Electrophysiological Determinants of Inducibility of Ventricular Tachyarrhythmias in Experimental Diabetes Mellitus of Different Duration

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Introduction

Diabetes mellitus (DM) increases the risk of ventricular arrhythmias and sudden cardiac death in patients with coronary artery disease. However, experimental studies often yield inconsistent results concerning arrhythmic outcomes in DM. Moreover, some studies reported that DM confers antiarrhythmic protection. We hypothesized that the duration of experimental diabetic conditions might be crucial in the DM-related arrhythmogenesis and evaluated myocardial electrical remodeling and susceptibility to ventricular tachyarrhythmias in rabbits with DM of different duration in the experimental ischemia/reperfusion model.

Methods

Ventricular epicardial contact potential 64-lead mapping and arrhythmia susceptibility burst-pacing testing were performed in 43 healthy and 55 diabetic (alloxan model) anesthetized rabbits undergoing 15-min left anterior descending coronary artery occlusion, followed by 15-min reperfusion. DM duration was from 28 to 76 days (median 42 days, interquartile range (IQR) 36-54 days).

Results

During ischemia, arrhythmia inducibility did not differ between the groups (14 out of 55 vs 7 out of 43 in the DM and control groups, respectively, p=0.272), but the number of reperfusion ventricular tachycardias and/or fibrillations (VT/VFs) was higher in the DM group (14 out of 55) as compared to control (3 out of 43, p=0.017). In the diabetic animals, the DM duration was an independent predictor of reperfusion VT/VF in logistic regression analysis adjusted for glucose concentration (OR 1.060; 95% CI 1.006-1.117; p = 0.029). We compared electrophysiological parameters before ischemia in the control group, and groups with short and prolonged DM (cut-point 42 days of DM). The groups did not differ in dispersion of repolarization, time of epicardial breakthrough, duration of epicardial and total ventricular activation. Only duration of activation-repolarization intervals (ARIs) differed between the groups being increased in the prolonged DM group (fig.1)

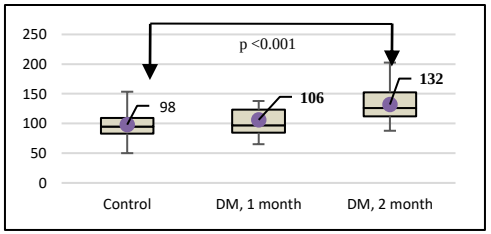

Fig.1. Comparison of ARI average of groups.

Among mapping parameters, DM duration was associated with the prolongation of total ventricular activation duration (B 0.152; 95% CI 0.049-0.255; p=0.005) and activation-repolarization intervals (ARIs) (B 0.900; 95% CI 0.315-1.484; p=0.003). The prolonged ARI was the only mapping characteristic predicting reperfusion VT/VF development (OR 1.028; 95% CI 1.009-1.048; p = 0.004).

Conclusion

Prolongation of alloxan DM leads to the progressive lengthening of repolarization and increase in the reperfusion VT/VF inducibility.