Multiparametric prostate MR Imaging and Spectroscopy in patients with high-risk localized prostate cancer before radical prostatectomy assesses risk of extracapsular extension and/or positive margins.

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Background: Multiparametric MRI and MR spectroscopic imaging (MRSI) of the prostate using endorectal coil allows preoperative evaluation of prostate cancer and is useful in the definition of tumor size, location and stage (1).

Purpose: The present study analyzes its value to alert before surgery upon the risk of extracapsular extension and/or positive surgical margins in the high-risk group (biopsy Gleason score greater than 7, PSA levels of >10 ng/ml, or T2c stage or higher).

Materials and methods: We prospectively evaluated 30 patients with high-risk localized (T1-2) prostate cancer undergoing radical prostatectomy. Both pathologist and radiologist blindly judged the risk of extracapsular extension and affected margins before prostatectomy in a "yes" or "no" fashion before surgery. The pathologist's decision was based on multifocality, Gleason score and linear sum of cancer in transrectal biopsy, and the radiologist's upon proximity of the tumor to the lateral margin of the prostate in multiparametric MRI and MRSI. The MR study was performed on a 1.5 T system (Avanto; Siemens Heathcare Solutions) using an endorectal coil combined with pelvic and spine phased-array coils, thus allowing the use of parallel imaging techniques. The protocol included a T2w-TSE sequence for prostatic morphology, multi-voxel chemical-shift imaging for 3D ^{1}H-MRSI, EPI sequence for diffusion-weighted imaging, and a dynamic contrast-enhanced T1-w fat suppressed 3D-FLASH sequence (Fig. 1). Whole-mount transverse serial section was the pattern of reference to establish extraprostatic disease (either R1 or pT3R0). *Kappa* statistics was used to determine the consistency in assessing the risk, both in the individual patient (n=30) and on each side of the prostate (n=60).

Results: Mean PSA value was 16.6 ng/ml (range 3-83.7). Twenty-one patients (70%) were high-volume disease, mainly affecting the transitional zone. Twelve cases (40%) were pT3 and 7 (35%) R1. Biopsy Gleason total score was >7 in 9 cases (30%). The pathologists' evaluation of the biopsy cylinders failed to correctly predict the risk of extraprostatic disease in 46.6% of the patients (14/30, 10 FN; k=-0.035, IC -0.29,0.36), whereas the radiologist's assessment failed to detect it correctly in 36% (11/30, 9 FP; k=0.27, IC -0.03,0.61). Considering each side as independent observation the pathologist predicted the risk erroneously in 35% of the evaluations (21/60, 18 FN; k=0.19, IC -0.03, 0.40), whereas the radiologist did so in 18.3% (11/60, 7FN and 4FP; k=0.61, IC 0.40, 0.81).

Conclusions: Multiparametric MRI and MRSI of the prostate preoperatively alerts upon the risk of extracapsular disease in high-risk localized prostate cancer better than accurate review of transrectal biopsy. This imaging modality can also help urologists to better plan individual wide-excision surgery for each side in order to diminish the risk of positive margins.

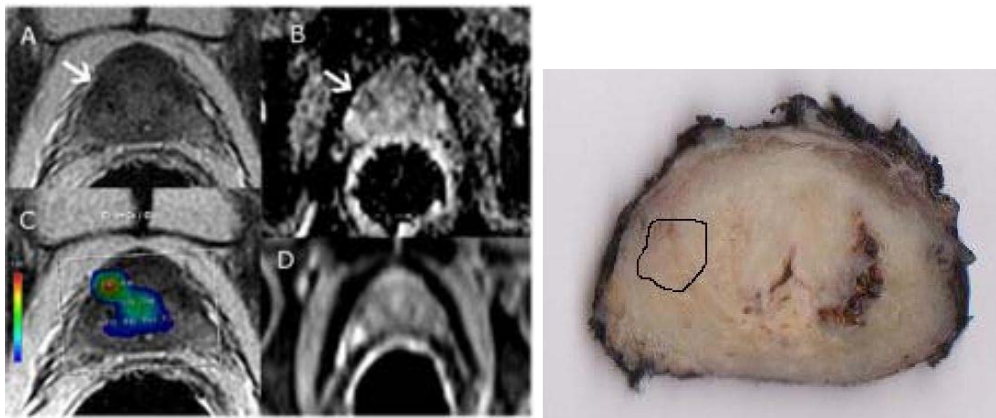1. Mazaheri Y, et al. MAGMA 2008; 21:379-392.

Fig.1. Multiparametric MRI and MRSI study obtained using an endorectal coil on a 65-year old patient with prostatic cancer (T2 stage, biopsy Gleason score 6, PSA 5 ng/ml). (A) T2-w morphologic imaging shows a poorly-defined hypointense zone in the right peripheral zone and adjacent central gland (arrow). (B) This finding correlates on the ADC (apparent diffusion coefficient) map with a zone with pathological free water restriction suspicious for malignancy (arrow). (C) MRSI data shown as a colorimetric map with the values of the (Choline+Creatine)/Citrate cocient superimposed on axial T2-w images demonstrate pathological values of this cocient (>1; red colored) in the same area as in A and B, also suspicious of malignancy. (D). The dynamic contrast-enhanced T1w 3D-FLASH corresponding image does not show a pathological contrast uptake. The pathology correlation after radical prostatectomy confirmed the existence of a solitary focus of adenocarcinoma in the right prostatic lobe without extracapsular extension (marked area).