CARDIAC TISSUE ENGINEERING: BONE MARROW STEM CELLS vs. ADIPOSE-DERIVED STEM CELLS

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Introduction

Many cell sources have been recruited in the field of tissue engineering for myocardial repair, such as embryonic, bone marrow and endothelial progenitor stem cells. Bone marrow mesenchymal stem cells (BMSCs) represent the most widely studied category, yet another promising option has emerged, adipose tissue-derived stem cells (ADSCs). We aimed to compare the characteristics of these two types of stem cells with regard to their use for myocardial repair, based on recent experimental data.

Methods

We conducted a literature review for the time period from 2010 to 2013 in order to identify all the relative studies on BMSCs and ADSCs used for Cardiac Tissue Engineering. For this purpose we searched PubMed database and references cited in the retrieved articles.

Results

Both BMSCs and ADSCs encompass characteristics of self-renewal, extensive proliferative capacity and multipotency. They are characterized by the expression of the same cell surface markers, such as CD13, CD29, CD44 [Park, 2010] and they both produce paracrine mediators (growth factors and cytokines) with proangiogenic, anti-apoptotic and anti-inflammatory properties. They also have immunomodulatory capacity and thus the potential for allogenic transplantation [De Miguel, 2012]. Moreover, animal trials demonstrate that they repair the infracted myocardium and improve its contractile performance [Okura, 2012].

The ADSCs are readily available in large quantities and can be obtained through a less invasive procedure, namely as surplus tissue from lipoaspirates. They have also demonstrated a higher proliferation rate and so they diminish the need for extensive in vitro expansion. On the contrary, BMSCs are harvested through an invasive procedure, they constitute a small percentage of cells composing the bone marrow and their number and regenerative capacity decline with age [Vidal, 2012]. Finally, ADSCs are proved to be more efficient than BMSCs in producing and crosslinking certain types of collagen and elastin under stretching conditions and they migrate uniformly across the scaffold of heart valves [Colazzo, 2011].

Conclusion

Adipose-derived stem cells seem to share all the advantages of BMSCs and possess some superior characteristics that favor their use in cardiac tissue engineering. However, many issues need to be addressed before they are applied in clinical practice. For example, the limited viability and engraftment of both BMSCs and ADSCs have led to the implementation of new strategies, such as the genetic modification of MSCs through a hybrid nanodelivery system [Paul, 2012], indicating a feasible direction of stem cell research.

References

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