BLOOD STEM CELL TRANSPLANT

A blood stem cell transplant (often called a **Bone Marrow Transplant**) involves destroying the diseased **hematopoietic** stem cells in a patient's bone marrow through chemotherapy and/or radiation and then replacing these cells with healthy blood-forming stem cells from a matched or related donor. Once injected into the patient's blood steam, the stem cells travel to the bone marrow where they begin to replicate and produce all of the required blood cells.

Hematopoietic stem cells can come from three possible sources. The source most familiar to people is bone marrow. If a patient receives cells collected from bone marrow, then the person is said to be having a **bone marrow transplant** or BMT. Bone marrow donors do require surgery as the bone marrow tissue is withdrawn from a large bone (typically a hip bone) under anaesthetic. Harvested bone marrow can be frozen to keep the cells alive until they are needed.

Another source of stem cells is peripheral blood (the blood that circulates throughout the body). If a patient receives stem cells collected from peripheral blood, then the person is said to be having a **peripheral blood stem cell transplant** or PBSC transplant. Peripheral blood donors undergo a process called **apheresis**. For several days before the apheresis procedure, the donor is given medication to increase the number of stem cells in the blood stream. During the procedure itself, the patient's blood is removed from a vein in one arm, transferred into a machine which removes the stem cells and then returned to the donor's other arm. This procedure is less painful and invasive than traditional bone marrow tissue collection.

The third source of stem cells is blood that has been collected from an umbilical cord after a baby is born. If a patient receives cells collected from cord blood, then the person is said to be having a **cord blood transplant**. Umbilical cord blood comes from donations of blood retrieved from umbilical cords to public **cord blood banks** or stored umbilical cord blood samples in private cord blood banks. Only a small amount of blood can be retrieved from this source, so the collected stem cells are typically only used for children or small-sized adults.

Depending on the patient's situation, the patient may receive his/her own stem cells (**autologous stem cell transplant**), stem cells from an identical twin (**syngeneic transplant**) or stem cells from another person (**allogeneic stem cell transplant**). Autologous transplants have an advantage in that the body recognizes its own cells and hence does not trigger an autoimmune response. For people with leukemia, there is the possibility of having cells collected while they are in remission, but there remains a risk of having the sample contain some cancerous cells.

For many patients, an allogeneic transplant from a family member or unrelated donor is the only option. To minimize the immune response, doctor most often use stem cells that match the patient's own stem cells as closely as possible.
To identify matches, doctors identify the **Human Leukocyte Antigens** (HLAs) - protein markers found on the surface of cells – using a blood test (see **Jiao's HLA Family Tree** for more information). The higher the number of matching markers, the greater the chance that the patient's body will accept the donor's stem cells. Close relatives, especially siblings, are more likely than unrelated people to be HLA-matched to a recipient. However, patients only have a 25-35% chance of having an HLA-matched sibling and a 50% chance or better of finding a HLA-matched unrelated donor. The chance of finding an HLA-matched donor is greatly improved when the donor and recipient have the same ethnic and racial background. Although the number of people in bone marrow registries worldwide is growing, individuals from certain ethnic and racial groups still have a lower chance of finding a match than other people.

In general, patients are less likely to develop complications if the stem cells of the donor and patient are closely matched. The degree of difference between the donor and patient's cells will determine the intensity of **Host-Versus-Graft** (HVG) effect (when the patient's immune system [the host] fights and rejects the donor stem cells [the graft]) as well as **Graft-Versus-Host Disease** (GVHD) (when the donor stem cells attack the patient's cells). HVG and GVHD do not occur if the transplantation is autologous (from self) or syngeneic (from an identical twin).

It would seem from the information above, that ideally all patients should donate cells to themselves to avoid transplant rejection-related complications. However, it has been found that for leukemia, the **Graft-Versus-Tumor** (GVT) effect which occurs after an allogeneic transplant is crucial to the effectiveness of the transplant. GVT occurs when white blood cells from the donor identify the cancer cells that remain in the patient's body after the chemotherapy and/or radiation (the tumor) as foreign and attack them.