TRUS guided biopsy in patients with PSA 4 – 10 ng/mL

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Introduction: Transrectal Ultrasound (TRUS) guided systematic needle biopsy of the prostate is the standard histo-pathological procedure used in men suspected to have prostate cancer on the basis of an abnormal digital rectal examination (DRE) or an elevated serum prostate specific antigen (PSA) level. However, the detection rate of TRUS guided biopsies in detecting prostate cancer is low because of its low sensitivity and specificity especially in patients whose PSA level is between 4 – 10 ng/mL [1]. Currently no imaging modality can reliably detect tumor within the prostate. 3D ¹H MRSI provides biochemical information which is shown to have the potential in identification of cancer within the prostate gland. In this pilot study, we evaluated (i) the usefulness of MRSI for the detection of prostate cancer foci in men with an elevated (4-20 ng/mL) serum PSA level, and/or abnormal DRE, and (ii) the feasibility of directing TRUS guided needle biopsies at the lesions found on MRSI.

Methods: Men with a serum PSA level between 4 – 10 ng/mL with/without an abnormal DRE were recruited (n = 25, age = 60.5 ± 6.5 years) with informed consent to participate in the study and institute ethics committee approved the study. MR data was acquired using 1.5 Tesla whole body scanner (Sonata, Siemens). MR imaging was carried out using pelvic phased array coil in combination with endorectal surface coil, while only endorectal coil was selected for spectroscopy. MRSI spectral map was overlaid on corresponding T2-weighted image. In each patient, all the voxels in the peripheral zone were individually analyzed. Voxels suspicious of prostate cancer were identified as indicated by increased [(Choline+Creatine)/(Citrate)] ratio (Fig 1A). A [(Cho+Cr)/cit] ratio < 0.7 was considered as normal, while the ratio in the range 0.7 – 0.85 was classified as equivocal, and a value > 0.86 was taken as indicative of malignancy [2]. TRUS guided biopsy, in most patients, was performed within 2 days after MRSI. After a preliminary TRUS, needle biopsies were taken first from the MRSI detected lesion area in those patients in whom MRSI was positive (Fig 1 B & C). This was achieved by using the x-coordinate (distance from midline of prostate in axial plane) and z-coordinate (distance of transverse plane from the base of prostate) of the suspicious voxel and 2 – 3 cores were taken from the suspected site (Fig.1 C). Later, a systematic sextant biopsy was carried out in all the patients, with 2 extra cores from glands larger than 80 ml. Finally any hypo echoic lesion seen on TRUS was sampled if it had not been already included. MR imaging was also carried out after the biopsy to confirm the site of biopsy (Fig.1 D).

Results and Discussion: Prostate cancer was diagnosed in 5 out of 25 patients (20%) on TRUS guided biopsy while MRSI showed areas of malignancy (based on the metabolite ratio) in 15 out of 25 patients. Out of these 15 patients who had suspicious area of malignancy on MRSI, 5 patients (33%) showed positive on TRUS guided biopsy. Thus a 13 % increase in detection rate is noticed when TRUS guided biopsy is performed using MRSI coordinates for the localization of the areas of malignancy. None of the patients who had a negative MRSI were positive for cancer. This indicates that MRSI may detect early changes of malignancy. Longitudinal evaluation of these patients with MRSI and TRUS biopsy would be useful to validate this finding and such an investigation is in progress.

Conclusion: These preliminary results indicate that it is feasible to perform TRUS guided biopsies directed on suspicious areas found on MRSI. In addition, our results reveal that the detection rate of prostate cancer in men with PSA level 4 – 10 ng/mL, increases if TRUS guided biopsy is performed using the coordinates of the suspicious site derived from MRSI data.

References:

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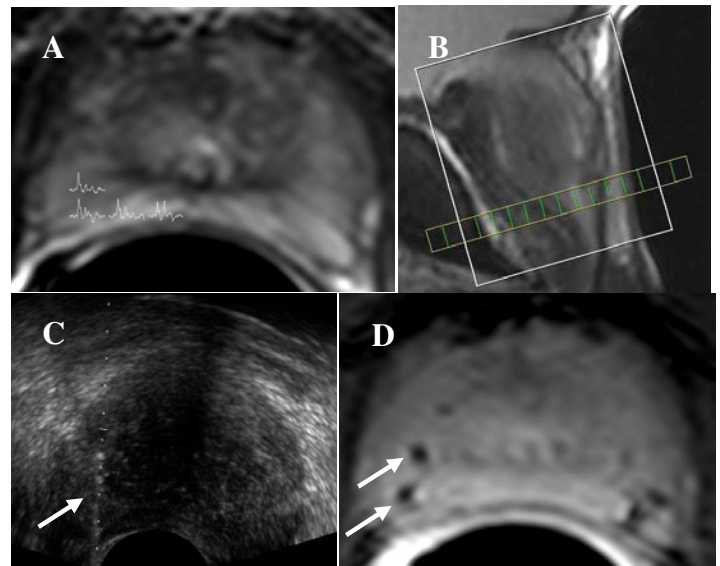


Fig 1 (A) 3D ¹H MRSI spectral map superimposed over T2 weighted images of prostate showing suspicious area for malignancy with reduced citrate and high choline (B) localization of axial section on sagittal plane (C) TRUS guided biopsy of prostate from the suspicious site of MRSI (arrow showing needle mark) (D) MR image after biopsy to confirm site of biopsy (arrows).