Preservation of the cardiac function in infarcted rat hearts by the transplantation of adipose-derived stem cells with injectable fibrin scaffolds.

Authors: Zhang X, Wang H, Ma X, Adila A, Wang B, Liu F, Chen B, Wang C, Ma Y

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Abstract:

Cell-based therapy can improve cardiac function but is limited by the low cell retention and survival within ischemic tissues. Injectable cardiac tissue engineering aims to support cell-based therapies and enhance their efficacy for cardiac diseases. So far, no research has been devoted to studying the usefulness of the combination of fibrin glue (as scaffold) and adipose-derived stem cells (ADSCs) to treat myocardial infarction. In our study, the rat ADSCs were isolated from subcutaneous adipose tissues. The surface phenotype of these cells was analyzed by flow cytometry. The fibrin glue was then co-injected with ADSCs into the left ventricular wall of rat infarction models. The structure and functional consequences of transplantation were determined by detailed histological analysis and echocardiography. Most cultured ADSCs expressed CD105 and CD90, and were negative for CD34 and CD45. After injection, both the 24-h cell retention and four-week graft size were significantly higher and larger in the Fibrin + ADSCs group than those of the ADSCs group alone ($P < 0.01$). The heart function improved significantly in the Fibrin + ADSCs group compared with that of the ADSCs group four weeks after transplantation ($P < 0.01$). In addition, the arteriole densities within the infarcted area improved significantly in the Fibrin + ADSCs group compared with those in the ADSCs group four weeks after transplantation ($P < 0.01$). In conclusion, the ADSCs with the fibrin glue has the therapeutic potential to improve the function of infarcted hearts. The method of in situ injectable tissue engineering combining fibrin glue with ADSCs is promising clinically.