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SIMULATIONS OF ELECTRICAL PROPAGATION IN TRANSMURAL SLABS AND LEFT VENTRICLES WITH SCAR REGIONS

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We report three-dimensional and time-dependent numerical simulations of the propagation of electrical action potentials in rectangular regions and realistic left-ventricle geometries. The simulations are performed using a finite-element method for the solution of the monodomain equations of cardiac electrical excitation based on the work of Rossi and Griffith (2017). The detailed ionic ventricular cell model of Mahajan et al. (2008) is used for the description of the transmembrane current and calcium dynamics. A region with reduced conductivity and suitably modified excitability is introduced to model scar tissue due to myocardial infarction. Electrical activation times, contour maps of the action-potential duration and of the calcium concentration in transmural direction and at the epicardial surface are computed for several different stimulation protocols and stimulation locations. The numerical results are compared with experimental measurements in rabbit control preparations and preparations with myocardial infarction obtained by a panoramic optical mapping method (Myles 2009, Myles et al. 2010, Allan 2016).

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