Clinical breast MRS at 1.5T using a water-fat suppression technique

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Introduction

Most malignant breast tumours are characterised by high choline signal in MR spectra (1,2). However, lipid signals from the selected volume-of-interest (VOI) often dominate the spectra. A reduction of the methyl and methylene peaks at 0.9-1.2 ppm would be valuable for clinical interpretation of the spectra, due to a better delineation of the choline signal. This can be obtained using long echo time during acquisition (3) but result in poor signal-to-noise ratio. The aim with the present study was to implement and test out the feasibility of a water-fat suppression technique in a clinical breast MRI/MRS protocol.

Materials and Methods

Breast cancer patients (n=6) with lesions larger than 2 cm scheduled for neoadjuvant chemotherapy were included in the study. The patients were positioned in prone position using a standard available breast coil. The examination was performed on a Siemens Symphony 1.5T system using a breast MRI protocol including a dynamic contrast enhanced 3D FLASH sequence (TR=14 msec, TE=6.3 msec, flip angle 25°, FOV 320 mm, slice thickness 2.5 mm, 64 slices, acquisition time 1.34 min, 6 repetitions). A bolus injection of 0.1 mmol/kg b.w gadodiamide (Ominscan) was administered between the two first repetitions. The VOI size was chosen to fit inside the tumour, typically 1.5x1.5x1.5 cm^3. MRS acquisition was performed using a PRESS sequence with TR=1600, TE 270, 1024 data points and 256 averages. Fat/water signal reduction was obtained using the spectral saturation method, by which transverse magnetization is dephased selectively before and after the second slice selective 180-degree spin echo pulse. This dephasing is defined to affect both the water signal and the lipid signals from 0.7 to 2 ppm. The spectral suppression method has been described as "MEGA" (4).

Results

The water-fat suppression the sequence was tested on a number of healthy volunteers; while residual water and lipid signals remained visible, the spectral range from 3.0 to 3.4 ppm showed no artefactual signal. In all patients, the fat signal was significantly reduced compared to the standard PRESS acquisition. A typical example is shown in figure 1. All tumour spectra demonstrated a strong signal from cholines. The VOI was placed in the most enhancing part of the tumours determined from the MRI images in 3 planes (figure 2).

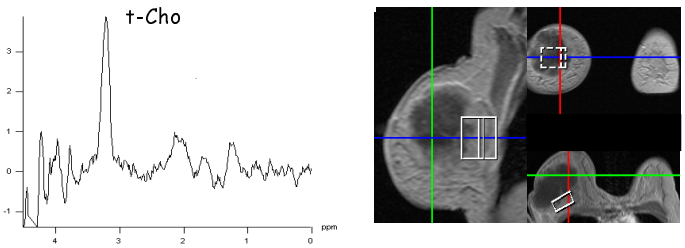

Figure 1: In vivo MR spectrum from a patient (35 years) with a ductal carcinoma obtained using the water-fat suppression sequence and the corresponding planscans of the selected VOI. (t-Cho – total choline signal)

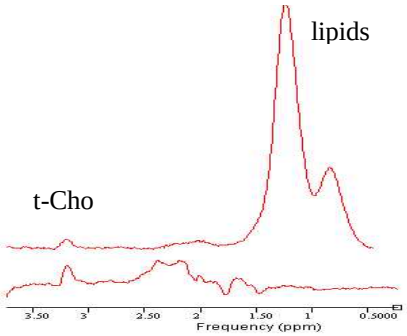

Figure 2: MR spectra from a patient (37 years, ductal carcinoma) using the water-fat suppression sequence (lower) and standard PRESS acquisition (upper).

Discussion

We have demonstrated that an in vivo water-fat suppression sequences can be included in a clinical MRI/MRS breast protocol and give significant suppression of the fat signal. The sequence gives 5 minutes additional examination time and can easily be included in a clinical MRI/MRS protocol

References

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