Mesenchymal Stem Cells Are Superior to Angiogenic Growth Factor Genes for Improving Myocardial Performance in the Mouse Model of Acute Myocardial Infarction

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Abstract

Both cell therapy and angiogenic growth factor gene therapy have been applied to animal studies and clinical trials. Little is known about the direct comparison between cell therapy and angiogenic growth factor gene therapy. The goal of this study was to compare the effects of human bone marrow-derived mesenchymal stem cells (hMSCs) transplantation and injection of angiogenic growth factor genes in a model of acute myocardial infarction in mice. The hMSCs were obtained from adult human bone marrow and expanded in vitro. The purity and characteristics of hMSCs were identified by flow cytometry and immunophenotyping. Immediately after ligation of the left anterior descending coronary artery in male severe combined immunodeficient (SCID) mice, culture-expanded hMSCs or angiogenic growth factor genes were injected intramuscularly at the left anterior free wall. The engrafted hMSCs were positive for cardiac marker, desmin. Infarct size was significantly smaller in the hMSCs-treated group than in the angiopoietin-1 (Ang-1) or vascular endothelial growth factor (VEGF)-treated group at day 28 after infarction. hMSCs transplantation was better in decreasing left ventricular end-diastolic dimension and increasing fractional shortening than Ang1 or VEGF gene therapy. Capillary density was markedly increased after hMSCs transplantation than Ang1 and VEGF gene therapy. In conclusion, intramyocardial transplantation of hMSCs improves cardiac function after acute myocardial infarction through enhancement of angiogenesis and myogenesis in the ischemic myocardium. hMSCs are superior to angiogenic growth factor genes for improving myocardial performance in the mouse model of acute myocardial infarction. Transplantation of MSCs may become the future therapy for acute myocardial infarction for myocardial regeneration.