Impact of inversion-recovery fat suppression on hepatic R2* quantitation in transfusional siderosis.

Antonella Meloni[1,2], J. Michael Tyszka[3], Alessia Pepe[1], Massimo Lombardi[1], and John C Wood[2,4]

[1]CMR Unit, Fondazione G.Monasterio CNR-Regione Toscana and Institute of Clinical Physiology, Pisa, Italy, [2]Department of Pediatrics, Division of Cardiology, Children's Hospital Los Angeles, Los Angeles, California, United States, [3]Division of Biology, California Institute of Technology, Pasadena, California, United States, [4]Department of Radiology, Children's Hospital Los Angeles, Los Angeles, California, United States

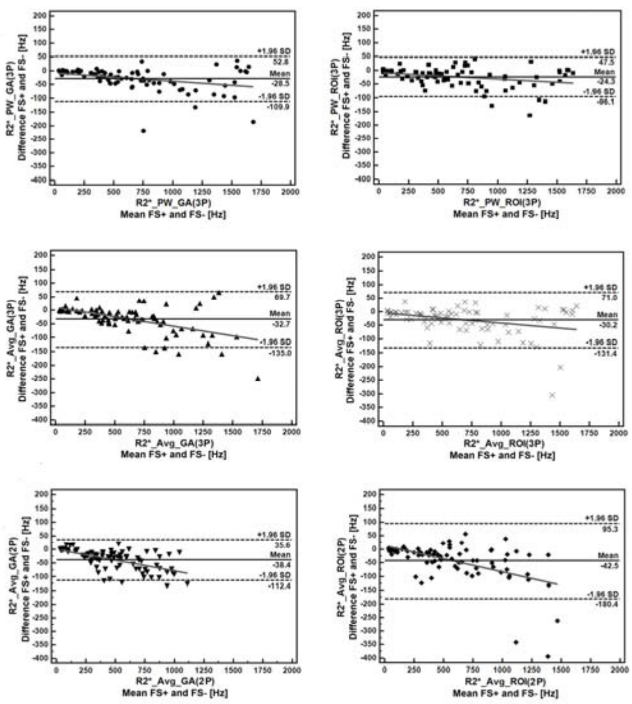
Introduction. MRI relaxometry has been increasingly used to quantify liver iron. However, the presence of fat can introduce additional modulations with echo time (TE) in the acquired signal, that manifest as erroneous increases in the apparent R2* [1]. Conventional fat suppression (FS) techniques can 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 R2* 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 R2* values for maximum generality. Each analysis was defined by three different aspects, summarized in the Table on the right.

R2* values	Type of ROI	Type of fitting	Curve-fitting model	Reference
*R2*_VW_GA(3P)*	entire liver profile in the slice	voxel-wise approach	Offset model	4
*R2*_Avg_GA(3P)*	entire liver profile in the slice	Averaged-signal approach	Exp-C model.	5
*R2*_Avg_GA(2P)*	entire liver profile in the slice	Averaged-signal approach	Truncation model	
*R2*_VW_ROI(3P)*	area of homogeneous liver tissue	voxel-wise approach	Offset model	6
*R2*_Avg_ROI(3P)*	area of homogeneous liver tissue	Averaged-signal approach	Offset model.	7
*R2*_Avg_ROI(2P)*	area of homogeneous liver tissue	Averaged-signal approach	Truncation model	8

Results. The Table below summarizes the effect of fat saturation on R2* estimation. FS lowered R2* 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 R2* 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 R2* values exceeding 200 Hz, the Bland Altman analysis showed a bias that grew linearly for all post-processing methods (see Figure).

	Paired t-test			Regression Analysis			
	Values, mean±SD [Hz]	Diff mean±SD [Hz]	P	Slope (SE)	Intercept (SE) [Hz]	R2	CoV (%)
*R2*_VW_GA(3P)* FS+ vs FS-	677.5±472.3 vs 706.0±486.7	-28.5±41.5	<0.0001	0.967 (0.009)	-5.388 (7.620)	0.993	5.1
*R2*_Avg_GA(3P)* FS+ vs FS-	605.9±388.5 vs 638.6±416.1	-32.7±52.2	<0.0001	0.928 (0.012)	13.283 (8.861)	0.988	7.0
*R2*_Avg_GA(2P)* FS+ vs FS-	468.3±276.2 vs 506.6±298.9	-38.4±37.7	<0.0001	0.919 (0.011)	2.684 (6.437)	0.989	7.8
*R2*_VW_ROI(3P)* FS+ vs FS-	674.3±466.5 vs 698.6±477.2	-24.3±36.6	<0.0001	0.975 (0.008)	-6.692 (6.936)	0.994	4.5
*R2*_Avg_ROI(3P)* FS+ vs FS-	665.5±458.6 vs 695.5±475.6	-30.2±51.6	<0.0001	0.959 (0.011)	-1.593 (9.568)	0.989	6.2
*R2*_Avg_ROI(2P)* FS+ vs FS-	557.2±361.9 vs 599.7±398.4	-42.5±70.3	<0.0001	0.897 (0.016)	19.229 (11.669)	0.975	10.0



Conclusions. FS resulted in systematically lower R2* estimates. Since calibration curves were derived using images without fat suppression, these biases should be corrected when reporting liver iron concentration from FS images.

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