

Elucidating the effect of respiratory motion on in vivo ^{31}P magnetic resonance spectroscopic imaging in the human liver at 7 Tesla

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Introduction: Respiratory motion affects the reconstructed spectra in magnetic resonance spectroscopic imaging (MRSI), as it changes the location of the nuclei and the B_0 field they experience during the signal acquisition. B_0 changes lead to a frequency shift of the acquired signal. This study aimed to determine the maximum frequency shift due to respiratory motion in a typical ^{31}P liver MRSI scan at 7 Tesla.

Method: We instructed a human volunteer to control his breathing, guided by an audio signal, during the acquisition of a 3D ^{31}P MRSI liver scan. The breathing pattern contained two breath holds, one after maximal inhalation and another after full exhalation. The obtained spectra were compared with a prospectively gated scan.

Results: In addition to increased peak line widths compared to the gated scan, we found that several spectra exhibited a splitting of the signals into two separate peaks, with frequency shifts between the peaks of up to 0.57 ppm depending on the location in the liver.

Conclusion: Respiratory motion induces significant frequency shifts of the signal obtained in liver ^{31}P MRSI, leading to both an increase in line width and a frequency shift of the peaks. This may result in overlapping or masking of peaks, which hampers the quantification of metabolite concentrations. The application and further development of prospective gating and other motion correction methods is highly recommended.

Field

Software and quantification

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