The critical isthmus sites of ischemic ventricular tachycardia are in zones of tissue heterogeneity, visualized by magnetic resonance imaging.

A need exists to develop alternative approaches to VT ablation that provide an improved delineation of the arrhythmogenic substrate. The aim of this study was to evaluate the hypotheses that: (1) the heterogeneous zone (HZ, a mixture of normal-appearing tissue and scar) in magnetic resonance imaging (MRI) contains the critical isthmus(es) for ventricular tachycardia (VT), (2) successful ablation of VT would include ablation in the HZ, and (3) inadequate ablation of HZ allows for VT recurrence. MRI and an electrophysiology study (EP) were performed in a model of chronic myocardial infarction in 17 pigs. In animals that were inducible for VT, ablations were done guided by standard EP criteria and blinded to the MRI. After ablation, electroanatomic mapping results were co-registered with MRI. In 8 animals, 22 sustained monomorphic VTs were generated. The HZ was substantially larger in inducible (n = 8) compared with noninducible animals (n = 9) [25% ± 10% vs 13% ± 5% of total scar, respectively, P = .007]. Acutely, all targeted VTs were successfully ablated, and postprocedure analysis showed that at least 1 ablation was in the HZ in each animal. In 5 animals, a second EP and MRI were performed 1 week after ablation. Three animals had inducible VTs, and MRI showed that the HZ had not been completely
ablated. In contrast, the 2 animals without inducible VT revealed no remaining HZ. These findings show that MRI can define an HZ and determine the location of ablated lesions. The HZ may be a promising ablation target to cure ischemic VTs. Remnants of HZ after ablation may be the substrate for clinical relapses.