Stem Cell Therapy in Myocardial Infarction: Latest Trends

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Abstract
Heart Diseases are a major cause of morbidity and mortality world wide. Myocardial infarction is the leading cause of congestive heart failure and death in the industrialized world. Current therapy is limited in preventing the progression of ventricular remodeling and congestive heart failure. Recent interest has focused on stem cells, which are undifferentiated and pleuropotent cells that can proliferate, potentially self-renew, and differentiate into cardiomyocytes. The article tries to underline the beneficial effects of the stem cell therapy for use in patients where other modes of therapy are not advisable and the multiple purpose effects of such as therapy.

Keywords: Pleuropotent cells; Stem cells; Implantation; Angiogenesis; Ventricular remodeling

Introduction
The sources of stem cells are varied such as pre-implantation embryos, children, adults, aborted fetuses, embryos, umbilical cord, menstrual blood, amniotic fluid and placenta.

Stem cells or mother or queen of all cells are pleuropotent and have the remarkable potential to develop into many different cell types in the body. Serving as a sort of repair system for the body, they can theoretically divide without limit to replenish other cells as long as the person or animal is alive. When a stem cell divides, each new cell has the potential to either remain a stem cell or become another type of cell with a more specialized function, such as a muscle cell, a red blood cell, or a brain cell [1]. Stem cells differ from other kinds of cells in the body. All stem cells regardless of their source have three general properties:

They are unspecialized
one of the fundamental properties of a stem cell is that it does not have any tissue-specific structures that allow it to perform specialized functions.

They can give rise to specialized cell types
These specialized stem cells can give rise to specialized cells, including heart muscle cells, blood cells, or nerve cells.

They are capable of dividing and renewing themselves for long periods
Unlike muscle cells, blood cells, or nerve cells which do not normally replicate themselves-stem cells may replicate many times. A starting population of stem cells that proliferates for many months in the laboratory can yield millions of cells.

Because heart muscle cells do not replace themselves naturally, those who now suffer from a heart attack, from congenital heart disease, or from congestive heart failure have few treatment options. And while heart transplants potentially could help more patients, the supply of organs is limited. It may become possible to generate healthy heart muscle cells in the laboratory and then transplant them into patients with chronic heart disease. These cells have shown remarkable ability to produce cardiomyocytes and vascular cells in vitro and in vivo.

Patients who feel they have exhausted treatment options such as Coronary Artery Bypass Surgery (CABG) or balloon angioplasties are candidates. For patients with other medical conditions that make these conventional procedures too risky or otherwise not possible, adult stem cell therapy may be a viable alternative.

Discussion
The heart is the first organ to form as the embryo develops in the uterus, the heart also apparently lacks the ability to repair itself. However, the researchers hope that what they learn about mouse stem cell differentiation can be used as a blueprint for prompting human stem cells to differentiate in the laboratory into cells that could then be used therapeutically to repair damaged or diseased hearts.

Ideally stem cells must be able to:

- Divide to produce sufficient cells
- Differentiate into the cell types needed
- Survive after transplant
- Mesh into the surrounding tissues
- Function properly for long enough to extend the recipient’s life or to improve it significantly
- Avoid harming the recipient [1].

Stem cell therapy
We use stem cells taken from your own blood so there is no danger of your body rejecting them. In the absence of new treatments unique capacity to develop into any kind of human tissue and they can divide indefinitely in laboratory cultures .Stem cells are found throughout the body

Cardiologists and heart surgeons are currently using stemCells to improve the quality of life of patients suffering from ischemic heart disease, (or coronary artery disease), cardiomyopathy, and congestive...
Paracrine effects

Bone marrow-derived stem and progenitor cells home to sites of ischaemia. This may allow the local release of factors acting in a paracrine manner on the surrounding ischaemic tissue. Bone Marrow-Derived Mononuclear Cells (BMCs) release angiogenic growth factors such as Vascular Endothelial Growth Factor (VEGF), basic Fibroblast Growth Factor (bFGF) and angiopoietins, thereby enhancing the local angiogenic response [10]. Isolated human EPCs also express various growth factors which can enhance cardiac myocyte survival and improve angiogenesis. Compared to acute myocardial infarction patient treated by standard therapy alone, a group that received additional stem cell treatment reduced infarct volume as well as increases in infarction wall movement velocity, stroke volume index, left ventricular end-systolic volume and contractility, and myocardial perfusion of the infarct region.

Types of stem cells should be used for cardiac therapy.

Skeletal myoblasts: One of the first cell-based cardiac regeneration strategies was injection of autologous skeletal myoblasts into ischaemic myocardium. Myoblasts are resistant to ischemia can differentiate into myotubes in vivo and improve ventricular function in laboratory animal experiments. This proved to be a failure [11].

Bone marrow cells: Most clinical studies have used bone-marrow mononuclear cells and showed either no benefit or small (but possibly clinically important) improvements in cardiac function. The mechanisms of these functional improvements are unknown, but it is unlikely that the improvements result from differentiation of the injected cells into cardiomyocytes. Growth factor and cytokine release by injected cells is frequently suggested as a potential mechanism of action, and improved micro vascular function has been shown [11].

Embryonic Stem (ES) cells: are the prototypical stem cells. They unambiguously fulfill all requirements of stem cells: clonality, self renewal and multipotentiality. ES cells can differentiate into any cell present in the adult organism and have the potential to completely regenerate the myocardium. Two of the obstacles that stand in the way of the therapeutic use of ES cells are immunological rejection and the propensity of ES cells to form teratomas when injected in vivo [12].

Endogenous cardiac stem cells: can be isolated and expanded from human myocardial samples obtained using a minimally invasive biopsy procedure. Thus, from autologous CSCs, it might be possible to generate enough cells to transplant into patients with heart failure, a procedure that would have minimal risk of immune rejection or teratoma formation [13].

From the discussion we can infer that stem cell therapy has advantages in the facts that:

- Stem cell therapy can be used in patients where conventional procedures are too risky or cannot be used.
- There is problem like shortage of donors
- Stem cells can be easily harvested.
- Sources of obtaining stem cells are multiple

The beneficial effects of treatment are multiple:

- Improve Angiogenesis
- Improve collateral circulation
- Improve neovascularization
• Improve ventricular function
• Have positive effects on ventricular remodeling

Understanding cardiomyocytes development and turnover both in normal development and after injury will be essential for guiding the development of stem-cell-based therapies. Defining the factors present in the hostile microenvironment of injured myocardium that limit the survival and functional integration of transplanted cells is also crucial. As the barriers that prevent human cardiac regeneration are further defined, clinical trials should proceed with caution and with a paramount concern for patient safety [14].

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