Intra-myocardial homing of adult stem cells in a goat model: Glandular vs. mesenchymal stem cells

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Abstract

Objectives:

Stem cell therapy is a promising approach treating end-stage heart failure. Mesenchymal stem-cells (MSCs) injected intra-myocardially differentiate into capillaries while glandular stem cells, derived from pancreas, parotis or submandibularis, transform into cardio-myocytes. Major questions of applying stem cell therapy in a failing myocardium are the intra-myocardial homing and the development of gap junctions. The following study will deal with these 2 questions.

Methods:

Glandular stem cells were characterized by red PKH26 and MSCs by green PKH67 makers. A mix of one million of each cell type was injected into three locations of the goat’s myocardium of the left ventricle. Intra-myocardial homing of glandular stem cells and MSCs (CD133+) were evaluated in 6 female goats after 1 and 3 hours after intra-myocardial injection. Additionally from 6 female goats myocardium was harvested with injected stem cells after 6 weeks. Furthermore glandular stem cells of goats were co-cultured with goat’s myocardium for 48 h and kept in culture for 3 weeks. An immune-histological staining of connexin 43 (gap junctions) was performed on these cultured glandular stem cells.

Results:

Having used a mix of intra-myocardial injection of GSCs and MSCs, MSCs showed a significant cell migration into the surrounding myocardium, more expressed after 3 hours than after one hour. After 6 weeks, within the frozen myocardial slices 76.4% of the marked stem cells were identified as GSCs (red) but only 23.6% as green MSCs (P≤0.05). Additionally in cell cultures glandular stem-cells being in contact with myocardium developed connexin 43 mainly in that part of the cell membrane being in cell to cell contact. These primarily results of course need more research work concerning connexin 43 expression after an intramyocardial injection in a big animal model.

Conclusion:

Due to a significant better intra-myocardial residence of GSCs in comparison to MSCs combined with the ability expressing connexin 43 (gap junctions), glandular stem cells might become a very promising treatment option for the repair of irreversible damaged myocardium.