In vivo histology by cardiovascular magnetic resonance imaging

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A 65-year-old male patient with a blank cardiac history was admitted to our hospital after an out-of-hospital cardiac arrest due to ventricular fibrillation. Immediate coronary angiography showed significant three-vessel disease without culprit lesions and no intervention was performed. Cardiac enzymes remained within normal limits and he made a complete recovery. Cardiovascular magnetic resonance (CMR) imaging on day 6 revealed a dilated left ventricle with low ejection fraction (26%). Late gadolinium enhancement (LGE) imaging showed subendocardial increased signal intensity (SI), which was 25–50% transmural in the mid-anteroseptal, anterior, and anterolateral segments, and 50–75% transmural in the apical segments (arrows, Panel A). In addition to these dense areas of subendocardial scarring, areas of diffuse fibrosis were visible which were less intensely staining by Sirius red, for example in the inferolateral papillary muscle (*, Panel C). This represents scar tissue of an infarct of at least several weeks old (transition phase between granulation tissue and old scar tissue). Both areas of dense and diffuse fibrosis highly correlated with in vivo LGE, albeit with different SI (* and arrows, Panel A). Small discrepancies between histology and LGE CMR are explained by slightly different slice levels, the lower spatial resolution, and partial volume effect of CMR.

Late gadolinium enhancement accurately delineates reversible and irreversible myocardial injury in animal studies. In humans, scar size determined with LGE closely correlates with positron emission tomography and can be used to predict reversible myocardial dysfunction after revascularization.

Literature reports comparing LGE CMR with histological confirmed macroscopy in humans are scarce. Our case demonstrates the ability of LGE CMR to detect both dense and diffuse fibrosis.