Impact of inversion-recovery fat suppression on hepatic $R_2^*$ quantitation in transfusional siderosis.

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Introduction. MRI relaxometry has been increasingly used to quantify liver iron. However, the presence of fat can introduce additional modulations with echo time (TE) in the acquired signal, that manifest as erroneous increases in the apparent $R_2^*$ [1]. Conventional fat suppression (FS) techniques can minimize fat signal contributions [2, 3]. The aim of this study was to evaluate if the application of spectral presaturation inversion recovery (SPIR) FS in standard multi-echo gradient echo sequences had a significant impact on hepatic $R_2^*$ estimates in patients with iron overload syndromes.

Materials and methods. Eighty patients were scanned with a multi-echo gradient echo sequence without and with the application of SPIR. Six different post-processing methods were used to extract $R_2^*$ values for maximum generality. Each analysis was defined by three different aspects, summarized in the Table on the right.

Results. The Table below summarizes the effect of fat saturation on $R_2^*$ estimation. FS lowered $R_2^*$ values by between 3.9% and 7.0% (P<0.0001 in all pair-wise comparisons), independently of the post-processing algorithm. Coefficients of variation (CoV) for $R_2^*$ ranged from 4.5% to 10.0%. Regardless to the size of the region of interest (area of homogeneous tissue or entire liver profile in the slice), pixelwise approaches combined with an exponential-plus-constant fitting model yielded the lowest CoV (4.5% and 5.1%) while truncated exponential fits of the averaged signals produced the highest CoV (7.8% and 10%). For $R_2^*$ values exceeding 200 Hz, the Bland Altman analysis showed a bias that grew linearly for all post-processing methods (see Figure).

Conclusions. FS resulted in systematically lower $R_2^*$ estimates. Since calibration curves were derived using images without fat suppression, these biases should be corrected when reporting liver iron concentration from FS images.