

Adipose-derived stem cell adhesion on laminin-coated microcarriers improves commitment toward the cardiomyogenic lineage

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For tissue-engineering studies of the infarcted heart it is essential to identify a source of cells that may provide cardiomyocyte progenitors, which is easy to amplify, accessible in adults, and allowing autologous grafts. Preclinical studies have shown that human adipose-derived stem cells (ADSCs) can differentiate into cardiomyocyte-like cells and improve heart function in myocardial infarction. We have developed pharmacologically active microcarriers (PAMs) which are biodegradable and biocompatible polymeric microspheres conveying cells on their biomimetic surface, therefore providing an adequate three-dimensional (3D) microenvironment. Moreover, they can release a growth factor in a prolonged manner. In order to implement ADSCs and PAMs for cardiac tissue engineering we first defined the biomimetic surface by studying the influence of matrix molecules laminin (LM) and fibronectin (FN), in combination with growth factors present in the cardiogenic niche, to further enhance the in vitro cardiac differentiation of ADSCs. We demonstrated that LM increased the expression of cardiac markers (Nkx2.5, GATA4, MEF2C) by ADSCs after 2 weeks in vitro. Interestingly, our results suggest that the 3D support provided by PAMs with a LM biomimetic surface (LM-PAMs) further enhanced the expression of cardiac markers and induced the expression of a more mature contractile protein, cardiac troponin I, compared with the 2D differentiating conditions after only 1 week in culture. The enrichment of the growth-factor cocktail with TGF- β 1 potentiated the cardiomyogenic differentiation. These results suggest that PAMs offering a LM biomimetic surface may be efficiently used for applications combining adult stem cells in tissue-engineering strategies of the ischemic heart.

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