Quantitative Liver Function Analysis using T1 mapping with fast multi-slice B1 correction on Hepatocyte-specific contrast enhanced MR

Jeong Hee Yoon[1], Jeong Min Lee[1], Eun Ju Kim[2], Tomoyuki Okuaki[3], Joon Koo Han[1], and Byung Ihn Choi[1]
[1]Radiology, Seoul National University Hospital, Seoul, Seoul, Korea, [2]Philips Healthcare Korea, Seoul, Seoul, Korea, [3]Philips Healthcare Japan, Tokyo, Japan

Target audience: people who are interested in quantitative imaging of body MR

Purpose: To determine whether a T1 mapping sequence using the variable flip angle (VFA) method with fast multi-slice B1 correction shows better diagnostic performance than T1 mapping without B1 correction, for estimating liver function on Gd-EOB-DTPA enhanced MRI.

Methods: This retrospective study was approved by our institute of review board. Seventy six consecutive patients (M:F=57:19, mean age: 61.1 years) with chronic liver disease who underwent liver MRI at 3.0T scanner were included. Patients were Child-Pugh score A5 (n=62), A6 (n=6), and B7 (n=8). A multislice two-dimensional spoiled gradient-recalled echo (GRE) pulse sequence with VFA (2D SPGR-VFA) (VFA, TR/TE, 9/1.4msec; FA, 5' and 29', NEX, 1.0; and matrix 128x128) and B1 mapping (TR/TE, 771.9/40msec; FA, 130'; NEX, 1.0; and matrix 128x95) were performed for T1 mapping of the liver using 10 minutes after standard dose of Gd-EOB-DTPA injection. B1 map[1] was optimized for the liver through phantom study in our institution. B1 mapping and T1 mapping covered the whole liver within one breath hold. T1 relaxation time was assessed by using dedicated software, and then T1 relaxation times of the enhanced liver with/without B1 correction were compared among different C-P score groups.

Results: Postcontrast T1 relaxation times with B1 correction of the liver on Gd-EOB-DTPA MRI were significantly different among different C-P score groups: 427.8±145.8 msec in A5; 502.5±134.9 msec in A6; and 640.9±370.8 msec in B7 (P<0.001). As for T1 relaxation times of the liver without B1 correction, values were 375.9±156.8 msec in A5; 338.3±82.8 msec in A6; and 565.2±336.2 msec in B7.

Discussion: There have been attempts to estimating liver function by measuring liver enhancement degree on hepatocyte-specific MR. However, measuring signal intensity is not appropriate for quantification due to MR signal is prone to magnetic field inhomogeneity and image parameters. In our study results, postcontrast T1 relaxation time measured by the T1 mapping sequence using the VFA method with fast multi-slice B1 correction was significantly longer in C-P score B, and T1 relaxation time with B1 correction tended to show better discrimination among different C-P score groups than T1 relaxation time without B1 correction.

Conclusion: T1 mapping using a breath-hold 2D-SPGR-VFA and B1 correction can be used for quantitatively estimate liver function using hepatocyte-specific contrast enhanced MRI.

Reference: Rt. Treier, A. Steingoetter, M. Fried et al, Optimized and combined T1 and B1 mapping technique for fast and accurate T1 quantification in contrast-enhanced abdominal MRI, MRM 2007;57(3):568-576

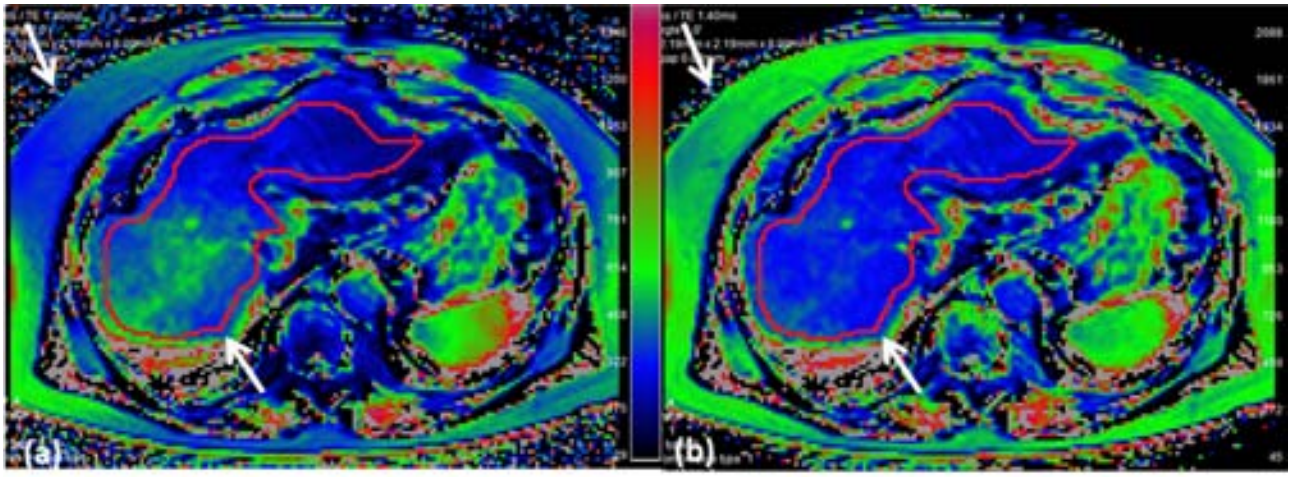

Figure 1. T1 map of a 74-year-old man with liver cirrhosis. On T1 maps with B1 correction (b), field inhomogeneity was corrected which was seen as heterogeneous signal intensity (arrows) on T1 map without B1 correction (a). The T1 relaxation time increased after B1 correction (460.837 msec, and 336.291 msec, respectively).