

Prospective comparison of transient elastography, MRI and serum scores for grading steatosis and detecting non-alcoholic steatohepatitis in bariatric surgery candidates

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Supplementary materials and methods

Proton density fat fraction was calculated using multiecho magnitude images. Data processing was carried out with a numerical fitting procedure using Matlab (The Mathworks, Natick, USA) as described elsewhere¹. Briefly, the fit function describing MRI magnitude as a function of echo time was parameterized with a single, generic T2* value for the water and the fat compartments to stabilize the numerical procedure and accounted for all pairs of signal interferences between the resonances of water and fat. The fat compartment was modeled as a spectrum with six resonances of fixed chemical shift and amplitudes². The fitting algorithm was Levenberg-Marquardt. The fit was repeated 2000 times using a different set of starting values for the water signal magnitude, the fat signal magnitude and the T2*. The center of this starting value grid search was obtained using fat and water proton densities obtained using the in-out-in paradigm³, and a linear approximation of signal decay using the first two in phase echoes for the T2*. The fit yielding the best root mean square deviation between fit and experimental data, was kept. The data from each echo was weighted by its corresponding signal magnitude to noise ratio. The fat and water proton densities derived from the fit (ρ_f and ρ_w , respectively) were used to derive the proton density fat fraction (PDFF) in percent using $PDFF = 100 \times (\rho_f / (\rho_f + \rho_w))$. No particular correction was brought for T1 correction since the flip angle was low².

Table S1.

Comparison of performance in “Intention to diagnose” of CAP, MRI-PDFF and serum scores for steatosis grading. For each pair of compared tests, the percentage of correctly classified (true negative + true positive) patients for each test are indicated, along with the individual comparisons p-values

Comparison	S0 vs S1-3 (>5%)			S0-1 vs S2-3 (>33%)			S0-2 vs S3 (>66%)		
	Correctly classified (%)			Correctly classified (%)			Correctly classified (%)		
	test 1	test 2	p-value	test 1	test 2	p-value	test 1	test 2	p-value
CAP vs. MRI-PDFF	63.4	91.1	3.0×10^{-6}	59.2	81.2	6.7×10^{-4}	53.5	82.3	1.3×10^{-5}
CAP vs. ST	63.4	68.3	0.46	59.2	70.3	0.10	53.5	72.4	5.7×10^{-3}
CAP vs. HSI	63.4	73.1	0.14	59.2	66.9	0.26	53.5	56.6	0.66
CAP vs. FLI	63.4	71.0	0.25	59.2	62.8	0.60	53.5	59.3	0.41
MRI-PDFF vs. ST	91.1	68.3	6.1×10^{-4}	81.2	70.3	0.07	82.3	72.4	0.09
MRI-PDFF vs. HSI	91.1	73.1	9.0×10^{-4}	81.2	66.9	0.02	82.3	56.6	7.8×10^{-5}
MRI-PDFF vs. FLI	91.1	71.0	2.9×10^{-4}	81.2	62.8	3.8×10^{-3}	82.3	59.3	3.5×10^{-4}
ST vs. HSI	68.3	73.1	0.46	70.3	66.9	0.60	72.4	56.6	0.02
ST vs. FLI	68.3	71.0	0.68	70.3	62.8	0.26	72.4	59.3	0.05
HSI vs. FLI	73.1	71.0	0.74	66.9	62.8	0.54	56.6	59.3	0.70

IRM-PDFF n= 130; CAP n= 142; ST n= 145; HIS n= 145; FLI n= 145

Table S2.

Comparison of performance between MRI-PDFF, CAP, and serum scores for steatosis grading (n= 97 patients) with DeLong test according to biopsy length and number of portal tracts. For each pair of compared tests, the individual test comparisons p-values (after adjustment for alpha risk) are indicated, along with the AUROC of each respective test.

Pairwise comparison (test 1 vs. test2)	S0 vs S1-3			S0-1 vs S2-3			S0-2 vs S3		
	AUROC test 1	AUROC test 2	p-value	AUROC test 1	AUROC test 2	p-value	AUROC test 1	AUROC test 2	p-value
MRI-PDFF vs. CAP	0.97	0.82	0.053	0.97	0.78	3.0×10 ⁻⁴	0.93	0.75	0.0015
Biopsy length <10 mm	0.97	0.51	0.010	1.00	0.76	0.653	0.89	0.65	0.932
Biopsy length ≥10 mm	0.97	0.91	0.579	0.95	0.78	0.003	0.94	0.76	0.008
Portal tracts <10	0.98	0.80	0.345	0.99	0.84	0.542	0.92	0.77	0.845
Portal tracts ≥10	0.96	0.87	0.587	0.95	0.75	0.003	0.93	0.74	0.019
MRI-PDFF vs. ST	0.97	0.77	5.5×10 ⁻⁴	0.97	0.77	4.0×10 ⁻⁵	0.93	0.81	0.071
Biopsy length <10 mm	0.97	0.73	0.389	1.00	0.85	0.713	0.89	0.88	0.932
Biopsy length ≥10 mm	0.97	0.77	0.012	0.95	0.74	2.5×10 ⁻⁴	0.94	0.79	0.027
Portal tracts <10	0.98	0.76	0.167	0.99	0.91	0.693	0.92	0.91	0.845
Portal tracts ≥10	0.96	0.77	0.034	0.95	0.70	2.3×10 ⁻⁴	0.93	0.77	0.038
MRI-PDFF vs. HSI	0.97	0.74	1.9×10 ⁻⁴	0.97	0.72	3.0×10 ⁻⁶	0.93	0.72	6.6×10 ⁻⁴
Biopsy length <10 mm	0.97	0.62	0.104	1.00	0.88	0.791	0.89	0.87	0.932
Biopsy length ≥10 mm	0.97	0.74	0.003	0.95	0.67	9.0×10 ⁻⁶	0.94	0.68	1.7×10 ⁻⁴
Portal tracts <10	0.98	0.81	0.345	0.99	0.84	0.409	0.92	0.80	0.845
Portal tracts ≥10	0.96	0.68	0.009	0.95	0.65	2.5×10 ⁻⁵	0.93	0.68	0.001
MRI-PDFF vs. FLI	0.97	0.74	5.5×10 ⁻⁴	0.97	0.68	8.7×10 ⁻⁸	0.93	0.70	3.7×10 ⁻⁴
Biopsy length <10 mm	0.97	0.55	0.051	1.00	0.72	0.241	0.89	0.85	0.932
Biopsy length ≥10 mm	0.97	0.78	0.022	0.95	0.65	1.9×10 ⁻⁶	0.94	0.66	9.4×10 ⁻⁵
Portal tracts <10	0.98	0.78	0.209	0.99	0.79	0.182	0.92	0.82	0.845
Portal tracts ≥10	0.96	0.73	0.034	0.95	0.60	1.9×10 ⁻⁶	0.93	0.64	3.1×10 ⁻⁴

CAP controlled attenuation parameter; MRI-PDFF magnetic resonance proton density fat fraction; FLI, fatty liver index; HSI, Hepatic steatosis index; ST, SteatoTest.

Supplementary references

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