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Slow Pulse due to Calcium Current induces Phase–2 Reentry in Heterogeneous Tissue

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Abstract

Phase–2 reentry is a basic mechanism for the transition to VT and VF in the heart. It is thought to underlie many causes of idiopathic ventricular arrhythmias as, for instance, those occurring in Brugada syndrome. Reentry is usually linked to heterogeneity in tissue repolarization. We study some circumstances under which a region of depolarized tissue can reexcite adjacent regions that exhibit shorter action potential duration (APD), eventually inducing reentry. Simulations are performed using a simplified ionic model that reproduces well the ventricular action potential (AP). We analyze first the conditions that lead to very short action potentials (APs). Then, we show that reexcitation takes place via a slow (calcium current induced) pulse that propagates into the region of short APs until it encounters excitable tissue. In two dimensions, this may give rise to reentry with the formation of counter-rotating spiral waves.

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