Recent patents on stem cell transplantation in cardiovascular medicine

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Introduction:

Heart failure is a leading cause of morbidity and mortality worldwide. Coronary artery disease (CAD) is currently one of the most common identifiable cause of heart failure. Mortality after myocardial infarction depends on the time when reperfusion of the infarct-related artery is performed. If this is not done rapidly, necrosis, scar formation and left ventricular remodelling occur. Today, cell-based therapy either by direct application or mobilisation has gained a lot of interest and is believed to improve left ventricular function after myocardial infarction.

Aim:

We screen various available patent data bases to give an overview on different patent applications of cell-based therapies in cardiovascular medicine.

Results:

The first patents presented are about application of stem cells for heart failure or for inducing neoangiogenesis. Patents have been filed that differ between stem cell therapy alone or stem cell therapy in combination with other factors such as growth hormones. Stem cell therapy alone mostly consists of various steps: 1) isolation of cells from a patient. This is done by muscle or bone marrow biopsy, liposaspirate or taking circulating blood from the patient. 2) Cultivation and/or expansion of the favoured cell type. These include lineage negative (Lin-) cells (Freyman, US7097833), adipose tissue-derived stem cells (Strem, MX5009044A), bone marrow-derived stem cells (Furcht et al., US7015037) or others. 3) Transplantation of the cell type. This is solved either by direct injection into the specific organ or intravenous administration. Stem cell therapy in combination with other factors requires an additional step. In this setup, accessory factors, like growth hormones (PDGF, FGF, PDGF) or other factors like adrenomedulin are given either to the isolated cells or are directly given to the patient. Other authors are using the administration of growth hormones or other factors like nicotine or nicotine-receptor agonists alone to mobilize stem cells from the bone marrow (Cooke et al., US6720340). We also present an overview about current patent applications of cardiomyocytes generation from embryonic or adult stem cells. Various cell types can be isolated and used to generate myocytes, e.g. cells from the endometrial membrane of the uterus or mesenchymal stem cells obtained from menstrual blood (Umezawa et al., WO06078034A1), TVEM-expanded CD34+/CD38- cells from the peripheral blood (Rudd, WO 06093860A3) or myogenic stem cells from adipose tissue (Geng et al., WO06017320A3). In addition, mesenchymal...
or myogenic stem cells used for myocyte generation need to be taken into culture before administration to the patient. Culture conditions for cardiac cells differ from those for other cell types. Isolated cells are cultured, e.g. in rotating bioreactor vessels (Rudd, WO 06093860A3) or engrafted on a histoengineered scaffold material of thermoplastic resin having a porous three-dimensional network and application of a pulsatile flow (Nakayama et al., JP2006246770A2). After a certain period of cultivation, myoblasts are then re-transplanted into the patient. We finally report patents in the field of cell culture methods for human stem cells that are used for generation of different types of cardiovascular cells.

Conclusions:

A systematic overview on the current patent situation about use of stem cells in cardiovascular medicine enables optimized future decision making in the development of novel strategies for improved regenerative medicine.