EXTENDED ABSTRACT

Stem Cell Therapy in Hematologic Malignancies

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In recent years stem cells has become the subject of increasing interest because their utility in numerous biomedical application. Stem cells are capable of renew in themselves. They can be continuously cultured in their undifferentiated state. These undifferentiated cells can be cultured into more specialized cells such as bone marrow, heart, liver, pancreatic, blood vessel, and nerve cells. Therefore they can be utilized *in vitro* to replace damaged cells and/or to test drugs or chemicals. The ability to differentiate is the ability to develop into other cell types. A stem cell can develop into cells from all three germinal layers.

Tissue engineering is a developing field that combines biology and engineering in order to create a biological method which can replace or restore malfunctioning tissues. Cells from bone marrow or peripheral blood has been cultured in the laboratory and selected subpopulation of these cells are then used to treat malfunctioning tissue/organs.

Adult patients suffering from coronary artery and peripheral vascular diseases continously need small-diameter vascular graft. In 1986, Science published a report by Weinberg and Bell who were among the first scientists able to construct a vessel in the laboratory using collagen and vascular cells which resembled a normal vessel in structure as well as in function. In 1999 Niklason demonstrated the feasibility of creating small arteries in the laboratory that mimics physiologically pulsatile blood flow and pressure.

Tissue engineering in the cardiovascular system may offer several advantages over the current treatment. Tissue-engineered structures contain living cells so that it has the potential to grow and remodel over the time and might function for decades or even a lifetime. Since the cells are mostly derived from the patient who received the implant there should be no rejection by the immune system; neither thrombus formation.

Pittengter (1999) published a technique for isolation of pure mesenchymal stem cells (MSC) which have the potential to differentiate into fat, bone, cartilage, muscle as well as cardiac cells. Hoerstrup has described the use of MSC from bone marrow to create heart valves.

Guleserian et al, reported in 2001 to have been able to isolate endothelial progenitor cells (EPC) from human umbilical cord, and demonstrated these cells could grow in culture in response to vascular endothelial growth factor (VEGF) and basic fibroblast growth factor (bFGF). In 2002 Hoerstrup reported that EPCs isolated from human umbilical cord have cellular, extracellular matrix, and biochemical properties similar to native tissue.

Bone marrow stem cells can become brain cells, liver cells precursors, heart cells, skeletal as well as smooth muscle.

Harvesting umbilical cord blood poses no risk to mother or child, whereas a bone marrow donor must undergo anaesthesia and is exposed to the risk of infection. Because the stem cells in those in the bone marrow are more primitive from adult donors, they carry much lower incidence of GVHD.

This makes it possible to perform transplant with less than perfect matches of type.

Many regenerative therapies are being developed which use the patient's own stem cell. One of the most common and promising is the use of stem cell for heart repair ; adult patients who have banked cord blood would have a ready source of stem cells regenerative medicine. On the other hand, they also have a rich source of stem cells in their bone marrow. When parents bank the cord blood from a new baby, in the near term they are most likely providing medical insurance fpr the child's siblings. Only in the long term when the donor grows up will they have value for self-use.

The diseases in which stem cells has been tried most widely are bone marrow, heart disease, diabetes, and Parkinson's disease. Bone marrow stem cells either taken from the peripheral blood or from the bone marrow have been widely used and reported.

Only bone marrow transplantations have been performed in Indonesia in around 1989-1990, one in Yogyakarta, one in Semarang, one in Bandung and four in Jakarta. Of the four bone marrow transplantation performed in the Jakarta, one is done with stem cells that is mobilized from the bone marrow into the peripheral blood. Financial condition is the main

problem for bone marrow transplantation in Indonesia.

Perhaps the best-known stem cell therapy to date is the bone marrow transplantation, which is used to treat leukemia and other types of cancer, as well as various blood disorders.

Leukemia is a cancer of white blood cells, or leukocytes. Like other blood cells, leukocytes are made in the bone marrow through a process that begins with multipotent adult stem cells. Mature leukocytes are released into the bloodstream, where they work to fight off infections in our bodies.

Leukemia results when leukocytes begin to grow and function abnormally, becoming cancerous. These abnormal cells cannot fight off infection, and they interfere with the functions of other organs.

Successful treatment for leukemia depends on getting rid of all the abnormal leukocytes in the patient, allowing healthy ones to grow in their place. One way to do this is through chemotherapy, which uses potent drugs to target and kill the abnormal cells. When chemotherapy alone can't eliminate them all, physicians sometimes turn to bone marrow transplants.

In a bone marrow transplant, the patient's bone marrow stem cells are replaced with those from a healthy, matching donor. To do this, all of the patient's existing bone marrow and abnormal leukocytes are first killed using a combination of chemotherapy and radiation. Next, a sample of donor bone marrow containing healthy stem cells is introduced into the patient's bloodstream.

If the transplant is successful, the stem cells will migrate into the patient's bone marrow and begin producing new, healthy leukocytes to replace the abnormal cells.

Bone marrow transplantation (BMT) has been used to treat lymphoma for over ten years, much of that time on a trial basis but now much more in the mainstream. Sometimes lymphoma becomes resistant to treatment with radiation therapy or chemotherapy. Very high doses of chemotherapy may then be used to treat the cancer. Because the high doses of chemotherapy can destroy the patient's bone marrow, marrow is taken from the bones before treatment. The marrow is then frozen, and the patient is given high-dose chemotherapy with or without radiation therapy to treat the cancer. The marrow that was taken out is then thawed and given back through a needle in a vein to replace the marrow that was destroyed. This type of transplant is called an autologous transplant. If the marrow given is taken from another person, the transplant is called an allogeneic transplant.

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Hope is the only good which is common to all men
(Thales)