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Mesenchymal Stem Cell-Derived Exosomes Improve the Microenvironment of Infarcted Myocardium Contributing to Angiogenesis and Anti-Inflammation

Xiaomei Teng, Lei Chen, Weiqian Chen, Junjie Yang, Ziying Yang, Zhenya Shen

PMID: 26646808 DOI: 10.1159/000438594

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Abstract

Background/aims: Bone marrow mesenchymal stem cells (MSCs) widely applied for treating myocardial infarction face survival challenges in the inflammatory and ischemia microenvironment of acute myocardial infarction. The study hypothesized that MSC-derived exosomes play a significant role in improving microenvironment after acute myocardial infarction and aimed to investigate the paracrine effects of exosomes on angiogenesis and anti-inflammatory activity.

Methods: MSCs were cultured in DMEM/F12 supplemented with 10% exosome-depleted fetal bovine serum and 1% penicillin-streptomycin for 48 h. MSC-derived exosomes were isolated using ExoQuick-TC. Tube formation and T-cell proliferation assays were performed to assess the angiogenic potency of MSC-derived exosomes. Acute myocardial infarction was induced in Sprague-Dawley rats, and myocardium bordering the infarcted zone was injected at four different sites with phosphate-buffered saline (PBS, control), MSC-derived exosomes, and exosome-depleted MSC culture medium.

Results: MSC-derived exosomes significantly enhanced the tube formation of human umbilical vein endothelial cells, impaired T-cell function by inhibiting cell proliferation in vitro, reduced infarct size, and preserved cardiac systolic and diastolic performance compared with PBS markedly enhancing the density of new functional capillary and hence blood flow recovery in rat myocardial infarction model.

Conclusions: Exosomes stimulate neovascularization and restrain the inflammation response, thus improving heart function after ischemic injury.

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