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Effect of different type of exercise on mitochondrial homeostasis in rats with myocardial infarction

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Objective To investigate the different effect of moderate-intensity continuous training (MCT) and high-intensity interval exercise training (HIT) on ventricular remodeling and mitochondrial homeostasis after acute myocardial infarction (AMI).

Methods The AMI rat model was achieved by ligating coronary artery. The AMI and sham operation rats were randomly divided into four groups: sham operation group (Sham), AMI control group (AMI), AMI MCT group (AMI+M), and AMI HIT group (AMI+H). Animals in the AMI+M and AMI+H groups underwent 4 weeks MCT and HIT respectively. Five weeks after AMI, hemodynamic changes, mitochondrial bioenergetics, and PINK1, Beclin1, Mfn2, Drp1, Tfam, COXIV, PGC-1 α were detected.

Results Comparing with AMI group, in AMI+M and AMI+H groups, Beclin1 (146.33 \pm 18.47, 143.28 \pm 16.96 vs. 123.27 \pm 13.27, P <0.05), PINK1 (150.33 \pm 20.54, 152.28 \pm 18.34 vs. 125.27 \pm 17.67, P <0.05), Mfn2 (122.28 \pm 18.81, 117.19 \pm 17.04 vs. 46.27 \pm 6.72, P <0.01), and PGC-1 α (82.15 \pm 16.58, 102.25 \pm 13.27 vs. 60.27 \pm 9.36, P <0.05~0.01) expression elevated significantly, whereas ROS generation (122.28 \pm 18.81, 117.19 \pm 17.04 vs. 46.27 \pm 6.72, P <0.01) and Drp1 expression (9.58 \pm 1.40, 10.18 \pm 1.37 vs. 15.85 \pm 1.61, P <0.05) showed dramatic decrease. In addition, in AMI+H group, +dp/dt max (6326 \pm 325 vs. 5368 \pm 271, P <0.05), -dp/dt max (-5312 \pm 246 vs. -4457 \pm 250, P <0.05), mitochondrial membrane potential (85.24 \pm 11.94 vs. 71.28 \pm 8.34, P <0.05), ATP synthesis activity (38.77 \pm 5.16 vs. 32.33 \pm 4.14, P <0.05), Tfam (95.25 \pm 12.05 vs. 78.27 \pm 12.22, P <0.05) and COXIV (89.25 \pm 14.06 vs. 67.27 \pm 13.71, P <0.05) expression improved significantly. Comparing with AMI+M group, in AMI+H group, +dp/dt max (6326 \pm 325 vs. 5775 \pm 310, P <0.05), -dp/dt max (-5312 \pm 246 vs. -4778 \pm 305, P <0.05), PGC-1 α (102.25 \pm 13.27 vs. 82.15 \pm 16.58, P <0.05), Tfam (95.25 \pm 12.05 vs. 80.15 \pm 11.99, P <0.05) and COXIV (89.25 \pm 14.06 vs. 72.15 \pm 10.89, P <0.05) expression improved significantly.

Conclusions High-intensity interval exercise training is superior to moderate-intensity continuous training for ameliorating ventricular remodeling and mitochondrial homeostasis after acute myocardial infarction.