Influence of M-cells on the generation of re-entry in Short QT Syndrome

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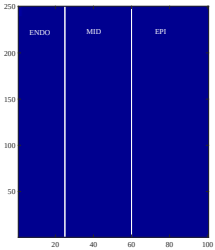
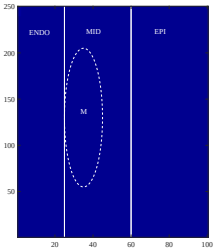
The distribution of M-cells (those with longest action potential duration (APD)) have always been vital in creating intrinsic spatial heterogeneity thereby acting as a substrate for the development and maintenance of re-entry. Here, a 2D anisotropic transmural tissue made up of endocardial (endo), midmyocardial (mid) and epicardial (epi) layers was constructed by using the ventricular cell model developed by Ten Tusscher et al. Two configurations, the entire column of mid layer and an island within the mid layer of the tissue were considered as M cells. In the latter configuration, slight alterations were introduced in the slow delayed rectifying potassium current and the outward transient current so that the APD is highest in the M-cells followed by the endo, mid and epi cells. The likelihood of reentry generation under conditions of KCNQ1-linked Short QT syndrome type 2 (SQTS2) was then analysed in these two types of tissue configurations. Simulation results show that on including SQTS2 conditions and on pacing the tissue with premature beats in between normal beats, re-entrant waves were generated in the tissue containing a column of M- cells whereas in the tissue including the M-cell island, re-entry was not generated. This study is not in line with those reported earlier due to the variations in the size of the chosen M-cell island as well as the cellular electrophysiological properties. From this investigation, the need for further analysis on the size, location as well as the ionic properties of the M-cells in relation to the neighbouring cells has been emphasized.



(a)Tissue First Configuration



(b)Tissue Second Configuration