Proton Magnetic Resonance Spectroscopy Techniques to Measure the Lipid Olefinic Resonance In Vivo

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Purpose:

The purpose of this educational abstract is to discuss methods that have been designed to enable measures of lipid unsaturation to be determined *in vivo* with proton magnetic resonance spectroscopy (MRS).

Outline of content:

Levels of lipid unsaturation determined by proton MRS have shown to be useful in the study of liver disease, obesity, bone disease, and breast cancer (1-7). The olefinic resonance at about 5.4 ppm yields a measure of lipid unsaturation because it represents signal from protons bonded to the double-bonded carbons. However, the olefinic resonance is severely overlapped by the water peak at approximately 4.8 ppm, particularly at clinical field strengths such as 1.5 T and 3 T. Therefore, different techniques have been investigated for resolving the olefinic resonance from that of water. In some studies, spectral fitting was employed (4,7) whereas in other studies spectral editing techniques were implemented. A selective multiple quantum coherence transfer (Sel-MQC) was developed to suppress water signal and was applied to study breast tissue at 2.1 T (1). Long echo time (TE) PRESS (Point RESolved Spectroscopy) has been optimized for measuring the olefinic resonance at 1.5 T (8,9) and 3 T (10). Recently, the STEAM (Stimulated Echo Acquisition Mode) MRS sequence was optimized for resolving the olefinic resonance from water by optimizing a long-TE (11) and by exploiting diffusion weighting (12).

The objective of the proposed educational e-poster is to discuss the following:

- The relevance of lipid unsaturation levels in the study of diseases.
- The challenges of quantifying the olefinic resonance *in vivo.*
- The J-coupling interactions of lipid olefinic protons.
- The different *in-vivo* methods employed for olefinic resonance quantification.
- The role of J-coupling of the olefinic protons in the Sel-MQC sequence and in optimizing the long TE values for PRESS and STEAM.

Summary:

The objective of the presented educational abstract is to discuss quantifying lipid unsaturation levels *in vivo* with proton MRS. Different methods employed to measure lipid unsaturation *in vivo* are discussed. The role of J-coupling interactions in the design of some of the techniques is also explained.

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