

Detectability of Small Metastatic Liver Tumors Evaluated with Low-b-factor Diffusion-Weighted Images with Ferucarbotran

T. Tounan¹, K. Fujimoto², S. Azuma¹, N. Ono³, S. Mastushita¹, N. Hayabuchi²

¹Radiology, Chikugo city hospital, Chikugo, Fukuoka, Japan, ²Radiology, Kurume university school of medicine, Kurume, Fukuoka, Japan, ³Internal medicine, Chikugo city hospital, Chikugo, Fukuoka, Japan

Purpose: To evaluate the detection of small (≤ 2 cm) metastatic liver tumors using low-b-factor diffusion-weighted image with/without super paramagnetic iron oxide particle (ferucarbotran) and to compare the tumor-liver signal contrast-to-noise ratio between long echo time and short echo time.

Methods and Materials: Eleven patients with metastatic liver tumors (n=92) who underwent ferucarbotran-enhanced MR imaging of the liver were examined. The median of the longest diameters of all nodules was 1 cm (range 0.3 to 2.0 cm); 92 nodules were divided into two size groups; 42 nodules were into group A (less than 1 cm), 50 nodules were into group B (range between 1 and 2 cm). On MR imaging, respiratory-triggered low-b-factor diffusion-weighted image (DWI) using long echo time (long TE-DWI = repetition time 1300 ms, echo time 90 ms, b-factor 8sec/mm²) and using short echo time (short TE- DWI = repetition time shortest, echo time 30 ms, b-factor 8sec/mm²) were obtained before and after administration of ferucarbotran. Two independent observers scored all nodules for the presence or absence and assigned confidence levels to their observations (0 = not detected, 1 = possibly detected, 2 = fairly detected, 3 = definitely detected). To assess the effect of ferucarbotran, the tumor-liver signal contrast-to-noise ratio (tumor-liver-CNR) was also calculated for detected nodules by the same two observers with consensus.

Results: There was good to excellent interobserver agreement for the grading score of nodules on each sequence (kappa statistic, 0.61 to 0.86). In qualitative analysis, the frequency of nodule that scored 2 or 3 on each sequence is as follows: in group A (n=42); 76% (32/42) on long TE-DWI without ferucarbotran, 93% (39/42) on long TE-DWI with ferucarbotran, 31% (13/42) on short TE-DWI without ferucarbotran, and 98% (41/42) on short TE-DWI with ferucarbotran; in group B (n=50); 72% (36/50) on long TE-DWI without ferucarbotran, 98% (49/50) on long TE-DWI with ferucarbotran, 42% (21/50) on short TE-DWI without ferucarbotran, and 100% (50/50) on short TE-DWI with ferucarbotran. In quantitative analysis, there were significant differences in the tumor-liver-CNR between pre-contrast long TE-DWI and long TE-DWI with ferucarbotran and between pre-contrast short TE-DWI and short TE-DWI with ferucarbotran (Bonferroni correlation, $P < .005$, all comparisons in group A and B). There was significant difference in the tumor-liver-CNR [mean (25%-75% interquartile range)] of group A between long TE-DWI with ferucarbotran [3.2 (2.1 – 4.1)] and short TE-DWI with ferucarbotran [4.4 (3.3 – 5.4)] (Bonferroni correlation, $P < .005$); however there was not significant in that of group B.

Conclusion: The detectability of small (≤ 2 cm) metastatic liver tumors on low-b-factor DWI was improved by the administration of ferucarbotran. For the detection of metastatic liver tumors (< 1 cm), short TE-DWI with ferucarbotran is superior to conventional long TE-DWI with/without ferucarbotran.