Phase-2 re-entry

Dr. Andrés R. Pérez Riera

Phase-2 re-entry is thought to underlie many causes of idiopathic ventricular arrhythmias as, for instance, those occurring in Brugada syndrome (BrS). J-point elevation, ST-elevation, and T-wave changes documented in the last sinus beat prior to ventricular extrasystoles are in agreement with phase 2 reentry, suggesting that this may be the responsible mechanism for ventricular extrasystoles and ventricular tachycardia/fibrillation. The reported pathogenesis of BrS is phase-2 reentry resulting from shorteningof the epicardial AP duration at the right ventricular outflow tract (RVOT) (**Ohkubo 2010**). Studies in an isolated canine RVOT model of BrS demonstrated that reversal of the transmural gradient of repolarization caused the ECG characteristics and that major intraepicardial and transmural dispersion of APs initiated phase 2 reentry, PVCs, and tachyarrhythmias (**Morita 2009**). In BrS patients, ST-segment elevation is modulated by cardiac sodium (I(Na)), transient outward (I(to)) and L-type calcium currents (I(CaL)). ST-segment elevation in Brugada patients, is modulated by I(to) and I(CaL) (**Hoogendijk 2011**). PVC falling after the end of the T wave triggered VF at night and monomorphic ventricular tachycardia (MVT) during daytime. While I(to) dispersion is necessary for phase-2 reentry, altered sodium inactivation kinetics influences the probability of reexcitation in a highly nonlinear fashion (**Cantalapiedra 2009**).

References

1. Ohkubo K, Watanabe I, Okumura Y, et al.Right ventricular histological substrate and conduction delay in patients with Brugada syndrome. Int Heart J. 2010 Jan; 51:17-23.

2. Morita H, Zipes DP, Wu J. Brugada syndrome: insights of ST elevation, arrhythmogenicity, and risk stratification from experimental observations. Heart Rhythm. 2009 Nov; 6 (11 Suppl):S34-43.

3. Hoogendijk MG, Potse M, Vinet A, et al. ST-Segment Elevation by Current-to-Load Mismatch: an Experimental and Computational Study. Heart Rhythm.2011 Jan;8(1):111-8.

4. Cantalapiedra IR, Peñaranda A, Mont L, et al. Reexcitation mechanisms in epicardial tissue: role of I(to) density heterogeneities and I(Na) inactivation kinetics. J Theor Biol. 2009 Aug 21;259:850-859.