太极拳和有氧操对冠心病患者脂质代谢、炎症反应及血管内皮功能的影响

李亚梦[1,2]，李翠含[2]，刘明宇[2]，张建伟[2]，吕韶钧[2]

1 西北工业大学，陕西西安，710072

2 北京师范大学，北京，100875

摘要：目的：探讨太极拳和有氧操对冠心病患者脂质代谢、炎症反应及血管内皮功能的影响及其可能机制。**方法：**招募 53 名冠心病患者，经过纳入、排除后，48 名受试者随机进入太极拳组和有氧操组，进行为期 12 周、每周 3 次、每次 60-75 min，运动强度控制在 40-60%心率储备（Heart Rate Reserve, HRR)的运动干预。测试运动干预前、后冠心病患者的心肺耐力、脂质代谢、炎症反应和血管内皮功能。采用心肺运动实验（Cardiopulmonary Exercise Testing，CPET）的峰值摄氧量（Peak Oxygen Uptake，VO2 peak）、代谢当量（Metabolic Equivalent of Task， MET）和 6 分钟步行试验（6-Minute Walking Test，6MWT）结果代表心肺耐力，采用酶联免疫吸附法检测血管内皮功能和炎症反应相关指标。采用酶比色法测定血脂指标。**结果：**1）心肺耐力：12 周太极拳和有氧操运动干预显著改善冠心病患者的 VO2 peak、METs 以及 6MWT（P＜0.05），但太极拳组与有氧操组的组间差异不显著（P＞0.05）；2）血管内皮功能：12 周太极拳和有氧操运动干预显著提升冠心病患者的 NO、NOS 水平，降低 ET-1 水平（P＜0.05），但太极拳组与有氧操组的组间差异不显著（P＞0.05）；3）脂质代谢和炎症反应：12 周太极拳和有氧操运动干预显著提升冠心病患者的 IL-10 水平，降低 CRP、IL-6、ox-LDL 水平（P＜0.05），但太极拳组与有氧操组的组间差异不显著（P＞0.05）；4）相关性分析：12 周运动干预前、后 ox-LDL 的变化与 NO（r=-0.41，P＜0.05）、NOS（r=-0.41，P＜0.05）的变化呈显著负相关，与 CRP（r=0.57，P＜0.001）的变化呈显著正相关。IL-6 的变化和 ET-1 的变化呈正相关（r=0.49，P＜0.05）。**结论：**1）太极拳和有氧操运动干预均可提升冠心病患者心肺耐力，脂质代谢水平、降低炎症反应程度，改善血管内皮功能。2）太极拳对冠心病患者血管内皮功能的改善可能与脂质堆积的减少，炎症反应程度的降低有关。

关键词：太极拳；有氧操；冠心病；血管内皮功能；脂质代谢

Effects of Tai Chi and Aerobic Exercise on Lipid Levels,

Inflammatory Response, and Vascular Endothelial Function in Patients with Coronary Artery Disease

LI Yameng[1,2], LI Cuihan[1], LIU Mingyu[2], ZHANG Jianwei [2], LYU Shaojun[2]

1 Northwestern Polytechnical University, Shaanxi Xian, 710072, China
2 Beijing Normal University, Beijing, 100875, China

Abstract：Objective: To explore the effects of Tai Chi and aerobic exercise on lipid levels, inflammatory response, and vascular endothelial function in patients with coronary artery disease （CAD） and its possible mechanism. **Methods:** Fifty-three patients with coronary artery disease were recruited for the study. After testing, 48 subjects were randomly assigned to either the Tai Chi group or the aerobic exercise group. Both groups participated in a 12-week exercise intervention program consisting of three sessions per week. Each session lasted between 60 and 75 minutes, with exercise intensity maintained at 40-60% of their heart rate reserve (HRR). Before and after the exercise intervention, several assessments were conducted to evaluate cardiorespiratory fitness, lipid metabolism, inflammatory response, and vascular endothelial function in the CAD patients. Cardiorespiratory fitness was measured using peak oxygen uptake (VO2 peak), metabolic equivalent of task (MET) obtained from cardiopulmonary exercise testing (CPET), and the results of the 6-minute walking test (6MWT). Vascular endothelial function and inflammatory response markers were analyzed using enzyme-linked immunosorbent assay (ELISA), while lipid profiles were assessed through an enzyme colorimetric assay. **Results:** 1) Cardiopulmonary fitness: The 12-week Tai Chi and aerobic exercise interventions significantly improved VO2 peak, METs, and 6MWT in CAD patients ($P < 0.05$). However, no significant between-group differences were observed between the Tai Chi and aerobic exercise groups ($P > 0.05$). 2) Vascular endothelial function: Tai Chi and aerobic exercise interventions significantly increased NO and NOS levels, while decreasing ET-1 levels in CAD patients ($P < 0.05$). However, no significant differences were observed between the Tai Chi and aerobic exercise groups ($P > 0.05$). 3) Lipid metabolism and inflammatory response: The 12-week exercise interventions significantly increased IL-10 levels and decreased CRP, IL-6, and ox-LDL levels in CAD patients ($P < 0.05$). However, no significant difference was observed between the Tai Chi and aerobic exercise groups ($P > 0.05$). 4) Correlation analysis: Changes in ox-LDL before and after the 12-week

exercise intervention were found to be significantly negative correlated with changes in NO ($r = -0.41$, $P < 0.05$) and NOS ($r = -0.41$, $P < 0.05$), and significantly positive correlated with changes in CRP ($r = 0.57$, $P < 0.001$). Changes in IL-6 were positively correlated with changes in ET-1 ($r = 0.49$, $P < 0.05$). **Conclusions:** 1) Both Tai Chi and aerobic exercise interventions have been shown to improve cardiopulmonary fitness, enhance lipid metabolism, reduce inflammatory responses, and improve vascular endothelial function. 2) Improvements in vascular endothelial function in CAD patients may be associated with reduced lipid accumulation and diminished inflammatory responses following exercise interventions.

Keywords: Tai Chi; aerobic exercise; coronary heart disease; vascular endothelial function; lipid levels

分论坛 1：太极拳健康促进的实证研究