Tumour-laden Prostates NOT Detected by MRSI

L. Ryner[1], L. LeBoldus[2], A. Hussain[2], I. C. P. Smith[1], T. Bezabeh[1]

[1]Institute for Biodiagnostics, National Research Council Canada, Winnipeg, MB, Canada, [2]Dept. of Urology, Health Sciences Centre, Winnipeg, MB, Canada

Introduction: The use of MRSI to detect malignancies of the prostate has been well reported (1). It is clear that the ratio of choline+creatine to citrate is a useful diagnostic marker for malignancy. However, full evaluation of sensitivity and specificity of this marker at different clinical sites has not yet been reported. There have been some reports in the literature showing that this technique is not 100% sensitive and specific (2). However, with relatively few negative reports, we report here our initial experience on MRSI findings that did not concur with histopathology on radical prostatectomy patients.

Methods: All experiments were performed on a GE (Waukesha, WI) 1.5T Signa LX MR scanner equipped with Echospeed actively-shielded gradient coils (22 mT/m, 120 T/m/s) using a Medrad endorectal coil in combination with a torso phased array coil. The product PRESS sequence was modified to incorporate a spectral/spatial 90º excitation pulse in place of the standard slice-selective 90º RF excitation. Its properties included: true nulling (in contrast to opposed nulling), a frequency offset of –110 Hz (with water at 0 Hz), a nulling frequency of 110 Hz (placing null points at 0 Hz [water], and -220 Hz [lipid]), a spectral bandwidth of 75 Hz (spectral Full-Width-Half-Maximum region from -72.5 Hz to –147.5 Hz), a spatial bandwidth of 1750 Hz, 4 trapezoidal gradient cycles, and a total pulse width of 18.2ms which allowed a 40ms minimum TE. The spectral/spatial pulse was spatially selective on the physical z-axis of the magnet (patient superior/inferior axis), and the patient table was moved such that the slice-offset was always zero. Additional water suppression pulses were not necessary. 3D MRSI datasets were acquired with a FOV of 110mm S/I x 55 mm R/L x 55 mm A/P and a 16x8x8 phase encoding resulting in 0.32 cc voxels. Other parameters were: TR=1000ms, TE=130ms and 50ms (not reported here), spectral width of 2500 Hz, and 512 points. Data processing included eddy current correction using the residual water signal, sine bell spatial apodization, 3 Hz Gaussian spectral line broadening, zero-filling to 2048 points, high-pass convolution filter to remove residual water, and linear baseline correction. A total of 3 patients scheduled for radical prostatectomy and 9 patients with high PSA and negative biopsy have been scanned.

Results: Sample spectra from one patient scheduled for radical prostatectomy are shown in Figs. 1 and 2. The central slice of the CSI dataset (zoomed from 4 to 1 ppm) overlaid on the T2-weighted localizer is shown in Fig.1. The reduction of citrate at 2.6ppm (the large peak in the middle of each spectrum) on the patient's left side is clearly seen. Evidence of a small choline peak on the same side is also observed. Cho+Cr/Cit ratio of 0.27 is observed in Fig.2, a spectrum representative of the highest ratio in the 3D dataset. This patient's PSA value was 13.0, Gleason score 3+3 with infiltrating prostatic adenocarcinoma involving the left apex, anterior and posterior left lobe, left base, and posterior right lobe. The two other patients showed similar results with high PSA levels, positive histopathology, yet negative MRSI.

Discussion: None of the three patients scanned with MRSI showed the expected high Cho+Cr to Cit ratio for malignant prostate tissue. The trend to an increased choline+creatine to citrate ratio was observed in all patients, as seen in Fig.1 on the patient's left lobe identified as infiltrating prostatic adenocarcinoma in histopathology. Three negative MRSI studies on three patients with prostates laden with significant tumour burden suggests to us that a cautionary approach to interpretation of prostate MRSI results is needed.

References:

[1] J. Kurhanewicz, *et al.*, *JMRI* **16** (2002) 451-463

[2] J. Scheidler et al, *Radiology* **213** (1999) 473-480.