SPATIALLY MATCHED IN VIVO AND EX VIVO MR METABOLIC PROFILES OF PROSTATE CANCER – INVESTIGATION OF A CORRELATION WITH GLEASON SCORE

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Purpose: Prostate cancer is characterized by altered metabolite levels, specifically increased levels of choline and decreased levels of citrate1. Magnetic resonance (MR) metabolic profiling of the prostate is promising as an additional diagnostic approach to separate indolent from aggressive prostate cancer. Metabolite profiles can be obtained non-invasively from patients in vivo by magnetic resonance spectroscopic imaging (MRSI) or from tissue samples ex vivo by high resolution magic angle spinning (HR-MAS) MR spectroscopy (MRS). The objective of this study was to assess the relationship between Gleason score and the metabolic biomarker (choline+creatine+spermine)/citrate (CCS/C) measured ex vivo by HR-MAS MRS and in vivo by MRSI, and to evaluate the correlation between in vivo and ex vivo measured metabolite ratios from spatially matched prostate regions.

Methods: Patients (n=13) underwent in vivo MRSI prior to radical prostatectomy. Tissue samples (n=40) for ex vivo analyses were excised from a 2 mm transversal prostate slice according to a new harvesting method2. The location of the excised tissue samples were matched to in vivo MRSI voxels (Fig. 1). In vivo MRSI was performed on a 3T clinical MR system (Magnetom Trio, Siemens, Erlangen, Germany) and ex vivo HR-MAS on a 14.1T spectrometer (Bruker BioSpin GmbH, Germany). Relative metabolite concentrations were calculated by LCModel3 fitting of in vivo spectra and by peak integration of ex vivo spectra. Spearman’s rank correlations (ρ) between CCS/C from in vivo and ex vivo MR spectra and between metabolite ratios and their corresponding Gleason score were calculated.

Results: There was a strong positive correlation between Gleason score and CCS/C measured both in vivo and ex vivo (ρ=0.77 and ρ=0.69, respectively, p<0.001), and between in vivo and ex vivo metabolite ratios from spatially matched regions (ρ=0.67, p<0.001) (Fig. 2).

Conclusions: Our data indicates that MR metabolic profiling is a potential useful tool for the assessment of cancer aggressiveness. Moreover, the good correlation between in vivo and ex vivo measured CCS/C demonstrates that our method is able to bridge imaging information and molecular analysis.