Transplantation of hematopoietic stem cells

Transplantation of hematopoietic stem cells or bone marrow transplant is a procedure by which healthy bone marrow is transplanted into a patient whose bone marrow is not functioning properly. The healthy bone marrow may be taken from the own patient prior to chemotherapy or radiation treatment (autograft), or it may be taken from a donor (allograft).

Bone marrow is a soft, fatty tissue inside the bones. This is where blood cells (red blood cells, platelets, and white blood cells) are produced and where they develop. In a disease of the blood cells -- especially cancers such as leukemia -- high doses of chemotherapy may be required to destroy the cancer. However, this also destroys normal blood cells.

Usually, bone marrow cells which are rich in hemopoietic stem cells are taken (harvested) from the top of the hip bone from the patient or donor in the operating room while the donor is unconscious and pain-free (under general anesthesia). Alternatively, hemopoietic stem cells can be made to move (mobilized) from the bone marrow to the blood stream using special medications. These stem cells can then be taken from the bloodstream through a procedure called leukapheresis.

In most cases, the collected hematopoietic stem cells are not transplanted immediately, but are frozen and stored (cryopreservation) for later use. Once required, the frozen cells are thawed and transfused into the patient through a vein (IV). Transplanted cells have distinct signaling molecules on the membrane that naturally guide them specifically (and only) into the bone cavities where damage has occurred and they grow to replace the cells in the “old’ bone marrow.

When the patient is the donor of the hemotopoietic stem cells, a procedure previous to the collection and transplant must occur. Thus, the patient is prepared for collection and transplant by administering high doses of chemotherapy or radiation (conditioning). By this procedure the patient's abnormal blood cells or cancer are destroyed. At the same time, and when the patient will receive the cells from a donor, conditioning slows the patient's immune response against the donor bone marrow (graft rejection). Following conditioning, the patient is ready to receive the infusion of hematopoietic stem cells. After infusion, it takes 10 - 20 days for the bone marrow to establish itself. During this time, the patient requires support with blood cell transfusions.