ABSTRACT SUBMISSION FORM

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6th MR in RT Symposium 2018

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PRESENTATION TITLE

Longitudinal measurements of multiparamteric MRI: A phantom study

AUTHOR(S)

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ABSTRACT

Purpose: Quantitative imaging using multiparametric MRI (mpMRI) has been extensively studied to develop accurate and reliable biomarkers for cancer diagnosis and treatment response. Although studies using mpMRI have shown promise, the results are variable and is difficult to compare across centres. Differences between scanners (inter-scanner), and drifts of parameters in the same scanner (intra-scanner) contribute to uncertainties in the quantitative data and must be addressed to ensure comparability of imaging data across scanners and different time points. The goal of this study is to develop and validate a multicompartment phantom that allows the quantification of scanner accuracy, for the investigation of variability in mpMRI parameters including ADC, T2, T1, R2*.

Materials & Methods: A variety of contrast agents and solutions were investigated for stability and clinical relevance in mpMRI parameters. The range of clinically relevant values that resemble *in vivo* normal tissue and tumour are 1000-1800x10^{-6}mm/s for ADC, 1400-1600ms for T1, 100-200ms for T2, and 20-30ms^{-1} for R2*. The materials investigated were ethanol, copper sulphate solution (6mM), two concentrations of Gadolinium-doped (Gd) water (2.8mM and 4.3mM), 9.4mM Gd-doped gelatine, and two concentrations of undoped gelatine. The samples were imaged daily for one week using a 3.0-T MRI and clinical mpMRI sequences. Temperature of the scanner bore was monitored daily, which remained constant for all scans. ADC, T1, R2* maps were acquired from the scanner and T2 maps were calculated by fitting the mono-exponential decay signal function. The parametric values for each sample were extracted from a region of interest, and the coefficient of variance (COV) was calculated to evaluate the variability of the values in the daily measurements.

Results: The parametric values for each sample were extracted and plotted in *Figure1*, and the COV calculated for each of the samples. The Gd-doped samples produced stable T2 and R2* values resembling tumour, and T1 values resembling Gd-enhanced tissue. The copper sulphate sample also produced stable T1/T2 values resembling Gd-enhanced tissue and tumour but had a high variation in the R2* values. The low concentration undoped gelatine sample produced stable T1 values, and the high concentration undoped gelatine sample produced stable T2 values resembling normal tissue. The

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ethanol produced ADC values resembling tumour and had less variability compared with the undoped gelatine samples.

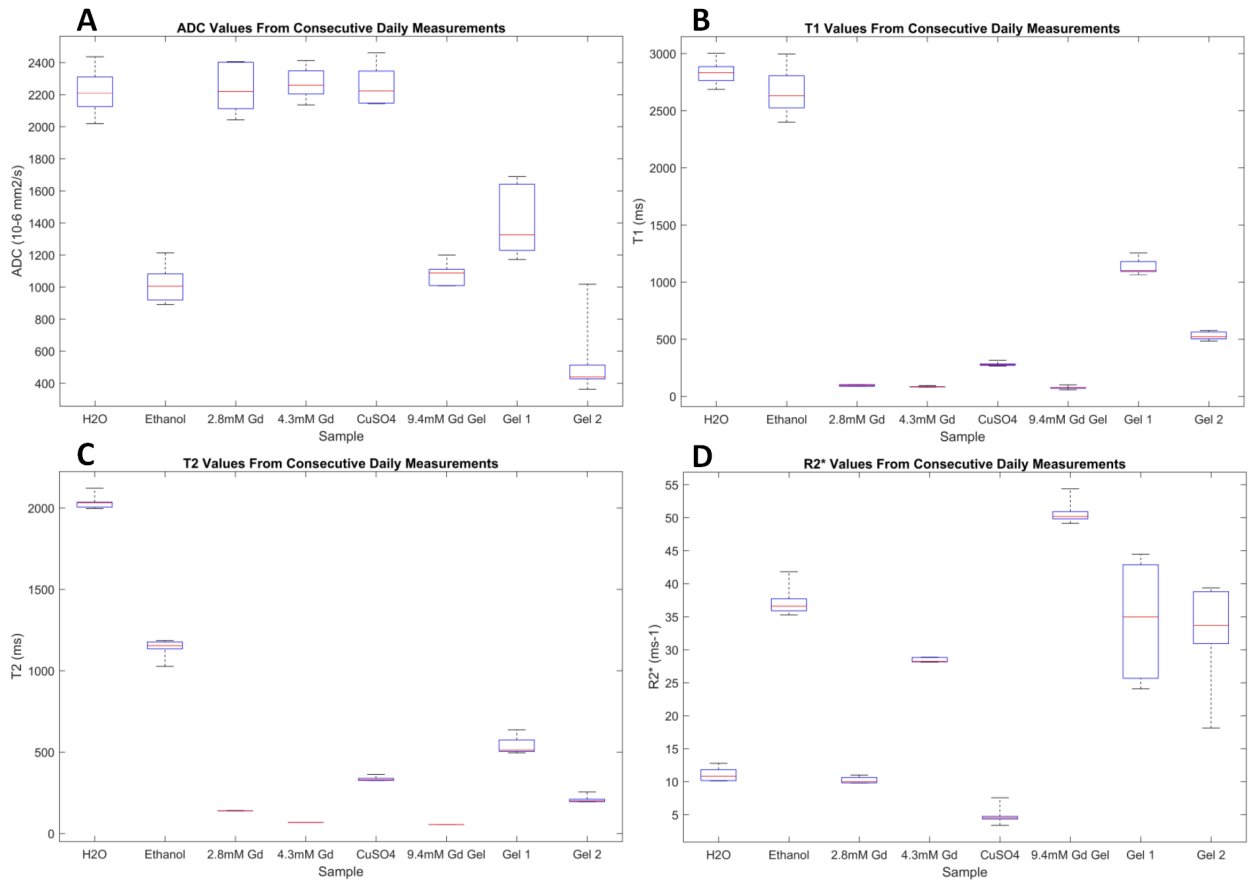

Figure: Parametric values for each sample measured from daily scans of mpMRI phantom over 5 consecutive days. Boxplots are plotted for A) apparent diffusion coefficient (ADC), B) T1 relaxation times, C) T2 relaxation times, D) R2* values for each of the eight samples.

Conclusions: The results from the daily measurements have been used to select a phantom composition for investigating inter-/intra-scanner mpMRI variability. Based on their similarity to *in vivo* parametric values and the stability of these measurements, the phantom should comprise of Gd-doped and undoped gelatine, and ethanol. Future work will focus on using a more permanent design for this phantom and imaging across multiple centres to assess variation for a subsequent clinical trial that aims to measure treatment response for prostate cancer using mpMRI.