

◇ 药学研究 ◇

# 葛根注射液抗心肌缺血的药理作用研究

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**摘要:**目的 考察葛根注射液的抗心肌缺血作用。方法 考察葛根注射液高中低剂量组对大鼠离体心脏左室峰压(LVSP)、冠脉流量(CF)及大鼠离体心脏缺血再灌注后的LVSP、左室舒张期末压(LVEDP)、心率(HR)、CF的影响。结果 葛根注射液可升高大鼠离体心脏心肌收缩力及冠脉流量;对离体心脏缺血再灌注导致的LVSP和LVEDP的升高、心率及冠脉流量的降低均有对抗作用。结论 葛根注射液具有抗心肌缺血的作用。

**关键词:**葛根注射液;大鼠;离体;抗心肌缺血

**doi:**10.3969/j.issn.1009-6469.2017.01.005

## Pharmacological study on anti-myocardial ischemia effect of gegen injection in rat isolated heart

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**Abstract:** **Objective** To investigate the anti-myocardial ischemia effect of Gegen injection in rat. **Methods** Determine the effect of Gegen injection in high, medium and low dose on the left ventricular peak voltage (LVSP), coronary flow (CF) of rat isolated heart and LVSP, left ventricular end diastolic pressure (LVEDP), heart rate (HR), CF of rat isolated heart with ischemia and reperfusion. **Results** Gegen injection can increase the myocardial contractility and coronary flow in isolated heart of rats. Gegen injection had the effect on the increase of LVEDP, LVSP, HR and CF in isolated heart ischemia reperfusion injury. **Conclusion** Gegen injection has the effect of anti-myocardial ischemia in rat isolated heart.

**Key words:** Gegen injection; Rat; Isolated; Anti-myocardial ischemia

葛根注射液由葛根提取纯化制备而成,葛根中含有异黄酮类、葛根苷类、三萜皂苷等成分,具有扩张血管、改善微循环、保护缺血组织和抗组织缺血再灌注损伤、减少急性缺血梗死面积等多种作用<sup>[1-2]</sup>。临床上葛根在心血管系统疾病治疗中发挥了重要的作用<sup>[3]</sup>。笔者通过葛根对大鼠离体心脏及大鼠离体心脏缺血再灌注的影响,考察其抗心肌缺血的作用。

### 1 材料与方法

**1.1 药物** 葛根注射液,每支 10 mL,按生药量计算为 500 g · L<sup>-1</sup>,自制,批号:120201;丹参注射液,每支 10 mL,正大青春宝药业有限公司,批号:1208112。

**1.2 动物** 清洁级 SD 大鼠,由南京医科大学提供。

**1.3 试剂** 氯化钠(NaCl)、氯化钾(KCl)、氯化钙(CaCl<sub>2</sub>)、磷酸二氢钾(KH<sub>2</sub>PO<sub>4</sub>)、硫酸镁(MgSO<sub>4</sub> · 7H<sub>2</sub>O)、碳酸氢钠(NaHCO<sub>3</sub>)、葡萄糖(Glucose)均为

分析纯。

**1.4 仪器** 改良型 Langendorff 离体心脏灌流系统,4S 离体血管灌流系统,Medlab-U/8c 生物信号采集处理系统均购自南京美易科技有限公司;XYC 型鼠断头器,淮北正华生物仪器设备有限公司。

### 1.5 实验方法

**1.5.1 药物及试液的配置** K-H 液配制方法:取 NaCl 6.92 g, KCl 0.35 g, CaCl<sub>2</sub> 0.14 g, KH<sub>2</sub>PO<sub>4</sub> 0.16 g, MgSO<sub>4</sub> · 7H<sub>2</sub>O 0.29 g, NaHCO<sub>3</sub> 2.1 g, Glucose 2.0 g, 采用新鲜蒸馏水配制成 1 L 的溶液。配制时 NaHCO<sub>3</sub> 经过充分的稀释再加入已经溶好的 CaCl<sub>2</sub> 中,边加边搅拌,以免产生混浊。

含复方丹参注射液 K-H 液配制方法:取丹参注射液 1 mL,用 K-H 液配制成浓度为 0.1% (V/V) 为的溶液 1 L,为丹参注射液组。

含葛根注射液 K-H 液配制方法:分别取葛根注射液(生药 2 kg · L<sup>-1</sup>) 0.5、1、2 mL,用 K-H 液配制

为 1 L 的溶液,制得药物浓度分别为 0.05%、0.1%、0.2% (V/V),按生药量计算浓度分别为 1、2、4 g · L<sup>-1</sup>,分别作为葛根注射液低中高剂量组 I 组、II 组、III 组。

**1.5.2 对正常大鼠离体心脏的影响** 清洁级 SD 大鼠 50 只,体质量 300 ~ 350 g,随机数字表法分为 5 组,每组 10 只。即为(1)正常对照组(A1);(2)丹参注射液组,给药浓度 0.1% (A2);(3)葛根注射液 I 组,给药浓度含葛根 0.05% (A3);(4)葛根注射液 II 组,给药浓度含葛根 0.1% (A4);(5)葛根注射液 III 组,给药浓度含葛根 0.2% (A5)。

大鼠断头处死,迅速取出心脏,心脏上连有约 4 mm 主动脉,放入冷的 K-H 液中,挤净心脏中的残血,剪去心脏上连的结缔组织,迅速将心脏悬挂于 Langendorff 离体心脏灌流系统中,用 K-H 液逆行灌注[K-H 液保持高度 60 ~ 70 cm,温度(37 ± 0.5)℃,用 95% O<sub>2</sub> 和 5% CO<sub>2</sub> 饱和]。A1 组灌流 30 min, A2 ~ A5 组平衡灌流 20 min 后按各组的浓度给药 10 min。用充满水的球囊插入左心室,Medlab-U/8c 生物信号采集处理系统记录左室峰压(LVSP),定时收集流出的 K-H 液(即为冠脉流量 CF)。

记录 K-H 液灌注达到平衡点及给药后 1、3、5、10 min 时的 LVSP 及 CF,比较各组之间的差异。

**1.5.3 对正常大鼠离体心脏缺血再灌注的影响** 清洁级 SD 大鼠 60 只,体质量 300 ~ 350 g,随机分为 6 组,分别为正常对照组(B1)、模型组(B2)、丹参组(B3)、葛根 I 组(B4)、葛根 II 组(B5)、葛根 III 组(B6),每组 10 只。分组方法同“1.5.2”项。

大鼠断头处死,迅速取出心脏,心脏上连有约

4 mm 主动脉,放入冷的 K-H 液中,挤净心脏中的残血,剪去心脏上连的结缔组织,迅速将心脏悬挂于 Langendorff 离体心脏灌流系统中,用 K-H 液逆行灌注[K-H 液保持高度 60 ~ 70 cm,温度(37 ± 0.5)℃,用 95% O<sub>2</sub> 和 5% CO<sub>2</sub> 饱和]。B1 组灌流 120 min, B2 组灌流 30 min,停灌 30 min 后再复灌 60 min, B3 ~ B6 平衡 20 min 后按各组的浓度给药 10 min,停灌 30 min 后复灌 60 min。用充满水的球囊插入左心室,Medlab-U8c 生物信号采集处理系统记录左室峰压(LVSP)、左室舒张期末压(LVEDP)、心率(HR)等指标,定时收集流出的 K-H 液(即为冠脉流量 CF)。

记录 K-H 液停灌前、复灌后 5、15、30、60 min 时离体心脏的 LVSP、LVEDP、HR 和冠脉流量,比较各组间的差异。

**1.6 统计学方法** 采用 SPSS17.0 进行数据分析。观测资料主要为计量数据,均通过正态性检验,文中以  $\bar{x} \pm s$  描述之。多组多时点资料的比较为两因素重复测量方差分析,两两比较则为 LSD-*t* 检验(组间)和差值 *t* 检验(时点间)。显著性水准  $\alpha = 0.05$ 。

## 2 结果

### 2.1 对正常大鼠离体心脏的影响

**2.1.1 对正常大鼠离体心脏 LVSP 的影响** 正常组大鼠离体心脏用 K-H 液灌流 20 min 时均平衡,在 20 ~ 30 min 之间, LVSP 无明显变化。葛根注射液各给药组在用 K-H 液灌流 20 min 时均达到平衡,用含药 K-H 液灌流后 LVSP 均抬高,在给药后 5 min 后略有下降。葛根注射液大剂量组对正常大鼠离体心脏的心肌收缩力具有增强作用。平衡点给药后的 LVSP 资料及统计结果见表 1。

表 1 葛根注射液对正常大鼠离体心脏 LVSP 的影响/(mmHg,  $\bar{x} \pm s$ )

| 时点                          | A1:正常对照组       | A2:丹参组       | A3:葛根 I 组    | A4:葛根 II 组   | A5:葛根 III 组  |
|-----------------------------|----------------|--------------|--------------|--------------|--------------|
| T1:平衡点                      | 99.9 ± 25.4    | 100.0 ± 27.6 | 98.7 ± 29.8  | 99.8 ± 27.2  | 102.1 ± 29.5 |
| T2:给药后 3 min                | 100.9 ± 26.4   | 100.6 ± 26.9 | 108.1 ± 30.1 | 113.9 ± 27.3 | 128.8 ± 28.4 |
| T3:给药后 5 min                | 100.7 ± 26.9   | 100.9 ± 24.5 | 109.9 ± 31.1 | 116.2 ± 28.8 | 127.4 ± 28.0 |
| T4:给药后 10 min               | 100.4 ± 26.2   | 100.3 ± 22.8 | 108.1 ± 30.4 | 113.7 ± 28.3 | 123.6 ± 28.4 |
| 整体分析 <i>F</i> 值, <i>P</i> 值 | (HF 系数:0.8264) |              |              |              |              |
| 组间比较                        | 1.001, 0.417   |              |              |              |              |
| 时点间比较                       | 13.906, 0.000  |              |              |              |              |
| 组 × 时点                      | 2.801, 0.005   |              |              |              |              |
| 组间比较 <i>t</i> 值, <i>P</i> 值 |                |              |              |              |              |
|                             | A1 vs A2       | A1 vs A3     | A1 vs A4     | A1 vs A5     |              |
| T1                          | 0.004, 0.997   | 0.103, 0.919 | 0.015, 0.989 | 0.175, 0.863 |              |
| T2                          | 0.027, 0.979   | 0.565, 0.579 | 1.080, 0.294 | 2.275, 0.035 |              |
| T3                          | 0.017, 0.986   | 0.706, 0.489 | 1.249, 0.228 | 2.175, 0.043 |              |
| T4                          | 0.008, 0.994   | 0.605, 0.553 | 1.088, 0.291 | 1.902, 0.073 |              |
| 时点比较 <i>t</i> 值, <i>P</i> 值 | A1             | A2           | A3           | A4           | A5           |
| T2 vs T1                    | 0.103, 0.920   | 0.056, 0.957 | 0.804, 0.442 | 1.277, 0.234 | 2.854, 0.019 |
| T3 vs T1                    | 0.079, 0.939   | 0.110, 0.915 | 1.137, 0.285 | 1.416, 0.190 | 2.390, 0.041 |
| T4 vs T1                    | 0.045, 0.965   | 0.032, 0.975 | 0.887, 0.398 | 1.197, 0.262 | 2.143, 0.061 |

**2.1.2 对正常大鼠离体心脏 CF 的影响** 葛根注射液各组在 K-H 液灌流达到平衡点后用含药 K-H 液灌流的 10 min 内,冠脉流量显著增加,经整体分析,组间及时点间以及交互作用分组×时间,均差异有统计学意义( $P<0.05$ ),两两组间比较及各时点和药前比较,也差异有统计学意义( $P<0.05$ )。见表 2。

**2.2 对正常大鼠离体心脏缺血再灌注的影响**

**2.2.1 对正常大鼠离体心脏缺血再灌注 LVSP 的**

影响 整体分析知组间差异无统计学意义,仅时间及交互作用差异有统计学意义。两两比较并结合数据来看:模型组大鼠离体心脏复灌后 LVSP 显著上升,然后逐渐下降,和正常组大鼠离体心脏的 LVSP 相比,在复灌后 5 min 及复灌后 15 min,差异有统计学意义( $P<0.05$ )。葛根注射液各组均可以降低复灌时 LVSP 的升高,但与模型组比较,差异无统计学意义。见表 3。

表 2 葛根注射液对正常大鼠离体心脏 CF 的影响/( mL, $\bar{x}\pm s$ )

| 时点                | A1:正常对照组        | A2:丹参组      | A3:葛根Ⅰ组     | A4:葛根Ⅱ组     | A5:葛根Ⅲ组     |
|-------------------|-----------------|-------------|-------------|-------------|-------------|
| T1:平衡点            | 7.1±1.0         | 7.1±0.3     | 7.0±0.9     | 7.3±1.0     | 7.0±0.9     |
| T2:给药后 3 min      | 7.2±1.0         | 8.4±0.6     | 8.0±0.9     | 8.5±1.2     | 8.7±0.7     |
| T3:给药后 5 min      | 7.1±1.1         | 8.4±0.7     | 8.3±0.7     | 8.7±1.0     | 8.5±0.9     |
| T4:给药后 10 min     | 7.2±0.9         | 8.5±0.7     | 8.0±0.9     | 8.6±1.1     | 8.8±0.7     |
| 整体分析 $F$ 值, $P$ 值 | (HF 系数:0.806 1) |             |             |             |             |
| 组间比较              | 3.150,0.023     |             |             |             |             |
| 时点间比较             | 132.170,0.000   |             |             |             |             |
| 组×时点              | 9.087,0.000     |             |             |             |             |
| 组间比较 $t$ 值, $P$ 值 | A1 vs A2        | A1 vs A3    | A1 vs A4    | A1 vs A5    |             |
| T1                | 0.047,0.963     | 0.190,0.852 | 0.453,0.656 | 0.230,0.821 |             |
| T2                | 3.235,0.005     | 1.861,0.079 | 2.631,0.017 | 3.831,0.001 |             |
| T3                | 3.174,0.005     | 2.906,0.009 | 3.440,0.003 | 3.110,0.006 |             |
| T4                | 3.656,0.002     | 1.962,0.065 | 3.147,0.006 | 4.436,0.000 |             |
| 时点比较 $t$ 值, $P$ 值 | A1              | A2          | A3          | A4          | A5          |
| T2 vs T1          | 0.333,0.747     | 8.439,0.000 | 2.828,0.020 | 2.811,0.020 | 6.581,0.000 |
| T3 vs T1          | 0.006,0.996     | 6.282,0.000 | 4.262,0.002 | 3.272,0.010 | 3.954,0.003 |
| T4 vs T1          | 0.249,0.809     | 6.514,0.000 | 2.469,0.036 | 3.236,0.010 | 5.605,0.000 |

表 3 葛根注射液对正常大鼠离体心脏缺血再灌注 LVSP 的影响/( mmHg, $\bar{x}\pm s$ )

| 时点                | B1:正常对照组        | B2:模型组      | B3:丹参组      | B4:葛根Ⅰ组     | B5:葛根Ⅱ组      | B6:葛根Ⅲ组     |
|-------------------|-----------------|-------------|-------------|-------------|--------------|-------------|
| T1:停灌前            | 100.4±26.3      | 99.7±23.0   | 104.2±27.2  | 108.2±30.8  | 113.9±28.3   | 123.6±28.2  |
| T2:复灌后 5 min      | 98.0±31.3       | 192.1±88.7  | 149.0±46.1  | 139.9±56.5  | 179.0±46.9   | 175.0±55.4  |
| T3:复灌后 15 min     | 98.6±33.1       | 162.8±65.1  | 105.7±18.2  | 120.4±32.6  | 139.1±54.3   | 121.1±29.5  |
| T4:复灌后 30 min     | 95.0±34.2       | 110.1±32.8  | 106.5±30.5  | 110.4±20.3  | 106.2±35.4   | 125.7±50.9  |
| T5:复灌后 60 min     | 93.6±34.2       | 93.3±25.3   | 93.9±29.0   | 98.5±26.1   | 98.3±33.0    | 126.9±68.0  |
| 整体分析 $F$ 值, $P$ 值 | (HF 系数:0.713 2) |             |             |             |              |             |
| 组间比较              | 1.760,0.137     |             |             |             |              |             |
| 时点间比较             | 41.201,0.000    |             |             |             |              |             |
| 组×时点              | 3.829,0.000     |             |             |             |              |             |
| 组间比较 $t$ 值, $P$ 值 | B1 vs B2        | B1 vs B3    | B1 vs B4    | B1 vs B5    | B1 vs B6     |             |
| T1                | 0.067,0.947     | 0.313,0.758 | 0.606,0.552 | 1.097,0.287 | 1.895,0.074  |             |
| T2                | 3.161,0.005     | 2.888,0.010 | 2.051,0.055 | 4.534,0.000 | 3.822,0.001  |             |
| T3                | 2.780,0.012     | 0.594,0.560 | 1.486,0.155 | 2.015,0.059 | 1.608,0.125  |             |
| T4                | 1.011,0.325     | 0.792,0.438 | 1.225,0.236 | 0.717,0.482 | 53.000,0.131 |             |
| T5                | 0.024,0.981     | 0.016,0.988 | 2.263,0.725 | 0.313,0.758 | 1.384,0.183  |             |
| 时点比较 $t$ 值, $P$ 值 | B1              | B2          | B3          | B4          | B5           | B6          |
| T2 vs T1          | 0.247,0.811     | 4.438,0.002 | 3.028,0.014 | 2.215,0.054 | 4.256,0.002  | 3.221,0.010 |
| T3 vs T1          | 0.167,0.871     | 4.021,0.003 | 0.184,0.858 | 1.152,0.279 | 1.476,0.174  | 0.224,0.828 |
| T4 vs T1          | 0.529,0.609     | 1.125,0.290 | 0.184,0.858 | 0.201,0.845 | 0.562,0.588  | 0.140,0.892 |
| T5 vs T1          | 0.596,0.566     | 0.803,0.443 | 0.847,0.419 | 0.966,0.359 | 1.205,0.259  | 0.211,0.837 |

**2.2.2 对正常大鼠离体心脏缺血再灌注 LVEDP 的影响** 整体分析知,组间和时间及其交互作用均差异有统计学意义( $P<0.05$ );两两比较并结合主要数据来看:模型组大鼠离体心脏复灌后 LVEDP 迅速升高,然后维持在较高水平,和正常对照组相比,差异有统计学意义。葛根注射液中、高剂量组均可对抗心脏缺血再灌注导致的 LVEDP 的升高,和模型组相比,差异有统计学意义( $P<0.05$ )。见表 4。

**2.2.3 对正常大鼠离体心脏缺血再灌注 HR 的影响** 整体分析结果同前。两两比较并结合数据来看,主要为:模型组大鼠离体心脏缺血再灌注后心率明显减慢,和正常对照组相比,在复灌后 5 min 及复灌后 15 min 差异有统计学意义( $P<0.05$ )。葛根注射液各组均可以对抗离体心脏缺血再灌注导致的心率降低,葛根低剂量组和模型组相比,差异有统计学意义( $P<0.05$ )。见表 5。

| 表 4 葛根注射液对正常大鼠离体心脏缺血再灌注 LVEDP 的影响/(mmHg, $\bar{x}\pm s$ ) |                 |              |             |              |             |              |
|---|-----------------|--------------|-------------|--------------|-------------|--------------|
| 时点  | B1:正常对照组        | B2:模型组       | B3:丹参组      | B4:葛根 I 组    | B5:葛根 II 组  | B6:葛根 III 组  |
| T1:停灌前  | 5.7±2.0         | 7.1±2.4      | 5.9±1.2     | 5.6±2.9      | 8.0±2.8     | 6.8±2.5      |
| T2:复灌后 5 min  | 6.1±2.1         | 43.1±12.0    | 27.9±10.8   | 38.7±11.6    | 28.4±11.7   | 15.7±5.0     |
| T3:复灌后 15 min   | 6.1±1.9         | 32.2±11.6    | 13.3±5.4    | 28.1±11.1    | 12.0±5.6    | 13.6±5.7     |
| T4:复灌后 30 min   | 6.1±1.9         | 26.0±9.4     | 13.3±4.2    | 25.2±10.4    | 13.3±5.1    | 13.9±5.8     |
| T5:复灌后 60 min   | 6.8±3.4         | 23.4±6.7     | 14.5±5.9    | 22.3±8.1     | 14.0±5.0    | 13.0±5.4     |
| 整体分析 $F$ 值, $P$ 值   | (HF 系数:0.462 0) |              |             |              |             |              |
| 组间比较  | 16.332,0.000    |              |             |              |             |              |
| 时点间比较   | 178.403,0.000   |              |             |              |             |              |
| 组×时点  | 17.040,0.000    |              |             |              |             |              |
| 组间比较 $t$ 值, $P$ 值   |                 | B1 vs B2     | B1 vs B3    | B1 vs B4     | B1 vs B5    | B1 vs B6     |
| T1  |                 | 1.420,0.173  | 0.270,0.790 | 0.090,0.929  | 2.102,0.050 | 1.078,0.295  |
| T2  |                 | 9.588,0.000  | 6.283,0.000 | 8.714,0.000  | 5.947,0.000 | 5.587,0.000  |
| T3  |                 | 6.994,0.000  | 3.972,0.001 | 6.182,0.000  | 3.151,0.006 | 3.939,0.001  |
| T4  |                 | 6.553,0.000  | 4.927,0.000 | 5.703,0.000  | 4.192,0.001 | 44.600,0.001 |
| T5  |                 | 6.992,0.000  | 3.569,0.002 | 50.100,0.000 | 3.755,0.001 | 3.080,0.006  |
| 时点比较 $t$ 值, $P$ 值   | B1              | B2           | B3          | B4           | B5          | B6           |
| T2 vs T1  | 0.578,0.578     | 15.222,0.000 | 8.592,0.000 | 10.470,0.000 | 7.558,0.000 | 6.121,0.000  |
| T3 vs T1  | 0.556,0.592     | 8.872,0.000  | 5.771,0.000 | 8.919,0.000  | 2.808,0.020 | 3.880,0.004  |
| T4 vs T1  | 0.476,0.645     | 8.116,0.000  | 8.524,0.000 | 8.768,0.000  | 3.298,0.009 | 4.109,0.003  |
| T5 vs T1  | 1.062,0.316     | 10.166,0.000 | 6.673,0.000 | 8.077,0.000  | 3.504,0.007 | 3.850,0.004  |

| 表 5 葛根注射液对正常大鼠离体心脏缺血再灌注 HR 的影响/(beats·min <sup>-1</sup> , $\bar{x}\pm s$ ) |                 |             |              |              |              |               |
|--|-----------------|-------------|--------------|--------------|--------------|---------------|
| 时点   | B1:正常对照组        | B2:模型组      | B3:丹参组       | B4:葛根 I 组    | B5:葛根 II 组   | B6:葛根 III 组   |
| T1:停灌前   | 280.8±53.5      | 235.4±76.6  | 262.0±28.2   | 282.3±60.1   | 296.3±44.1   | 278.9±43.4    |
| T2:复灌后 5 min   | 275.6±55.2      | 82.4±28.7   | 123.5±46.2   | 115.5±49.7   | 106.2±42.8   | 129.6±57.6    |
| T3:复灌后 15 min  | 275.2±57.4      | 149.7±59.4  | 239.2±63.6   | 252.2±67.5   | 237.2±90.1   | 240.4±65.3    |
| T4:复灌后 30 min  | 273.2±55.9      | 171.4±73.7  | 228.9±57.6   | 241.6±60.5   | 269.0±57.3   | 251.0±41.8    |
| T5:复灌后 60 min  | 267.9±55.1      | 183.9±58.2  | 219.5±56.0   | 235.0±52.4   | 250.6±48.9   | 234.5±51.0    |
| 整体分析 $F$ 值, $P$ 值  | (HF 系数:0.695 3) |             |              |              |              |               |
| 组间比较   | 4.650,0.001     |             |              |              |              |               |
| 时点间比较  | 227.908,0.000   |             |              |              |              |               |
| 组×时点   | 11.496,0.000    |             |              |              |              |               |
| 组间比较 $t$ 值, $P$ 值  |                 | B1 vs B2    | B1 vs B3     | B1 vs B4     | B1 vs B5     | B1 vs B6      |
| T1   |                 | 1.536,0.142 | 0.983,0.338  | 0.062,0.951  | 0.709,0.487  | 0.087,0.931   |
| T2   |                 | 9.812,0.000 | 6.677,0.000  | 6.813,0.000  | 7.669,0.000  | 5.788,0.000   |
| T3   |                 | 4.802,0.000 | 1.329,0.200  | 0.819,0.423  | 1.123,0.276  | 1.264,0.223   |
| T4   |                 | 3.479,0.003 | 1.746,0.098  | 1.214,0.240  | 0.164,0.872  | 129.800,0.329 |
| T5   |                 | 3.316,0.004 | 1.948,0.067  | 50.300,0.189 | 0.741,0.468  | 1.408,0.176   |
| 时点比较 $t$ 值, $P$ 值  | B1              | B2          | B3           | B4           | B5           | B6            |
| T2 vs T1   | 0.241,0.815     | 7.557,0.000 | 10.794,0.000 | 7.488,0.000  | 13.104,0.000 | 7.774,0.000   |
| T3 vs T1   | 0.254,0.805     | 3.857,0.004 | 1.501,0.167  | 1.158,0.277  | 2.052,0.070  | 1.788,0.107   |
| T4 vs T1   | 0.385,0.709     | 2.679,0.025 | 2.187,0.057  | 2.025,0.074  | 1.231,0.250  | 1.739,0.116   |
| T5 vs T1   | 0.567,0.585     | 1.867,0.095 | 3.102,0.013  | 1.974,0.080  | 2.501,0.034  | 2.379,0.041   |

表6 葛根注射液对正常大鼠离体心脏缺血再灌注 CF 的影响/( mL,  $\bar{x} \pm s$ )

| 时点            | B1:正常对照组        | B2:模型组       | B3:丹参组      | B4:葛根Ⅰ组      | B5:葛根Ⅱ组      | B6:葛根Ⅲ组      |
|---------------|-----------------|--------------|-------------|--------------|--------------|--------------|
| T1:停灌前        | 7.2±0.9         | 7.2±0.6      | 8.5±0.7     | 8.0±0.9      | 8.6±1.1      | 8.8±0.7      |
| T2:复灌后5 min   | 7.0±0.9         | 6.5±2.0      | 6.8±1.0     | 6.4±1.0      | 6.7±1.1      | 7.1±0.9      |
| T3:复灌后15 min  | 6.8±0.9         | 4.8±1.0      | 6.1±1.1     | 5.1±1.2      | 6.0±1.1      | 6.3±0.6      |
| T4:复灌后30 min  | 6.7±0.9         | 4.3±0.8      | 5.4±1.1     | 4.8±1.2      | 5.3±1.0      | 6.1±0.8      |
| T5:复灌后60 min  | 6.3±1.0         | 3.2±0.8      | 4.6±1.6     | 4.1±0.9      | 4.4±1.0      | 4.8±0.8      |
| 整体分析 F 值, P 值 | (HF 系数:0.773 7) |              |             |              |              |              |
| 组间比较          | 4.676,0.001     |              |             |              |              |              |
| 时点间比较         | 297.560,0.000   |              |             |              |              |              |
| 组×时点          | 8.160,0.000     |              |             |              |              |              |
| 组间比较 t 值, P 值 | B1 vs B2        | B1 vs B3     | B1 vs B4    | B1 vs B5     | B1 vs B6     |              |
| T1            | 0.000,1.000     | 3.649,0.002  | 1.982,0.063 | 3.087,0.006  | 4.367,0.000  |              |
| T2            | 0.707,0.489     | 0.417,0.681  | 1.369,0.188 | 0.667,0.513  | 0.247,0.807  |              |
| T3            | 4.822,0.000     | 1.576,0.132  | 3.533,0.002 | 1.807,0.088  | 1.560,0.136  |              |
| T4            | 6.368,0.000     | 2.912,0.009  | 4.090,0.001 | 3.297,0.004  | 8.900,0.118  |              |
| T5            | 7.705,0.000     | 2.855,0.011  | 7.600,0.000 | 4.289,0.000  | 3.766,0.001  |              |
| 时点比较 t 值, P 值 | B1              | B2           | B3          | B4           | B5           | B6           |
| T2 vs T1      | 0.503,0.627     | 1.663,0.131  | 5.231,0.001 | 4.129,0.003  | 4.124,0.003  | 4.949,0.001  |
| T3 vs T1      | 1.063,0.315     | 7.197,0.000  | 6.976,0.000 | 7.159,0.000  | 5.689,0.000  | 11.692,0.000 |
| T4 vs T1      | 1.420,0.189     | 12.325,0.000 | 7.908,0.000 | 9.656,0.000  | 8.149,0.000  | 9.831,0.000  |
| T5 vs T1      | 2.418,0.039     | 15.594,0.000 | 9.482,0.000 | 11.876,0.000 | 10.590,0.000 | 14.762,0.000 |

**2.2.4 对正常大鼠离体心脏缺血再灌注 CF 的影响** 整体分析结果同上。两两比较结果主要为:模型组大鼠离体心脏复灌后冠脉流量逐渐降低,在复灌 15 min 以后和正常对照组相比差异有统计学意义( $P<0.05$ )。葛根注射液各组在停灌时冠脉流量均显著高于模型对照组( $P<0.05$ );缺血再灌注后,葛根注射液各组冠脉流量均显著高于模型组( $P<0.05$ ),表明葛根注射液对抗缺血再灌注后冠脉流量的降低。见表 6。

3 讨论

葛根经提取纯化可得有效成分总黄酮含量较高的提取物<sup>[4]</sup>,提取物一般以总黄酮及葛根素作为衡量质量的标准,葛根及葛根素具有改善脑循环、抗血压、抗心率失常、治疗脑梗死等方面具有一定的疗效<sup>[5-10]</sup>,葛根注射液总黄酮含量 80% 以上,是葛根素 30% 以上的葛根提取物制成,具有解肌退热、生津止渴、升阳止泻之功效,拟用于心肌梗死、视网膜动、静脉阻塞、突发性聋及缺血性脑血管病等。蔡小军等研究了其对麻醉犬急性心肌缺血的保护作用及抗心肌缺血作用<sup>[11-12]</sup>。本文通过对大鼠离体心脏及大鼠离体心脏缺血再灌注模型的各项指标的影响,考察其抗心肌缺血作用。结果表明各剂量组可升高大鼠离体心脏心肌收缩力及冠脉流量;对离体心脏缺血再灌注导致的 LVSP 和 LV-EDP 的升高、心率及冠脉流量的降低均有对抗作

用,为临床用于心血管系统疾病提供了理论支持。

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