Multi-model direct inversion algorithms at 3.0T MR elastography of the liver: comparison with conventional multi-scale algorithm

Kengo Yoshimitsu[1], Atsushi Nozaki[2], and Richard L Ehman[3]

[1]Radiology, Fukuoka University, Fukuoka, Fukuoka, Japan, [2]GE Healthcare, Tokyo, Japan, [3]Mayo Clinic, Minessota, United States

Background and Purpose: The diagnostic performance of MR elastography (MRE) for non-invasively assessing liver fibrosis in patients with chronic liver disease has been well established. Recently, EPI-based 3.0 T clinical MRE [1,2] has been reported to be comparable to GRE-based 1.5T MRE in the liver fibrosis assessment [3]. MRE has been commercially available from since 2009, and until recently most published studies using commercially available technology have employed a processing algorithm called multi-scale direct inversion (MSDI). The purpose of this study was to compare a newer inversion algorithm (multi-model direct inversion algorithm (MMDI), offering reduced processing time and fewer artifacts [4]), now used in the newest MRE products offered by GE Healthcare, Siemens, and Philips, with the older algorithm on a 3.0T clinical unit.

Materials and Methods: After obtaining written informed consent, 33 consecutive patients who were suspected to have liver diseases underwent MRE with separate acquisitions using the older and newer inversion algorithms as part of clinical examination. There were 21 men and 12 women, with 22 hepatitis viral infection (C/ B/ C+B=13/ 6/ 3), 3 non-alcoholic steatohepatitis, and 8 no known liver disease. Parameters for MSDI were TR/ TE/ MEG = 1000 ms/ 59 ms/ 80 Hz: those for MMDI were 1000 ms/ 40 ms/ 155 Hz. A 19-cm-diameter pneumatic driver with 60 Hz waveform was used and 4 slices were obtained for both scans. The degree of images defects or artifacts (assessed qualitatively using 4-point scale), the ratio of measureable area (area without cross-hatching marks) to the area of the whole liver, and the measured stiffness of the liver (kPa) were compared between the scans (Wilcoxon's signed rank test).

Results: Fewer elastogram artifacts were present in the MMDI images than with MSDI (0.04 ± 0.2 vs 0.68 ± 0.6, $p<0.0001$). There was no significant difference in the ratio of the measurable area (0.42 ± 0.14 vs 0.4 ± 0.13). The average measured stiffness in this series was slightly lower in the MMDI images than in the MSDI images, probably due the fewer high-stiffness artifacts MMDI (4.32 ± 1.8 kPa) versus MSDI (4.6 ± 1.8 kPa) (Figure 1A-D).

Conclusion: 3.0T MRE with MMDI provides stiffness map with fewer artifacts, comparable measurable areas, and little systematic difference in mean stiffness compared with the older algorithm MSDI.

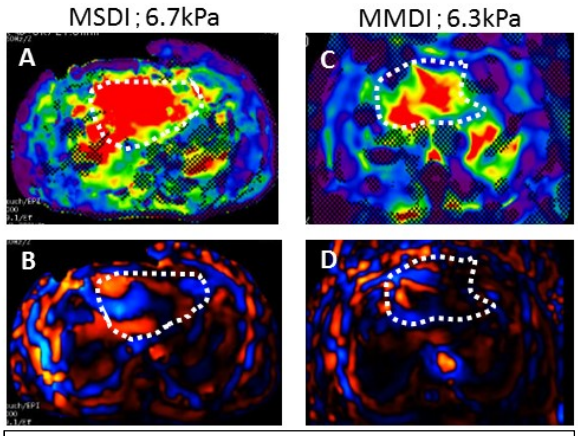

Figure1 72-year-old man with non-alcoholic steatohepatitis with histological fibrosis grade 4. Liver stiffness color maps (A, C) and phase images (B, D) using MSDI and MMDI, respectively. Measured liver stiffness was slightly lower with MMDI.

References

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