Cellular Grafts

ELE282 Biomedical Engineering Seminar I, March 6, 2000

Amy C. Kobayashi

Biomedical Engineering, University of Rhode Island, Kingston, RI 02881

Introduction

People with cancer of the blood are sometimes treated by a bone marrow transplantation procedure. Patients with nonmalignant disorders of the blood are sometimes treated in this fashion as well. An immune response which recognizes the incompatibility between the donor's graft and the recipient s tissues creates the most serious and diff~cult to treat problem.

Causes

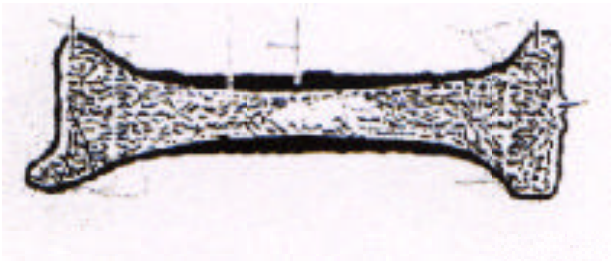
"Graft versus Host Disease" (GvHD) refers to the recently transplanted organ being attacked by mature immune cells. "Chronic rejection" is partially slowed by the use of immuno-suppressant drugs. These powerful drugs are expensive as well as toxic and require usage until the death of the patient. Even with use of the drugs, a second transplant is often needed.

Background

When both donor tissue and recipient's immune system is present and functioning within the body this is referred to as a state of mixed chimensm. A partial bone marrow transplant may create this state, but more often other measures need to be taken. White blood cells, red blood cells, and platelets are generated from bone marrow. Bone marrow is a spongy network of fibers and bones formed within bones. When normal blood cells are not produced by a person's bone marrow, a part or all of the marrow can be replaced. This new marrow, from a donor, will begin producing healthy, normal blood cells if the transplant is successful.

Solutions

A developing treatment that is able to circumvent the immune response is the combination of the organ transplant with a cellular transplant from the same donor as the organ. This treatment involves the patient receiving a standardized therapeutic product even though donor marrow and recipient tissue are not cellularly composed the same. Ideally, a mixed chimeric state will be created in the recipient using a cellular graft. The recipient's body will recognize the organ as belonging to its own body and will accept it without the use of immuno-suppressant drugs. "Tolerance", as this condition is known as, has been a goal of transplantation medicine since the beginning.



Applications

Leukemia is a cancer of the blood. This disease is one of the most commonly treated by bone marrow transplant diseases. Of the 29,000 diagnosed cases yearly (in the US) only about 14,000 are eligible for a BMT. Of the eligible 14,000, less than 3,500 actually receive transplants. Sickle Cell Disease is a mutation in oxygen carrying red blood cells. The advantage to the bone marrow transplant surgery is that the disease is actually cured. Until now, because of the risk of GvHD only patients harboring very severe cases of sickle cell anemia were considered for BMT.