Detection of Liver Radiofrequency Ablation Lesion using MREIT Conductivity Imaging

Keywords: MREIT; radiofrequency ablation; conductivity image; liver

Abstract: Radiofrequency (RF) ablation is a typical heat-based ablation technique for the non-invasive treatment of liver cancer. The lesion detection after RF ablation is one of the most active research topics to confirm the residual tumors or abnormalities and determine the follow-up studies. RF ablation causes thermal injury due to the resistive heating and leads to coagulation necrosis as a result. The thermal injury in the liver tissue may cause the changes in cellular structure, concentration and mobility of ions in intra- and extra-cellular fluids, and other factors. These features could be advantageous to the MREIT imaging technique, which is most typical tissue property imaging technique providing electrical conductivity information. In this study, we evaluate the feasibility of MREIT conductivity imaging in terms of its capability to detect ablated lesions and differentiate tissue conditions in the liver radiofrequency (RF) ablation. RF ablation procedures were performed in normal bovine livers. Ablation lesions were created using a power-controlled mode at 30, 50, and 70 W for 1, 3, and 5 minute exposure time, respectively. After RF ablation, we performed MREIT imaging experiment injecting the current with 10 mA of amplitude and 81 ms of total pulse width. The reconstructed conductivity images provide increased contrast and well-defined region which are closely related with the tissue condition including coagulation area, coagulation necrosis and carbonization. The relative conductivity contrast ratio (%, rCCR) of ablation lesions was increased with proportion to the exposure time of RF ablation. This change considerably related with the tissue coagulation after RF heating.

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