Absolute Quantification of Liver Fat by MRI fat volume fractions in comparison to Histopathology

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Purpose: To evaluate a new approach to absolutely quantify the liver fat content by fat volume fractions derived from MRI (FVF_{MRI}) using a surface-coil sensitivity correction in comparison to histopathology (FVF_{HISTO}) demonstrating the reference standard.

Materials and Methods: Twenty-four adults (11 women; 13 men; mean age, 54±15 years) underwent hepatic 1.5-Tesla MRI with a single-breathhold 3D spoiled dual gradient-echo sequence and surface-coil sensitivity correction prior to clinically indicated biopsy. FVF_{MRI} was calculated for each voxel in a region of interest in the in/out-of-phase and fat-only images as the fraction of signal intensity divided by global maximum fat-signal intensity after automated segmentation. FVF_{MRI} and FVF_{HISTO} were established in thirty-nine liver segments and statistically analyzed.

Results: Mean FVF_{HISTO} was 10.3±11.5% (1.0-36.0%). FVF_{MRI} derived from in/out-of-phase (r=0.88) and fat-only images (r=0.89) were significantly ($p<0.001$) correlated with FVF_{HISTO}. Mean measurement biases of FVF_{MRI} and FVF_{HISTO} were 6.1%±7.6% for in/out-of-phase and 5.1%±8.5% for fat-only images, respectively. The mean measurement bias of FVF_{MRI} from fat-only images was significantly ($p<0.01$) reduced as compared to FVF_{MRI} from in/out-of-phase images.

Conclusion: Absolute liver fat content can be quantified accurately by FVF_{MRI} with surface-coil sensitivity correction compared to FVF_{HISTO}. Fat-only images significantly reduce the measurement bias as compared to in/out-of-phase images.