To test the hypothesis that alterations in electrical activation sequence contribute to abnormal systolic function and timing of contraction in the infarct border zone, we examined the anatomical correlation of abnormal electromechanics and the infarct geometry in canine post-MI hearts, using a high resolution MR-based cardiac electromechanical mapping technique. Three to eight weeks after creating an MI, a 247-electrode epicardial sock was placed over the ventricular epicardium under thoracotomy. MI location and geometry were evaluated with a delayed hyperenhancement MRI and the mechanics, electrical activity, and infarct morphology obtained.

**Infarct Morphology**

High resolution MR images 15-30 minutes after the injection of Gd-DTPA show the detailed morphology of the myocardial infarct.

**Myocardial Tagging**

MR tagging acquisitions provided the displacement data required to determine the local myocardial function throughout the left ventricle. The color overlay gives the regional wall thickening, 40ms after the initial onset of contraction, showing the regional differences in wall function.

**Electrical Activation**

The voltages from individual electrodes on a 247 lead sock are shown for a region of the ventricle containing a significant infarct burden.

**Myocardial Fiber Structure**

Diffusion Tensor MRI (DTMRI) obtained in the hearts post-mortem allows us to reconstruct the structure of the myocardium down to the muscle fiber level. The direction of maximum water diffusion corresponds to the fiber direction. In the above 3D set, blue corresponds to fibers in the short axis plane, red corresponds to fibers perpendicular to that plan.

**Electromechanical Model**

Visualization of the different tensor components as 3D glyphs allows the user to immediately appreciate the orientation of the muscle fibers. Again, color represents angle (as in the previous panel) but the component’s fiber direction can also be visualized with the embedded shapes.

Ideally, all of the data obtained will be combined into a common 3D + time model of the infarcted heart from which predictions can be made regarding the susceptibility to fatal arrhythmias.

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