

Isolation and transplantation of stem cells to treat immunodeficiency disorders

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The regenerative potential of stem cells has led to the development of stem cell separation technologies for stem cell isolation. Stem cell isolation is a fundamental aspect of clinical application and basic research. The stem cells are isolated from blood, bone marrow or umbilical cord after certain clinical tests and examinations in general from the donor for stem cell transplantation. Stem cell boosting medication is given to the donor in advance (i.e. 4 days before) if stem cells are intended to be isolated from the blood to move stem cells out of the bone marrow into the bloodstream. Post-medication, the blood is examined for the presence of stem cells. This is followed by the withdrawal of blood from one arm that is passed through a cell separator filter to separate the stem cells. The rest of the blood product is returned through another arm. In bone marrow harvest, a needle is injected into the rear pelvic bone and several bone punctures are made to withdraw enough stem cells under anaesthetic conditions. With these processes, enough stem cells are collected and observed. These cells are subjected to frosting and preservation for later transplantation. The isolated stem cells from the donor are transplanted to the recipient.

Before initiating the process, the patient is treated with high doses of chemotherapy and radiotherapy to suppress the existing bone marrow cells and create space for the transplanted tissue, and stop the immune system from working to reduce the risk of transplant rejection. Certain medications are also given to the patient through the central line. Finally, the stem cells are passed into the patient's body through the central line. After the completion of transplantation, the patient is kept under observation to examine if the transplanted stem cells have settled in the bone marrow and started to produce new blood cells. The transplanted stem cells have the ability to produce more new blood cells with better immunity. Since the transplanted blood cells render better immunity than the patient's own, they have the unique ability to shut off pathological responses experienced in diseases, such as cancer and autoimmune disorders. Besides healing the damaged tissues, the stem cells modulate the immune system preserving its ability to defend the body from diseases. Meanwhile, the patient is recommended immunosuppressant medications to reduce the risk of the body cells attacking the transplanted cells or transplanted cells attacking the body cells. Much progress has been achieved over the past decade in stem cell isolation that has resulted in improved stem cell separation methods. Yet several challenges demand stem cell separation techniques that are advanced for clinical and research applications of stem cells.

Keywords: Stem cells, Transplantation, Chemotherapy, Immunity, Cancer, Autoimmune diseases, Blood, Bone marrow

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