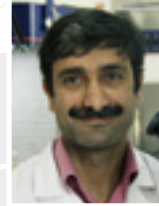


Project Title

Differentiation and technology of stem cells application in heart and liver regenerative medicine



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Abstract

Liver and cardiovascular diseases are among the leading causes of mortality worldwide. Novel clinical strategies are being developed for regenerative medicine in liver and heart using a variety of stem cell types and/or derivatives. Here, we produced pluripotent stem cells, including embryonic stem cells (ESCs) and induced pluripotent stem cells (iPSCs), and isolated tissue-specific stem cells as different sources for making hepatocytes and cardiomyocytes.

First, hepatocytes and cardiomyocytes were produced from stem cells by spontaneous differentiation, genetic manipulation, directed differentiation using growth factors, small molecules and co-culturing with other cells and/or extracellular matrix manipulation. In addition, the effect of tissue and nanoengineering was investigated on the differentiation and production of lineage-specific cells. Also generation of human iPSCs enabled us to produce patient-specific pluripotent stem cells which provided an opportunity to study liver and cardiovascular diseases in a dish. Second, the produced hepatocytes and cardiomyocytes were transplanted into animal models of liver and cardiovascular injuries.

Third, in order to extend stem cell knowledge from bench to bedside, various clinical trials were conducted using stem cells in liver and cardiovascular diseases.

The overall data showed that stem cells can produce sufficient number of hepatocytes and cardiomyocytes in vitro which have great potential to be used in developmental studies and translational research. Furthermore, the in vitro models of liver and cardiovascular diseases were established by producing patient-specific iPSCs. Finally, our clinical trial results demonstrated the safety and efficacy of human tissue-specific stem cells in the repair and regeneration of liver, heart and vessels.

