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Perspective

Stem Cell Therapy of Diabetes Mellitus

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DESCRIPTION

Stem cell therapy holds great promise for the treatment of diabetics. Studies on the ability of human embryonic stem cells to differentiate into islet cells define the developmental stages and transcription factors involved in this process. However, the clinical application of human embryonic stem cells is limited by ethical concerns and the potential for teratoma formation. As a result, alternative forms of stem cell therapy such as induced pluripotent stem cells, umbilical cord stem cells, and bone marrow-derived mesenchymal stem cells have become an intensive research area. Recent advances in stem cell therapy have the potential to make this a viable treatment for diabetes in the near future. Diabetes is one of the most prevalent metabolic disorders. Islet cell transplantation is the most common treatment to replace the function of pancreatic beta cells destroyed by diabetes. However, there are some restrictions. Alternatively, Human Pluripotent Stem Cells (hPSCs) may provide an unlimited source of pancreatic cells capable of secreting insulin in response to hyperglycemic levels. However, the determination of suitable candidate pancreatic strains for cell therapy to treat diabetes remains controversial. Although hPSC-derived beta cells are considered the ultimate candidate, their efficiency needs to be further improved in order to obtain a sufficient number of glucose-responsive beta cells for transplantation therapy. On the other hand, hPSC-derived pancreatic progenitor cells are efficiently produced in vitro and may further mature into glucose-responsive beta cells in vivo fertilization after transplantation.

Clinical pancreas or islet transplantation has been considered a feasible treatment option for T1DM patients with poor glycemic control. Until now more than 50,000 patients worldwide had received pancreas transplantations according to the International Pancreas Transplant Registry (IPTR). It was reported that seven consecutive patients with type 1 diabetes attained sustained insulin independence after treatment with glucocorticoid free immunosuppression combined with the infusion of adequate islet mass. This treatment known as the Edmonton protocol. Over the last two decades, continuous improvement in islet isolation and immunosuppression has increased the efficiency of islet transplantation, with approximately 60% of T1DM patients achieving insulin after islet transplantation.

Stem cells in the treatment of diabetes

The researchers collected and analyzed 13 studies published between 2006 and 2016. These include 342 patients who received cord blood-rich stem cells and 111 patients who received cord blood-rich stem cells. Not everyone responded to treatment, but researchers observed improved glucose control and decreased insulin dependence that lasted up to four years. The results were promising for the treatment of diabetes with stem cells, but some were the ideal candidates were the optimal route of administration, optimal dose, and whether multiple transfusions were needed.

The etiology of DM, whether type 1 or type 2, can be due to dysfunction of pancreatic beta cells. There are approved therapies that improve the function of beta cells, but none result in the regeneration of lost or dysfunctional beta cells. Studies have shown that beta cells can be reprogrammed with specific molecules such as GABA and hormones. However, these studies also reveal many uncertainties that need to be investigated. Stem cells for the treatment of DM come from a variety of biological sources such as embryos, placenta, and bone marrow. Progenitor cells are another exciting area of research. Like stem cells, these cells can take the form of various types of mature human cells, but unlike stem cells, they cannot divide indefinitely.

Precursor stem cells were used to proliferate insulin-producing cells from enterocytes and immature pancreatic cells under laboratory conditions. This article outlines the different approaches to regenerating the pancreas in diabetics, recent advances, including our contributions, and new approaches that may be explored in the future.

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