

MP53-12
ASSOCIATION OF QUANTITATIVE MAGNETIC RESONANCE IMAGING PARAMETERS WITH HISTOLOGICAL FINDINGS FROM MRI-ULTRASOUND FUSION PROSTATE BIOPSY

Seyed Saeid Dianat*, H. Ballentine Carter, Edward M. Schaeffer, Ulrike M. Hamper, Jonathan I. Epstein, Katarzyna J. Macura, Baltimore, MD

INTRODUCTION AND OBJECTIVES: Magnetic resonance – transrectal ultrasound (MR-TRUS) fusion biopsy of the prostate is a promising office-based technique to target lesions identified on multiparametric MRI (mp-MRI). The aim of this study was to evaluate the diagnostic yield of MR-TRUS fusion biopsy in men with high PSA level and negative or non-reassuring prior biopsies, and to study associations of quantitative MR parameters with biopsy findings.

METHODS: 26 patients who had 3.0 T mp-MRI and subsequent MR-TRUS fusion biopsy with GE Logiq 9 were included (16 men with high PSA and negative biopsies, 5 men in active surveillance (AS), 4 men for pre-treatment evaluation, and 1 man with post-brachytherapy biochemical recurrence). The mp-MRI consisted of T2-weighted (T2W), diffusion weighted (DWI), and dynamic contrast enhanced (DCE) images. A total of 50 MR-identified targets (median volume: 0.83 cm³) were adequately sampled by 120 cores using an 18 gauge biopsy device. The quantitative MR profiles were compared among benign, cancer-positive, and higher-grade cancer-positive (Gleason > 6) targets using Mann–Whitney U-test.

RESULTS: Of 50 targets, biopsy showed benign tissue in 31 (62%), cancer in 16 (32%), and atypia or high-grade prostatic intra-epithelial neoplasia in 3 (6%) targets. The cancer-positive targets (median volume: 1.77 cm³) were located in the transition zone in 56.3% of targets. 12 of 25 (48%) cancer-positive cores were higher-grade. Higher-grade and cancer-positive targets compared with benign targets exhibited lower apparent diffusion coefficient (ADC) (983.3 < 1062 < 1261), higher permeability coefficient (K^{trans}) (7.45 > 6.4 > 5.72) and lower extracellular volume fraction (ECF) (0.447 < 0.461 < 0.520), respectively. The difference in parameters was more pronounced between higher-grade cancers and benign targets (Table). ADC was the most predictive parameter to detect cancer-positive targets.

CONCLUSIONS: Quantitative MR parameters predict malignant histology on MR-TRUS fusion biopsy of the prostate, which is a valuable technique to ensure adequate sampling of MR-visible suspicious lesions under TRUS guidance and with impact on patient management.

Summary of quantitative MR profile of 50 targets; comparison between benign targets, cancer-positive targets and higher-grade (Gleason > 6) cancer-positive targets

	Benign target† (n = 34)	Cancer-positive target (n = 16)	Higher-grade (Gleason > 6) cancer-positive target (n = 6)	P-value (benign vs cancer-positive target)	P-value (benign vs higher-grade cancer-positive target)
MR suspicion score	2.32 ± 0.59	3.27 ± 1.1	4.0 ± 1.0	0.002	0.001
Mean T2SI	267.9 ± 79.3	225.8 ± 88.5	182.4 ± 72	0.09	0.01
Mean ADC	1261 ± 178.2	1062.4 ± 173.3	983.3 ± 175.9	0.002	0.003
Mean K ^{trans}	5.72 ± 7.69	6.40 ± 6.25	7.45 ± 6.22	0.51	0.29
Mean EVF	0.520 ± 0.147	0.461 ± 0.116	0.447 ± 0.105	0.24	0.31
Mean K _{ep}	10.61 ± 13.25	15.30 ± 15.71	18.57 ± 16.45	0.29	0.21

Values are shown as mean ± SD. SI: signal intensity, ADC: Apparent diffusion coefficient, K^{trans}: permeability rate, EVF: extracellular volume fraction, and K_{ep}: contrast efflux rate constant.

† Benign targets consisted of benign tissue, HGPIN or atypia in the targeted biopsy.

Source of Funding: None

MP53-13
DIAGNOSIS OF HIGH GRADE PROSTATIC CANCER USING DIFFUSE REFLECTANCE SPECTROSCOPY

Priya N. Werahera*, Edward A. Jasion, Yongjun Liu, M. Scott Lucia, Adrie van Bokhoven, Holly T. Sullivan, E. David Crawford, Paul D. Maroni, Aurora, CO; Fernando J. Kim, Denver, CO; John W. Daily, Boulder, CO; Francisco G. La Rosa, Aurora, CO

INTRODUCTION AND OBJECTIVES: High grade (HG) prostatic carcinoma (PCa) that includes Gleason patterns 4 and 5 indicate worse clinical outcome for patients. Due to sampling errors, transrectal ultrasound guided prostate biopsies often fail to diagnose HG PCa. Consequently, patients are often upgraded following prostatectomy. Diffuse reflectance spectra (DRS) depend on tissue morphology/architecture; hence DRS may be useful to differentiate cancer grades. We investigated whether DRS can be used to diagnose HG PCa.

METHODS: A 15 gauge minimally invasive optical biopsy needle with a light sensitive sensor was prototyped to take prostate biopsies after measuring DRS with a laboratory fluorometer. The optical sensor consists of eight 100 micron fibers for tissue excitation and a single 200 micron fiber to capture DRS. We obtained correlative biopsy cores from surgically excised prostates after measuring DRS between 500-700nm. Histopathology of tissue within the measurement window was correlated with corresponding spectra. Gleason score 3+3 cancer was classified as low grade (LG), Gleason score ≥ 7 as HG, and otherwise as benign. Partial least square analysis of tissue spectra was performed to identify partial least square components (PLSCs) as potential classifiers. Using linear support vector machine (SVM) and leave-one-out cross validation method, statistically significant PLSCs (P<0.05) were tested for their ability to classify biopsy tissue.

RESULTS: A total of 187 biopsies taken from 20 prostates were studied. By histopathology we classified 29 as HG cancer, 49 as LG, and 109 as benign within the measurement window. Four different SVMs, each with different sets of PLSCs were used for binary classification of prostate tissue as summarized in the table.

CONCLUSIONS: An optical biopsy needle adjunct with DRS has sufficient accuracy to differentiate HG carcinoma from LG carcinoma and benign tissue in clinical settings. This method may be applied for more precise targeting of HG PCa lesions, providing more accurate assessment of grade of the disease, with the consequent improvement of patient care. To confirm these findings, DRS data from in vivo studies are required. We anticipate that the presence of blood flow may affect tissue morphology in a positive manner as angiogenesis becomes a major contributing factor to further improve diagnosis of HG carcinoma.

Prostate Tissue Classification Using Diffuse Reflectance Spectra

Classification Type	Sensitivity	Specificity	Negative Predictive Value	Positive Predictive Value
High Grade versus Benign	76%	80%	93%	50%
High Grade versus Low Grade	76%	73%	84%	63%
Low Grade versus Benign	65%	71%	82%	50%
Malignant versus Benign	70%	73%	77%	65%

Source of Funding: Research grant from the Precision Biopsy, LLC, a subsidiary of Allied Minds, Inc., Boston, MA.