Visualization of Pulmonary Vein-Left Atrium Reconduction Site on Delayed-Enhancement Magnetic Resonance Imaging in the Second Atrial Fibrillation Catheter Ablation

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Figure 1. (A) 3-D reconstructed delayed-enhancement magnetic resonance imaging (DE-MRI). (B) 3-D segmented left atrium (LA) and pulmonary vein (PV) model with DE site in the NavX system. Blue, DE site (Upper, PA view; Middle, LAO view; Lower, RAO view). (C) 2-D slice from DE-MRI (Upper, upper PV; Middle, LIPV; Lower, RIPV). Red arrows, DE site; white arrows, artifacts in RSPV and RIPV. Of note, the artifacts were deleted manually in the 3-D segmented NavX model. LAO, left anterior oblique; LIPV, left inferior pulmonary vein; PA, posteroanterior; RAO, right anterior oblique; RIPV, right inferior pulmonary vein.
A 58-year-old man with palpitation was referred for catheter ablation due to drug-refractory paroxysmal atrial fibrillation (AF). At 6 months after the first procedure with pulmonary vein isolation (PVI), symptomatic AF recurred, therefore catheter ablation was indicated. Delayed-enhancement magnetic resonance imaging (DE-MRI) was used to assess lesion formation in the prior ablation. On DE-MRI 4 lesion gaps were identified: roof of the left superior pulmonary vein (LSPV); bottom of the left inferior pulmonary vein (LIPV); roof of the right superior pulmonary vein (RSPV); and bottom of the right inferior pulmonary vein (RIPV; Figure 1A). The DE-MRI data were transferred to the NavX system (Figure 1B). In the second procedure, a single sharp potential was recorded by the ablation catheter, which was placed on the lesion gap identified on DE-MRI (Figures 2B, C). A single radiofrequency (RF) application in each lesion gap eliminated the PV-left atrium (LA) conduction. Furthermore, several additional RF applications were done to close the lesion gap.

DE-MRI has been reported as a non-invasive tool for visualizing RF lesions as well as atrial fibrosis. As a practical application, we reported that DE-MRI could visualize the substrate of macro-re-entrant atrial tachycardia. Recently, an inverse relationship between fractionated electrograms and atrial fibrosis has been reported. The relationship between the RF lesion gap of a prior ablation and the electrical information including re-conduction of PV, however, has not been well discussed. Ranjan et al reported that the maximum gap length for conduction block was 1.4 mm in an animal study. The gap length assessed on DE-MRI was a maximum of 4 mm. In the present study, the gap length of each PV varied: LSPV, 13 mm; LIPV, 4 mm; RSPV, 6 mm; RIPV, 25 mm. The sharp potentials were recorded on the gap. In contrast, the sharp potentials were not recorded on any DE sites. This demonstrates the reliability of DE-MRI for visualizing RF lesions and is consistent with their result. Although the gap length was long in the bottom of the RIPV, a single RF application eliminated PV-LA conduction. The question is whether additional RF applications should be done to close the gap. Before re-isolation, sharp potentials were recorded along the relatively long gap. We considered that additional RF applications for that area should be done to achieve continuous and durable wide circular lesion formation.

This case highlights the relationship between lesion gap assessed on DE-MRI and electrical properties. DE-MRI lesion gap information may be useful to facilitate adequate RF application and achieve complete continuous lesions.

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**References**


