Higher-Order Polynomial Model of Ventricular Electrograms

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Technology description

Background: A higher-order representation of the ventricular electrogram (EGM) allows the capture of depolarization and repolarization phenomena using a limited number of coefficients. Methods: New Zealand White rabbits underwent chronic implantation of pacemakers through a left thoracotomy approach. Unipolar ventricular EGMs sampled at a frequency of 1 kHz were stored digitally in one-minute segments before and after intravenous injection of isoproterenol or procainamide. Each cardiac cycle was modeled in such a way that faithfully captured the morphology of the raw EGM (norm of residuals ~ 1.0). Results: The 14 coefficients of each cardiac cycle were stable and reproducible throughout the baseline recordings (r ┬Ií* 0.94, p < 0.002). Isoproterenol significantly altered 6 of the 14 coefficients of the EGM model (p-values<=0.0086). Procainamide caused statistically significant changes in 9 of the 14 coefficients (p-values<=0.036). Conclusion: Our data demonstrate the feasibility of a 14 coefficient model that reproduces the mammalian ventricular EGM. This model is stable, reproducible, and can predict the changes expected with anti-arrhythmic drug administration. If reproduced in humans, these findings can have wide applications in patients with implantable devices, ranging from morphologic discrimination of arrhythmias to early detection of metabolic derangements or drug effects.

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