Multiparametric 3T MRI of prostate cancer in correlation with TRUS biopsy

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INTRODUCTION:

MR imaging for diagnosis and staging of prostate cancer has been available since the late 1980's, initially using the body coil and then in the 1990's with an endorectal coil. The current techniques require multi-planar imaging with high spatial resolution and good contrast to noise. In the past 1.5T MRI was commonly used, but nowadays some clinics use 3T MRI which improved signal-to-noise ratio. Conventional T1-spin echo and T2-weighted fast spin echo scans are performed in the oblique axial plane, sagital and coronal plane to obtain images throughout the prostate. Magnetic resonance spectroscopy (MRS) measures metabolic changes (elevation of choline level with a decrease in citrate level is the spectral signature of prostate cancer). Dynamic contrast enhancement (DCE) is used to measure tissue perfusion, microvessel permeability and extracellular leakage (faster and stronger enhancement and faster washout in prostate cancer). Diffusion weighted imaging (DWI) evaluates the differences in the motion of water molecules between tissues (this motion is decreased in cancerous tissue).
The aim of this study is to compare the results of 3T MRI of the prostate with the results of transrectal ultrasound (TRUS)-guided biopsy of the prostate and to determine the sensitivity and specificity of 3T MRI.

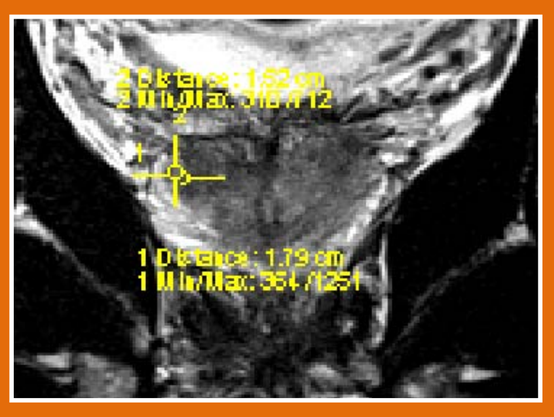

Fig. 1: MRI findings - tumor focus (size 15mm) in the right peripheral zone of the prostate with marginal infiltration of right seminal vesicle. Hypo-intense regions of the right peripheral zone of the gland in T2 weighted MR images.

MATERIAL AND METHODS:

We evaluated retrospectively 354 men in the period from 4/2011 to 5/2013.
All participants of the study underwent 3T MRI of the prostate without endorectal coil. 192 of them (54,4%) underwent MRI before TRUS biopsy of the prostate (pacients with a clinical suspicion of prostate cancer), the remaining 162 participants (45,6%) underwent MRI after TRUS biopsy (patients with at least one negative biopsy and ongoing suspicion of prostate cancer or patients before radical prostatectomy to specify staging).
The protocol of 3T MRI included triplane T2 weighted MRI, MR spectroscopy, diffusion-weighted imaging and dynamic contrast enhanced MRI. The results of 3T MRI were compared with the results of TRUS biopsy.

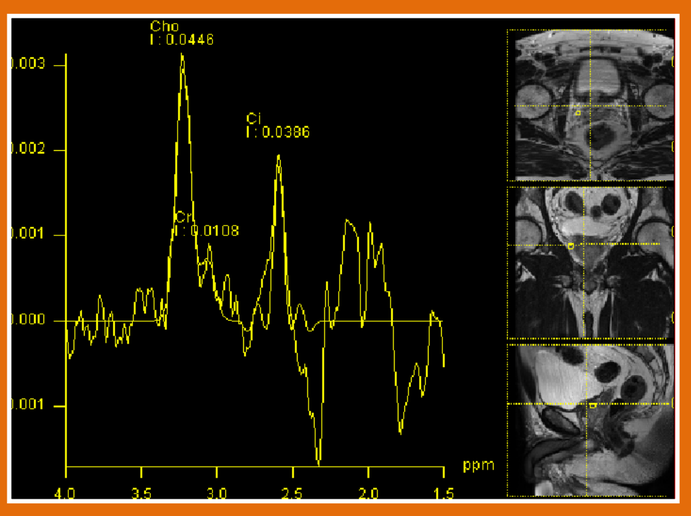

Fig. 2: MRI spectroscopy - elevation of choline level with a decrease in citrate level is the spectral signature of prostate cancer in the right peripheral zone of the prostate.

RESULTS:

The mean age was 66 years (from 46 to 82) and the mean PSA was 16,03 ng/ml (from 1,41 to 523). Despite the positive MRI results the highest number of negative biopsies in one patient was 7. Stage pT3a was described on MRI 14 times (3,9%), stage pT3b 28 times (7,9%). Sensitivity of MRI was 87,56%, specificity 56,52%, positive predictive value 70,7 % and negative predictive value 79,13%. Differences between results in patients with MRI before and after biopsy were apparent mainly in specificity – 46,67% vs. 70,7%.

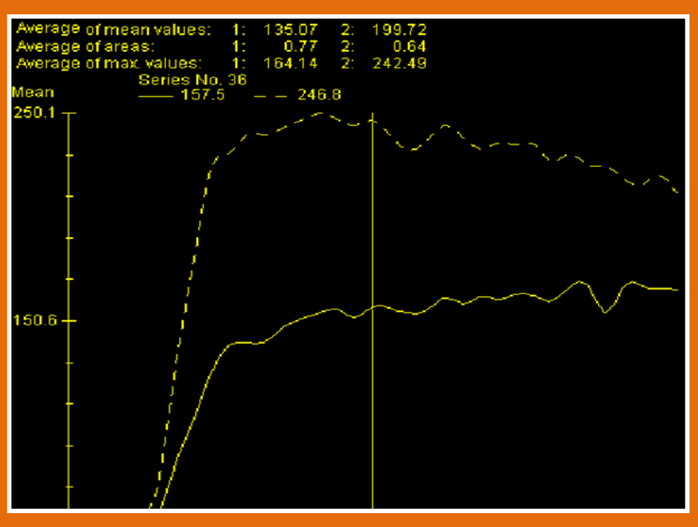

Fig. 3: Time–signal intensity curves from dynamic contrast-enhanced MR imaging show faster and stronger enhancement and faster washout in prostate cancer *(broken line)* than in normal tissue *(solid line)*.

CONCLUSIONS:

Our study showed a relatively high sensitivity (87,56%) and low specificity (56,52%) of 3T MRI of the prostate in the diagnostics of prostate cancer. The reason is not necessarily the failure of MRI but it can be the inability to detect cancer by biopsy. In our clinical practice the using of 3T MRI of prostate has been successful up to now. In case the biopsy is performed after MR we focus on the described cancer loci on MR, when cancer has been verified by biopsy the MR results are used for specifying the type of treatment.

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