Acute treatment with metformin improves cardiac function following isoproterenol induced myocardial infarction in rats

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Abstract:
Background: It has been proposed that metformin exerts protective effects on ischemic hearts. In the present study, we evaluated the effects of metformin on cardiac function, hemodynamic parameters, and histopathological changes in isoproterenol-induced myocardial infarction (MI).
Methods: Male Wistar rats were divided into six groups (n = 6) of control, isoproterenol (100 mg/kg; MI), metformin alone (100 mg/kg; sham), and metformin (25, 50, 100 mg/kg) with isoproterenol. Subsequently, isoproterenol was injected subcutaneously for two consecutive days and metformin was administered orally twice daily for the same period.
Results: Isoproterenol elevated ST-segment and suppressed R-amplitude on ECG. All doses of metformin were found to significantly ameliorate the ECG pattern. Isoproterenol also caused an intensive myocardial necrosis along with a profound decrease in arterial pressure indices, left ventricular contractility (LVdP/dt max) and relaxation (LVdP/dt end), and an increase in left ventricular end-diastolic pressure (LVEDP). Histopathological analysis showed a marked attenuation of myocyte necrosis in all metformin treated groups (p < 0.001). Metformin at 50 mg/kg strongly (p < 0.01) increased LVdP/dt max from 2988 ± 439 (mmHg/s) in the MI group to 4699 ± 332 (mmHg/s). Similarly, treatment with 50 mg/kg of metformin lowered the elevated LVEDP from 27 ± 8 mmHg in the myocardial infarcted rats to a normal value of 5 ± 1.4 (mmHg; p < 0.01) and the heart to body weight ratio as an index of myocardial edematous from 4.14 ± 0.13 to 3.75 ± 0.08 (p < 0.05).
Conclusion: The results of this study demonstrated that a short-term administration of metformin strongly protected the myocardium against isoproterenol-induced infarction, and thereby suggest that patients suffering from myocardial ischemia could benefit from treatment with metformin.

Key words: metformin, myocardial infarction, electrocardiography, isoproterenol