MRI/3D-MRSI of prostate to direct TRUS-guided biopsy in patients with prior negative biopsy

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Introduction

The aim of the study was to evaluate the accuracy of transrectal ultrasound-guided prostate biopsy (TRUS-biopsy) performed on regions with abnormal MRI and/or 3D-MRSI for both transitional (TZ) and peripheral (PZ) zones in patients with prior negative biopsy.

Materials and Methods

MRI and 3D-MRSI were performed in 44 consecutive patients (median age: 65 yrs, range 53-79) with persistently elevated PSA level (median PSA: 8.35 ng/ml, range 3-42) and/or abnormal digital rectal examination. All patients presented almost one or more prior (extended or sextant) TRUS-biopsies negative for cancer. The mean interval between MRI/3D-MRSI and the prior-negative biopsy was 12.3 months (range: 6-23; median: 12), and it was 1.8 months (range 1-5, median:1) before the successive biopsy.

On MRI, the presence of cancer was identified as areas of nodular low T_2 signal intensity within the PZ, and as homogeneous or lenticular shape T_2 hypointensity within TZ. 3D-MRSI voxels were regarded as malignant when Choline-plus-Creatine-to-Citrate ratio was at least 3 standard deviations (SD) over and above the mean healthy value[1] (mean±S.D.= 0.22±0.13) for the PZ and at least 4 SD for the TZ.

At biopsy each prostate was divided into 12-regions: left and right of lateral base, parasagittal base, lateral mid zone, parasagittal mid zone, apex and transitional zone. TRUS-biopsies following 3D-MRSI were performed on each region by visually overlapping 3D-MRSI voxels and MR images on TRUS images by using internal anatomical landmarks. Two to three cores were performed on regions presenting with abnormal 3D-MRSI/MRI. Descriptive statistics was used to calculate sensitivity, specificity, negative predictive value (NPV), positive predictive value (PPV) and accuracy.

Results

Seventeen of 44 patients (38,6%) had prostate cancer. Table 1 shows results of TRUS-biopsies performed on regions with abnormal MRI, 3D-MRSI, and "combined" MRI/3D-MRSI on a patient-by-patient analysis for prostate cancer detection. Table 2 shows results on a region-by-region analysis.

Table1

Technique	Sensitivity	Specificity	PPV	NPV	Accuracy
MRI	76,5%	51.9%	50.0%	77.8%	64.2%
3D-MRSI	88.2%	37.8%	46.9%	83.3%	64.2%
MRI **and** 3D-MRSI	70.6%	63.0%	54.5%	77.3%	66.8%
MRI **or** 3D-MRSI	94.1%	25.9%	44.4%	87.5%	60.0%

Table2

Technique	Sensitivity	Specificity	PPV	NPV	Accuracy
MRI	45.2%	91.6%	31.7%	95.1%	87.9%
3D-MRSI	73.8%	84.4%	29.5%	97.3%	83.5%
MRI **and** 3D-MRSI	28.6%	95.9%	37.5%	94.0%	90.5%
MRI **or** 3D-MRSI	90.5%	80.0%	28.1%	99.0%	80.9%

Discussion and Conclusions

MRI/3D-MRSI is useful to identify cancer foci in patients with prior negative biopsy. Detection rate was 38.6%, a value higher than extended pattern biopsy following a prior negative one (values from literature range from 15 to 30%). Despite a low specificity on a patient-by-patient analysis, the high NPV found in our study can be very useful to avoid further biopsies or to reduce the number of cores during TRUS-biopsy.

[1]Males RG, Vigneron DB, Star-Lack J, et al. Magn Reson Med 2000; 43:17-22.