Effects of Different Proportions of Salvianolic Acid and Hydroxysafflor Yellow A on the Myocardial Ischemia Model Induced by Pituitrin in Rats

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In this experiment, SD rats were injected intravenously with different proportions of test samples to observe the protective effect of intravenous injection of pituitrin (PIT) that induced myocardial ischemia in rats, and to determine the lipid peroxidation product of Malondialdehyde (MDA) in rat brain and the content and activity of Superoxide Dismutase (SOD), Creatine Kinase (CK) and Lactate Dehydrogenase(LDH). The role of the anti–myocardial ischemia model in the test and its optimal ratio were studied. Each group of test samples was injected through the tail vein and the II lead ECG was traced. After injection for 30 min, the rats were sublingually injected with 2U/kg pituitrin, and II lead ECG was recorded for 5 min. After 3 hours’ observation, the rats were sacrificed from the cervical spine, and the hearts were removed and placed in a refrigerator at –20 °C to measure various biochemical indicators. Intravenous injection of each group of tested products has the effect of reducing the content of MDA, LDH, and CK in myocardial tissue, which can enhance the activity of SOD in myocardial tissue, and has statistical significance compared with the model group (P≤0.05 or P≤0.01). Through comprehensive comparison, the A:B=1:10 dose group was found to have the best results.

Keywords: Salvianolic Acid; Hydroxysafflor Yellow A; Myocardial ischemia; Rats

Abbreviation: PIT, pituitrin; MDA, Malondialdehyde; SOD, Superoxide Dismutase; CK, Creatine Kinase; LDH, Lactate Dehydrogenase.

INTRODUCTION

Myocardial ischemia refers to a decrease in blood perfusion of the heart, resulting in decreased oxygen supply to the heart, abnormal myocardial energy metabolism, and a pathological condition that cannot support the normal work of the heart (Xu Bohua, et al., 2011). Ischemic cardiomyopathy is a public health concern with a rising incidence that results in high morbidity and mortality worldwide (Yellon DM, et al., 2007). Despite optimal treatment, ischemic heart disease – is the leading cause of death worldwide (Forouzanfar MH et al., 2010), and the second leading cause of cardiovascular death in China (Zhang XH, et al., 2007). Recently, constituents from natural herbs have attracted attention with regard to pharmaceutical development.

The mechanism of myocardial ischemia-reperfusion injury (MIRI) is mainly related to the massive production of reactive oxygen species (ROS), intracellular calcium overloading, the release of inflammatory mediators, and dyspoiesis of energy rich phosphate compounds (Wei Wei et al., 2007).

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Studies have shown that myocardial ischemia reperfusion produces large amounts of ROS through enzymatic and non-enzymatic systems. ROS mainly includes oxygen radicals (OFR) and the like. Low levels of ROS can usually be degraded by some antioxidant enzymes or substances. If high levels of ROS are accumulated in the cells, it will cause oxidative stress (Christophe Fleury et al., 2002). Accumulation of ROS in cells through oxidation of proteins and lipids not only make them lose Function and promote the formation of lipofuscin to affect lysosomal activity and cause cell death (Yorimitsu T et al., 2007). Therefore, the balance of production and degradation of ROS is a guarantee of the normal physiological functions of cells. SOD is a naturally occurring OFR scavenger in the myocardium and is an important antioxidant enzyme. Therefore, the activity of SOD can reflect the ability of the body's ability to scavenge OFR. This shows that SOD plays a role in protecting ischemic myocardium during myocardial ischemia reperfusion, and the change of SOD is related to the severe degree of ill. As the most important lipid peroxidation metabolites in cells, MDA can promote the cross-linking of proteins and lipids in cardiac muscle cells, resulting in mutation, aging or death of myocardial cell and cell membrane degeneration (Sima A et al., 1999). Severe and extensive myocardial damage leads to severe cell metabolic disorders. The increased production of free radicals increases the metabolic products of lipid peroxidation metabolites. And the content of MDA in blood gradually increases as the injury response worsens. Therefore, the level of MDA in the serum can directly reflect the degree of myocardial lipid peroxidation, and indirectly reflect the activity of oxygen free radicals, in order to understand the degree of oxidative damage of myocardial cells during ischemia-reperfusion (Bayram E et al., 2004).

In traditional Chinese medicine (TCM), a number of herbs are paired together in order to attenuate toxicity, as well as to enhance the therapeutic effects (Wang L et al., 2008). Radix Salvia miltiorrhiza (S. miltiorrhiza) and Carthamus tinctorius L. (C. tinctorius; also known as Flos Carthami) are usually used as a combination herbal formulation, known as Danhong injection, which can relieve the symptoms of angina pectoris, attenuate myocardial ischemia and promotes atherosclerotic plaque regression (Li SJ et al., 2013). The Traditional Chinese Medicine S. miltiorrhiza is widely used in the treatment of coronary artery disease and cerebrovascular diseases and as a remedy to improve microcirculation (Li Cheng TO et al., 2007, Han JY et al., 2007). Salvianolic acid is an important active ingredient of S. miltiorrhiza Bunge. Pharmacological experiments show that salvianolic acid compounds have strong anti-oxidation effect and can eliminate superoxide anion and hydroxyl radicals and inhibit lipid peroxidation so as to have a protective effect on myocardial and brain cell damage induced by ischemia–reperfusion (Lai Yujuan et al., 2011). Carthamus tinctorius L. is a traditional Chinese medicine that promotes blood circulation. The main pharmacological components of safflower are glycosides and safflower yellow pigments. Safflower yellow clinically has the effect of dispelling stasis and relieving pain, lowering cholesterol, lowering blood pressure, and is easily soluble in water (Cai Guang et al., 2003). In 1993, Meselhy et al. (MESELHY MR et al., 1993) isolated hydroxysafflor yellow A from Carthamus tinctorius L., which is the main effective ingredient of safflower yellow to activate blood circulation and it is the most effective water-soluble ingredient in the pharmacological efficacy of medicinal safflower. Hydroxysafflor yellow A can exert its anti-ischemic effect by improving hemorheology and coagulation function.

In this experiment, SD rats were injected intravenously with different proportions of salvianolic acid and hydroxysafflor yellow A to observe the protective effect of intravenous injection of pituitrin (PIT) on myocardial ischemia in animal models, and to study the optimal ratio of salvianolic acid and hydroxysafflor yellow A in the treatment of myocardial ischemic diseases.

MATERIALS AND METHODS

Test samples

Name: Salvianolic acid (A: 60.23 %; light brown powder), hydroxysafflor yellow A (B: 94.85 %; yellow loose powder).

Storage conditions: 4 °C refrigerator cold storage.

Providers: SHAANXI YUANBANG BIO-TECH CO., LTD.

Positive control: Danhong injection (light brown liquid; refrigerator at 4 °C; provided by Shanxi Buchang Pharmaceutical Group).

Solvent: Normal saline injection.

Preparation of the test sample: Accurately weigh a certain amount of the test articles A and B and add the normal saline to the required concentration in different proportions.

Experimental animals

Strains: SD rats used in this experiment were SPF–grade animals. A total of 80 SD rats were used in the experiment. They were half male and female, weighing between 180 and 200g. Animals were sourced from Beijing Vital River Laboratory Animal Technology Co., Ltd. (License No.: SCXK (Beijing) 2014–0001). All animals were handled according to the Principles for Care and Use of Experimental Animals from Hebei University and approved by the institutional committee on animal care. All animals were maintained under standard environmental conditions.
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(23±2°C, 55±5% humidity and 12h/12h light/dark cycle). All animals were allowed free access to tap water and standard laboratory rat food. Euthanasia method: the experimental animals were injected with 3 times dose of sodium pentobarbiturate for 30 mg, and the subsequent experiment was carried out after the death was confirmed.

**Animal identification and grouping methods:** Animals are marked with picric acid. Animals were weighed after the quarantine period and grouped according to the animal's body weight by stratified randomized grouping. And animals were divided into normal saline group, model group, positive control group, A:B (10:10) group, A:B (8:10) group, A:B (6:10) group, A:B (4:10) group, A:B (2:10) group, A:B (1:10) group, A:B (1:20) group, a total of 10 groups, six in each group, half male and female.

**EXPERIMENTAL DESIGN**

**Experimental design basis**

Adoption of standards: The experimental design was conducted in accordance with the Guidelines for the Study of New Drugs of Traditional Chinese Medicines – Pharmaceutical Pharmacology Toxicology issued by the State Food and Drug Administration.

Pre–experimental research data: The effective amount of myocardium ischemia induced by pituitary ligone in this batch was 2 U/kg (Concentration: 2 U/mL, Providers: Nanjing Xinbai Pharmaceutical Co., Ltd., batch number: 120204, specification: 1 mL: 6 U).

**Dosage and grouping:**

<table>
<thead>
<tr>
<th>Group</th>
<th>A:B (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline group</td>
<td>0</td>
</tr>
<tr>
<td>Model group</td>
<td>0</td>
</tr>
<tr>
<td>Positive control group</td>
<td>100</td>
</tr>
<tr>
<td>A:B 10:10</td>
<td>50 mgA+50 mgB</td>
</tr>
<tr>
<td>A:B 8:10</td>
<td>44.45 mgA+55.56 mgB</td>
</tr>
<tr>
<td>A:B 6:10</td>
<td>37.5 mgA+62.5 mgB</td>
</tr>
<tr>
<td>A:B 4:10</td>
<td>28.57 mgA+71.43 mgB</td>
</tr>
<tr>
<td>A:B 2:10</td>
<td>16.67 mgA+83.33 mgB</td>
</tr>
<tr>
<td>A:B 1:10</td>
<td>9 mgA+91 mgB</td>
</tr>
<tr>
<td>A:B 1:20</td>
<td>4.76 mgA+95.24 mgB</td>
</tr>
</tbody>
</table>

**Experimental Methods**

1. SD rats were injected sublingually with 2U/kg pituitrin (concentration:1U/mL). The BIOCAP MP150 multi–channel physiological recording instrument (BIOCAP Corporation) was used to observe the II lead electrocardiogram changes, and pituitrin sensitive rats were selected for experiment. (The T–wave is high, exceeding the R–wave 1/2 of the lead; the ST elevation of the lead> 0.1 mv; the ST shift of the lead> 0.1 mv; the T–wave is accompanied by ST segment shift; the R–wave amplitude is reduced; T wave inversion).

2. The experimental rats, half male and female, were randomly divided into normal saline group, model group, positive control group and administration group (7 groups).

3. Each group was intravenously injected 30 minutes in advance and administered at a dose of 1.0 mL/100 g.bw once. Then the animals were anesthetized with urethane (1 g/kg) in a 10 % mass fraction and fixed in a supine position on a rat stern and connected to a multi–channel physiological recorder. The II lead electrocardiogram was traced and given 30 minutes later. Pituitary chlorophyll 2 U/kg was injected into the sublingual vein of the rat and injection was completed within 5 s. The II lead electrocardiogram was traced for 5 min.

4. After 3 hours observation, the rats were sacrificed from the cervical spine, the heart was removed by thoracotomy, and frozen at −20°C.

5. Homogenate the heart into 10% myocardial tissue homogenates. And measure the content of MDA and the activity of SOD and CK and LDH in the myocardial tissue. The measurement method is carried out according to the reagent box.

**Test items:** Malondialdehyde (MDA), Superoxide Dismutase (SOD), Lactate Dehydrogenase (LDH), Creatine Kinase(CK), reagents provided by Nanjing Jiancheng Biological Engineering Institute, the batch numbers were 20111216, 20111217, 20120423, and 20120423 respectively, and were measured by using a KC–junior type microplate reader from Bio TEK, USA.

**Statistical analysis**

Data were presented as mean±standard deviation (S.D.). One–way ANOVA was used to compare means in SPSS 19.0. p < 0.05 was considered significantly.

**RESULTS**

**Effect on MDA Content of Rats with Myocardial Ischemia**

The MDA content in the myocardial ischemia model group was higher than that in the normal saline control group. The intravenous injection of the tested products in each group had the effect of reducing the MDA content in the myocardial tissue and had a good dose–effect
The effect of inhibiting MDA production increased with the increase of B content, and there was a significant difference between each dose group and the model group (P ≤ 0.01).

**Effect on SOD Activity of Myocardial Ischemia Rats**

The activity of SOD in myocardial ischemia model group was significantly lower than that in saline control group. Intravenous injection of the test article could enhance SOD activity in myocardium, except that the A/B=1/10 dose group had larger sample standard deviation, the remaining groups were statistically significant compared with the model group (P ≤ 0.05 or P ≤ 0.01), but the dose–effect relationship was not significant.

**Effect on LDH Levels of Rats with Myocardial Ischemia**

DH levels in the myocardial ischemia model group were significantly higher than those in the normal saline control group. Intravenous injection of the test article significantly decreased the LDH level in the myocardium. There was a statistically significant difference between the model group and the model group (P ≤ 0.05 or P ≤ 0.01). And it has a certain dose–effect relationship.

**Effect on CK Activity of Myocardial Ischemia Rats**

The CK level in the myocardial ischemia model group was significantly higher than that in the normal saline control group. Intravenous injection of the test article could reduce the myocardial CK content, and there was a statistically significant difference compared with the model group (P ≤ 0.05 or P ≤ 0.01).

**Effect on rats’ cardiac electrocardiogram change rate of ST and ST**

Compared with the normal control group, the change of ST segment value and change rate at 1–3 min after injection of Pit in the model group rats was significant (P ≤ 0.05 or P ≤ 0.01), indicating that the Pit replication myocardial ischemia model was successful. The test sample can significantly reduce the ST segment of myocardial ischemia induced by Pit. Compared with the model group, the difference is significant (P ≤ 0.05 or P ≤ 0.01).

**DISCUSSION**

In the reperfusion, of myocardial ischemia oxidative stress and lipid peroxidation caused by a large number of OFR are one of the factors causing myocardial cell damage. SOD can scavenge OFR and protect cells from OFR damage; MDA content can reflect the degree of lipid peroxidation and indirectly reflect cell damage. Antioxidative stress can inhibit the lipid peroxidation in vivo, and protect MIRI (Weyrich et al. 1992).

Traditional Chinese medicinal herbs and their ingredients have been widely used as important therapeutic agents in China since ancient times. In clinical practice, they are commonly prescribed in combination to solve the complexity of a disease (Ma X et al., 2009). For example, they were used to the treatment of myocardial ischemia. In traditional Chinese medicine theory, *S. miltiorrhiza* and *Carthamus tinctorius* L. are commonly used to promote blood circulation and improve myocardial ischemic symptoms.

Salvianolic acids are the most abundant water–soluble compounds extracted from Radix *S. miltiorrhiza*. In China, *S. miltiorrhiza* has been wildly used to treat cardiovascular diseases for hundreds of years. Salvianolic acids, especially salvianolic acid A (Sal A) and salvianolic acid B (Sal B), have been found to have potent anti–oxidative capabilities due to their polyphenolic structure. Recently, intracellular signalling pathways regulated by salvianolic acids in vascular endothelial cells, aortic smooth muscle cells, as well as cardiomyocytes, have been investigated both in vitro and in vivo upon various cardiovascular insults. It is discovered that the cardiovascular protection of salvianolic acids is not only because salvianolic acids act as reactive oxygen species scavengers, but also due to the reduction of leukocyte–endothelial adherence, inhibition of inflammation and metalloproteinases expression from aortic smooth muscle cells, and indirect regulation of immune function. Competitive binding of salvianolic acids to target proteins to interrupt protein–protein interactions has also been found to be a mechanism of cardiovascular protection by salvianolic acids (Ho JH et al., 2011). The modern pharmacological effects of salvianolic acid mainly include the ability to significantly dilate coronary arteries, increase coronary blood flow, inhibit myocardial contractility, reduce myocardial consumption of oxygen, effectively improve brain microcirculation and anti–cerebral ischemia. It is also proved that salvianolic acid is the main active ingredient of *S. miltiorrhiza* for removing blood stasis and invigorating the circulation of blood in modern pharmacological research (Fu Xu et al., 2013, Feng Fan et al. 2013). In experimental myocardial infarction in rat, Jiang et al reported that administration of salvianolic acids significantly decreased infarct size, improved left ventricular function and decreased myocardial malondialdehyde levels compared with the control group. The cardio protection of salvianolic acids against infarct–induced left ventricle remodelling was significantly contributed by the down–regulation of MMP–9 mRNA expression level and its activity at the infarct area (Jiang B et al., 2009).

The cardioprotective effects of Hydroxysafflor Yellow A in
myocardial ischemia operate partially through reducing oxidative stress induced damage and apoptosis. The protection is achieved by scavenging of ROS and mediating the PI3K signalling pathway (Han SY et al., 2009). Hydroxysafflor yellow A has protective effects on myocardial ischemia and reperfusion injury in rats, and its protective mechanism is similar to that of myocardial ischemic preconditioning. Hydroxysafflor yellow A can significantly reduce the myocardial infarct size in ischemic rats and significantly reduce lactate dehydrogenase (LDH) and produce serum creatine kinase MB type (CK–MB). Hydroxysafflor yellow can reduce the occurrence of blood viscosity and platelet aggregation in rats that have developed myocardial ischemia. Zhang Jianjun et al measured the expression level of Eg in serum by establishing rat ischemic preconditioning model and myocardial ischemia and reperfusion injury model. It was concluded that the group of hydroxysafflor yellow A was significantly decreased in the ischemic reperfusion injury group compared with the myocardial infarction area of the treatment group.

Salvianolic acid and hydroxysafflor yellow A are one of the few important Chinese medicine injections. They have a wide range of pharmacological effects and have good medicinal potential. Currently, they are emerging drug with promising prospects. And they have been widely recognized and valued by the medical community at home and abroad. Therefore, the best ratio for treating myocardial ischemic diseases is studied and applied to myocardial ischemic diseases to better serve humans. It provides a theoretical basis for clinical safety and reasonable use of traditional Chinese medicine.

In this study, we selected rats that were sensitive to pituitrin and successfully built a rat model of myocardial ischemia. Based on this model, we studied the different ratios of salvianolic acid and safflower yellow A in myocardial ischemia. In the treatment of rat model, under the experimental conditions, we observed that the levels of MDA, LDH, and CK in the model group were significantly higher than those in the saline control group, and the activity of SOD decreased significantly. Intravenous injection of each group's tested products has the effect of reducing the content of MDA, LDH, and CK in myocardial tissue, which can enhance the activity of SOD in myocardial tissue, and has statistical significance compared with the model group (P<0.05 or P<0.01). However, among the different ratios of salvianolic acid and safflower yellow A, the A:B=1:10 dose group had the best effect.

CONCLUSIONS

Under the experimental conditions, the tested products can significantly reduce the levels of MDA, LDH, and CK in the myocardial tissue of ischemic rats, and increase the activity of SOD. The effect of the test products has the tendency to enhance with the increase of B components and has a certain dose–effect relationship. Through comprehensive comparison, the A:B=1:10 dose group had the best results.

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We had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

REFERENCES

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APPENDIX

TABLE

Table 2: Effect of PIT on myocardial ischemia, MDA, SOD, LDH, and CPK in rats (\(\bar{x} \pm s, \ n=6\))

<table>
<thead>
<tr>
<th>Group</th>
<th>MDA (nmol/mgprot)</th>
<th>SOD (U/mgprot)</th>
<th>LDH (U/gprot)</th>
<th>CK (U/mgprot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal saline</td>
<td>20.92±5.089</td>
<td>48.59±6.415</td>
<td>193.08±17.55</td>
<td>1.82±0.303</td>
</tr>
<tr>
<td>Models</td>
<td>26.32±1.491(^a)</td>
<td>30.83±4.722(^aa)</td>
<td>264.61±208.73(^aa)</td>
<td>2.42±0.134(^aa)</td>
</tr>
<tr>
<td>Positive</td>
<td>19.82±3.209(^bb)</td>
<td>37.09±4.83(^ab)</td>
<td>189.89±91.96(^bb)</td>
<td>2.01±0.203(^bb)</td>
</tr>
<tr>
<td>A:B 10:10</td>
<td>20.13±4.531(^bb)</td>
<td>34.87±3.57(^ab)</td>
<td>205.5±134.34(^bb)</td>
<td>2.01±0.398(^bb)</td>
</tr>
<tr>
<td>A:B 8:10</td>
<td>20.17±3.989(^ab)</td>
<td>38.10±6.01(^ab)</td>
<td>203.7±300.16(^bb)</td>
<td>2.00±0.228(^bb)</td>
</tr>
<tr>
<td>A:B 6:10</td>
<td>19.45±2.967(^bb)</td>
<td>38.64±5.76(^bb)</td>
<td>216.85±314.96(^bb)</td>
<td>2.00±0.124(^bb)</td>
</tr>
<tr>
<td>A:B 4:10</td>
<td>19.02±4.528(^bb)</td>
<td>41.30±9.56(^bb)</td>
<td>209.01±377.37(^bb)</td>
<td>1.96±0.259(^bb)</td>
</tr>
<tr>
<td>A:B 2:10</td>
<td>19.07±4.560(^bb)</td>
<td>38.60±7.20(^bb)</td>
<td>187.11±308.92(^bb)</td>
<td>2.00±0.416(^bb)</td>
</tr>
<tr>
<td>A:B 1:10</td>
<td>17.92±1.201(^bb)</td>
<td>39.84±10.20(^bb)</td>
<td>185.17±210.92(^bb)</td>
<td>1.86±0.165(^bb)</td>
</tr>
<tr>
<td>A:B 1:20</td>
<td>17.67±2.977(^bb)</td>
<td>42.44±9.88(^bb)</td>
<td>198.11±369.79(^bb)</td>
<td>1.96±0.244(^bb)</td>
</tr>
</tbody>
</table>

Note: Compared with the saline group: \(^aP≤0.05\), \(^aaP≤0.01\); Compared with the model group: \(^bbP≤0.05\), \(^bP≤0.01\).

Table 3: Effect of ST—variation on myocardial ischemia in rats (\(\bar{x} \pm s, \ n=6\))

<table>
<thead>
<tr>
<th>Group</th>
<th>Dose mg/kg</th>
<th>ST change (mv)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>10s 1min 2min 3min 4min 5min</td>
</tr>
<tr>
<td>Normal saline</td>
<td>—</td>
<td>0.025±0.024 0.043±0.026 0.026±0.020 0.025±0.030 0.038±0.023</td>
</tr>
<tr>
<td>Models</td>
<td>100</td>
<td>0.056±0.037 0.086±0.044 0.118±0.014 0.093±0.038 0.071±0.029</td>
</tr>
<tr>
<td>Positive</td>
<td>100</td>
<td>0.033±0.036 0.022±0.044 0.014±0.034 0.024±0.023 0.055±0.036</td>
</tr>
<tr>
<td>A:B 10:10</td>
<td>100</td>
<td>0.038±0.038 0.050±0.047 0.079±0.052 0.047±0.067</td>
</tr>
<tr>
<td>A:B 8:10</td>
<td>100</td>
<td>0.060±0.046 0.059±0.057 0.073±0.061 0.077±0.056</td>
</tr>
<tr>
<td>A:B 6:10</td>
<td>100</td>
<td>0.035±0.062 0.035±0.059 0.030±0.040 0.030±0.057</td>
</tr>
<tr>
<td>A:B 4:10</td>
<td>100</td>
<td>0.035±0.062 0.025±0.059 0.035±0.048 0.025±0.040</td>
</tr>
<tr>
<td>A:B 2:10</td>
<td>100</td>
<td>0.051±0.059 0.038±0.048 0.048±0.043 0.048±0.058</td>
</tr>
<tr>
<td>A:B 1:10</td>
<td>100</td>
<td>0.047±0.047 0.038±0.015 0.015±0.056 0.022±0.026</td>
</tr>
<tr>
<td>A:B 1:20</td>
<td>100</td>
<td>0.041±0.041 0.026±0.047 0.026±0.021 0.026±0.004</td>
</tr>
</tbody>
</table>

Note: Compared with the saline group: \(^aP≤0.05\), \(^aaP≤0.01\); Compared with the model group: \(^bbP≤0.05\), \(^bP≤0.01\).
Table 4: Effect of ST-rate change on myocardial ischemia in rats (x±s, n=6)

<table>
<thead>
<tr>
<th>Group</th>
<th>Dose (mg/kg)</th>
<th>ST-rate of change</th>
<th>Normal</th>
<th>10s</th>
<th>1min</th>
<th>2min</th>
<th>3min</th>
<th>4min</th>
<th>5min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal saline</td>
<td>0</td>
<td></td>
<td>11.39</td>
<td>19.47</td>
<td>12.85</td>
<td>11.48</td>
<td>18.65</td>
<td>21.68</td>
<td></td>
</tr>
<tr>
<td>Models</td>
<td>100</td>
<td></td>
<td>±9.69</td>
<td>±9.43</td>
<td>±13.39</td>
<td>±7.91</td>
<td>±13.85</td>
<td>±9.95</td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>100</td>
<td></td>
<td>21.98</td>
<td>35.10</td>
<td>48.04</td>
<td>37.64</td>
<td>27.69</td>
<td>17.31</td>
<td></td>
</tr>
<tr>
<td>A/B 10/10</td>
<td>100</td>
<td></td>
<td>±12.45</td>
<td>±11.97</td>
<td>±8.85^a</td>
<td>±13.72^a</td>
<td>±10.14</td>
<td>±8.20</td>
<td></td>
</tr>
<tr>
<td>A/B 8/10</td>
<td>100</td>
<td></td>
<td>17.47</td>
<td>31.33</td>
<td>23.73</td>
<td>9.43</td>
<td>23.95</td>
<td>17.31</td>
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<td>±20.20^aa</td>
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Note: Compared with the saline group: ^aP≤0.05, ^aaP≤0.01; Compared with the model group: ^bP≤0.05, ^bbP≤0.01.

FIGURES

Figure 1: Effect of PIT on myocardial ischemia, MDA in rats (x±s, n=6)

Note: Compared with the saline group: ^aP≤0.05, ^aaP≤0.01; Compared with the model group: ^bP≤0.05, ^bbP≤0.01.
Effects of Different Proportions of Salvianolic Acid and Hydroxysafflor Yellow A on the Myocardial Ischemia Model Induced by Pituitrin in Rats

**Figure 2**: Effect of PIT on myocardial ischemia, SOD in rats (x±s, n=6)
Note: Compared with the saline group: aP≤0.05, aaP≤0.01;
Compared with the model group: bP≤0.05, bbP≤0.01.

**Figure 3**: Effect of PIT on myocardial ischemia, LDH in rats (x±s, n=6)
Note: Compared with the saline group: aP≤0.05, aaP≤0.01;
Compared with the model group: bP≤0.05, bbP≤0.01.
Figure 4: Effect of PIT on myocardial ischemia, CK in rats ( x±s, n=6)

Note: Compared with the saline group: aP ≤ 0.05, aaP ≤ 0.01;
Compared with the model group: bP ≤ 0.05, bbP ≤ 0.01.