1. INTRODUCTION

Taurine attenuates oxidative damage to DNA (Messina and Dawson, 2000). Taurine increases the expression of mitochondria-stabilizing anti-apoptotic Bcl-2 protein while decreasing that of the pro-apoptotic Bax protein and p53 the apoptosis initiator gene (Takahashi et al., 2003), rendering cultured rat cardiomyocytes resistant to hypoxia-induced injury. However, it is not clear whether aerobic or anaerobic mechanisms mediate those anti-apoptotic effects. The hypothesis that taurine preserves aerobic energy and enzyme activities and therefore provides a better function of myocardium subjected to ischemia/reperfusion was now tested in two groups of isolated rat hearts (a) in normothermic ischemia induced while beating, and (b) when high-"K"-depolarized and cold-preserved for 6 hours.

2. MATERIAL AND METHODS

We used adult male Sprague-Dawley rats (350-450 g body weight). All animals received humane care consistent with the “Principles of Laboratory Animal Care” formulated by the National Society for Medical Research and the “Guide for the Care and Use of Laboratory Animals” prepared by the Institute of Laboratory Animal Resources and published by the National Institute of Health. The rats were anesthetized with diethylether inhalation supplemented with intraperitoneal sodium pentobarbital (50 mg/kg).

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2.1. Heart Isolation and Perfusion

2.1.1. Thirty-Minute Ischemia (37.5°C) Group

Following laparotomy, heparin (1000 IU/kg) was injected into the inferior vena cava. The heart was exposed via median sternotomy. In the 30-min ischemia (37.5°C) group (A) the hearts were rapidly excised, weighed, and mounted on a non-recirculating Langendorff apparatus. Krebs-Henseleit buffer \([\text{KHB without or with 10 mmol/l taurine (Sigma-WAKO, Tokyo, Japan) KHB+T}]\) was perfused by gravity at a constant pressure of 100 mmHg at 37.5°C. KHB composition was \(\text{NaCl 118 mM, KCl 4.7 mM, MgSO}_4 1.2 \text{ mM, NaHCO}_3 25 \text{ mM, KH}_2\text{PO}_4 1.2 \text{ mM, CaCl}_2 2.5 \text{ mM, and glucose 11 mM, pH 7.4, gassed with a mixture of 95% oxygen and 5% carbon dioxide. After 20-min perfusion stabilization, ischemia was induced while the hearts were beating and maintained for 30 min at ambient temperature.}

2.1.2. Six-Hour Hypothermic Preservation Group

The hearts were arrested with an aorta injection of (20 ml/kg) of plain 4°C Saint Thomas Hospital Solution [(Group B) STS, \(n=8\)] or containing 10 mmol/l taurine (T) [(Group B) STS+T, \(n=8\)], excised, and immediately submerged at 4°C in 40 ml of plain STS or STS containing 10 mmol/l T for 6 hours. The composition of STS was \(\text{NaCl 110 mM, KCl 16 mM, MgCl}_2 16 \text{ mM, CaCl}_2 1.2 \text{ mM, and NaHCO}_3 10 \text{ mM).}

The hearts in both groups were re-perfused for 20 min on the Langendorff apparatus with plain KHB at 37.5°C and weighed. The pre-ischemic normothermic hearts served as control for the 6-h preservation hearts, \textit{in lieu} of their own pre-arrest data.

2.2. Evaluation of Left Ventricular Function

2.2.1a. Ventricular Pressure. A latex balloon was inserted into the LV cavity through the left atrium. Its end-diastolic pressure was set at 8 mmHg and connected to a pressure transducer for left ventricular pressure (LVP) measurements. Heart rate (HR), LV developed P (LVDP), and the positive maximum rate of P rise (LVP dp/dt, mmHg/s) were recorded at 5 and 20 min of reperfusion in all hearts. In the 30-min ischemic hearts pre-ischemia data were also obtained.

2.2.1b. Coronary Flow. The coronary effluent was collected for one minute. The coronary effluent collected as soon as re-perfused (time 0) was assumed to contain whatever was released during ischemia. The coronary flow index or coronary flow/g heart weight/min (CFi=ml/gHW/min) was calculated using the pre-arrest weight for the pre-arrest, 0-, and 5-min groups to CFi, and the post-20-min reperfusion weight for 20-min CFi.

2.3. Biochemical Analyses

The following components were analyzed in the collected effluents: (a) The energy metabolites pyruvic (PA) and lactic acids (LA) were measured (mg/dl), converted to efflux index (mg/gHW/min) using the proper CFi, and the ratio (LAi/PAi) was calculated. (b) The vital enzymes glutamate oxaloacetate transaminase (GOT), glutamate pyruvate transaminase (GPT), creatine phosphate kinase (CPK), creatine kinase myocardial