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Anatomical correlation of abnormal electromechanics in postinfarct heart using high-resolution DENSE and epicardial sock electrodes

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Background: Post-myocardial infarction (MI) ventricular tachyarrhythmia may be associated with chronic changes in myocardial structure that disturb normal electromechanical coupling in the ventricle. We qualitatively examined anatomical correlation of abnormal electromechanics with reference to the MI boundary in post-MI hearts in vivo.
Methods: Six dogs underwent MR studies 4 weeks after anterior MI by proximal LAD occlusion. MI location and geometry were evaluated with a high-resolution (0.8x0.8x3mm) late enhancement inversion recovery sequence following intravenous injection of gadopentetate dimeglumine at 0.2 mmol/kg. Epicardial circumferential strain (Ecc) was calculated from 3D displacement fields in five short axis slices using a high-resolution (1.4x1.4x8mm) DENSE sequence. Isochrome map of the epicardial electrical activation time was determined using 247-lead sock electrodes.
Results: Strain map showed abnormal stretch in the region extending far beyond the MI boundary. In contrast, the region of delayed electrical activation, defined as the region with a greater than 50% delay, corresponded to the MI region, but was smaller than the MI boundary.
Conclusion: The abnormal mechanics region is larger than the MI region, whereas delayed electrical activation region is smaller than the MI region. The resultant large area with abnormal mechanics and normal electrical activation may provide a potential substrate of ventricular tachyarrhythmia via stretch activated ectopy.