Population of myocyte model for Atrial Fibrillation Covering the Current Ex vivo Experimental Data

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Background: Due to difference of ex vitro experimental data obtained from different laboratories, the research results of the population of atrial fibrillation(AF) cells calibrated based on certain experimental data can only represent a limited population. The purpose of this study was to generate a more broadly representative and reliable cellular population of AF using existing experimental data from three laboratories.

Method: Using the Grandi et al. cellular model, the initial population of 200,000 action potentials was established by using Latin hypercube sampling to conduct large-scale sampling of the conductivity and permeability of key ion channels. The populations of 20,000 AF cells were calibrated subsequently from the initial population using three groups of ex vivo experimental data. The sensitivity between the biomarkers (action potential duration at 20%, 50%, and 90% repolarization (APD20, APD50, APD90, respectively), resting membrane potential (RMP), AP amplitude (APA), and AP triangulation) and ion channel conductance was analyzed to determine the reliability of the AF population.

Result: According to the existing three groups of ex vitro experimental data on AP biomarkers, populations of 20,000 AF cells were obtained from the initial cellular population containing 200,000 action potential. Sensitivity analysis conducted in the population of AF indicates that RMP, APA, APD20, and APD50 were mainly controlled by G_{Nak}, G_{Na}, G_{to}, and G_{to}, respectively. For APD90, G_{K1} and G_{Nak} are the main contributors. And AP triangulation is mostly determined by G_{K1} in the AF population.

Conclusion: Sensitivity analysis between AP biomarkers and ion channel conductance in the population of AF was consistent with previous studies. we ultimately constructed a more broadly representative and reliable cellular population of AF that can be used for drug evaluation and screening.