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Assessing Arrhythmia Risk in Diabetic and Ischemic-preconditioned Rat Hearts

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Diabetes has previously been shown to impair intercellular electrical coupling resulting in increased risk of arrhythmia. Diabetic tissue also relies on fatty acid as the main substrate for metabolism; as a result, many cardioprotective signals associated with arachidonic acid metabolites are activated. The purpose of this study is to understand the extent of protection against arrhythmia that Streptozotocin (STZ) induced diabetes and ischemic-preconditioning (IPC) on Sprague-Dawley rat hearts subjected to ischemia-reperfusion injury.

Hearts were extracted and perfused using the langendorff method with aerated Krebs Henseleit solution. ECG recordings were recoded as the hearts were subjected to 35 minute baseline, 30 minute of no flow (ischemia) followed by 1 hour of reperfusion. The four groups investigated were vehicle control, Streptozotocin (STZ) induced diabetic rats (65mg/kg STZ), ischemic preconditioned hearts (IPC) that were subjected to two 3 minute ischemic intervals followed by 5 and 10 minute reperfusion intervals respectively), and finally diabetic hearts that underwent ischemic preconditioning (STZ+IPC).

The time elapsed during ischemia until all ventricular activation stops for control hearts is 7.1±0.8 minutes, while STZ, IPC, and IPC + STZ are 15.5± 3.7, 8.6± 0.9 and 9.9± 1.6 minutes respectively. The STZ group was significantly different from the control group. When the time spent by each heart in the normal sinus rhythm state was analyzed during the 60-minute reperfusion period, control animals maintained normal rhythm for 20.9±9 minutes while STZ, IPC, and IPC + STZ maintained 29.6± 12.4, 31.7± 10.2, and 40.94+ 9.6 minutes respectively.
Furthermore, the time spent in ventricular fibrillation (VF) was analyzed, and the IPC+STZ group spent 0.24± 0.2 minutes while control hearts spent 11.28± 9.2 minutes in VF. The data suggests a trend of improved arrhythmia protection when treated with STZ, IPC, or both. The IPC+STZ group is potentially displaying an additive cardioprotective effect.

References

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