Water Unsuppressed 1H MR Spectroscopic Imaging Of The Prostate
Nassim Tayari1, Arend Heerschap1, and Alan J. Wright1
1Dept. of Radiology, RadboudUMC, Nijmegen, Gelderland, Netherlands

Target audience: MR spectroscopists interested in acquisition and quantification of MRSI data of the prostate

Purpose/Background
Proton MR spectroscopic imaging is commonly performed with water signal suppression to avoid artifacts from side bands of the large water signal caused by system oscillations. However, this signal can be very useful for referencing purposes as estimation of absolute metabolite values and to correct for various metabolite line shape deformations. For these purpose it is common to acquire a separate MRS data set without water suppression, but this takes quite some time, and thus rarely used in a clinical setting. Therefore, it remains an attractive option to attempt to acquire MRS(I) data without water suppression and implement proper processing to remove the water side bands. Several studies have explored non water suppressed 1H MRS(I) of the brain [1,2].

The aim of this study was to develop water unsuppressed 3D MRSI of the prostate and validate its value in a number of prostate cancer patients. We have used this technique to generate choline concentration maps for localization of prostate tumours.

Methods
Prostate Cancer patients underwent standard mpMRI exam. The semi-LASER sequence developed for water unsuppressed spectroscopic imaging which allows resolution of extra metabolite peaks [3] is utilized to collect MRSI data from each of these patients. An algorithm based on the method of Dong et al. [1] was developed to process 1H MRSI data of the prostate and water signal is used for absolute metabolite quantification(fig. 1). The large water signal is filtered from the metabolites and it is used as an internal reference for zero and first order phase correction as well as frequency correction. Taking the modulus spectrum of the data at this stage suppresses the water sidebands. The filtered metabolites are fitted based on the lineshape function derived from the water signal along with a model baseline. These water and baseline signals were subtracted from the spectrum to leave just the metabolites which were fitted with the model lineshape. Choline concentration maps were generated from this data. The choline + spermine + creatine over citrate (CSC/C) ratio was also calculated for each fitted voxel.

Discusstion
The water unsuppressed spectroscopic imaging data acquisition provides absolute quantification of the metabolites with the limitations of assuming non-significant variations for T1 and T2 relaxation phenomena. In healthy tissue the CSC/C ratio has a stronger correlation to citrate than choline suggesting that the ratio is more dependent on the former metabolites concentrations whereas in tumour tissue the two metabolites have an equally strong influence on this ratio. This suggests that in tumours the CSC/C is equally influenced by the displacement of benign tissue as it is on the increase of proliferation amongst tumour cells. Separating these metabolic biomarkers out allows for a choline concentration map that may act as a more specific marker for proliferative growth.


Acknowledgments: This work was supported by EU project TRANSACT.