

The transplantation of organs, cells and tissues is nowadays routine in the treatment of a variety of diseases. The first bone marrow transplant in Sweden was performed at Huddinge Hospital in Stockholm in 1975. Each year some 15,000 allogeneic stem cell transplants (where another person is the donor) and 30,000 autologous stem cell transplants (where the patient is the donor) are now performed around the world.

One function of the bone marrow is to produce stem cells which then mature into red and white blood cells and platelets. In leukaemia, the white blood cells are turned into cancer cells which crowd out the normal bone marrow cells.

Stem cell transplantation is used primarily as a treatment for leukaemia, severe aplastic anaemia, congenital immunodeficiency disorders and hereditary metabolic disorders.

#### INVALUABLE DONOR REGISTER

The transplantation of stem cells from a healthy donor, known as allogeneic stem cell transplantation or allogeneic bone marrow transplantation, is a common treatment for recurrent leukaemia. The tissue match between donor and recipient must be much closer with this type of transplant than for an organ transplant, as it is the actual immune system that is being transplanted.

The tissue types in question, known as HLA antigens, are found in most of the body's cells. The genes that code for these antigens are inherited from one's parents, and each set of siblings can have four different combinations. This means that a quarter of all siblings are HLA-identical. Transplantation between HLA-identical siblings is ideal when it comes to both organs and stem cells. However, it is also possible to use unrelated HLA-identical donors or HLA-identical parents, as is the case with around one per cent of patients.

There are a number of registers of voluntary stem cell donors and umbilical stem cells, of which the largest, with four million donors, is in the USA. In Sweden the Tobias Register at Huddinge Hospital contains 40,000 donors.

#### TREATMENT

Before the transplant, the patient is treated with chemotherapy, with or without whole-body radiotherapy, to kill the diseased cells in the marrow and make space for the new healthy

stem cells from the donor.

Either bone marrow can be taken straight from the donor, or stem cells can be taken from the donor's blood or from blood remaining in the umbilical cord after a baby is born. With the first option, bone marrow is harvested straight from the pelvis of the anaesthetised donor, placed in a blood bag and then given to the recipient as an intravenous transfusion.

Where the stem cells are taken from the donor's blood, the donor must first be given a special drug for five days which causes the stem cells from the bone marrow to release into the bloodstream. The blood is then tapped from a blood vessel in the donor's arm and runs into a device where the stem cells are collected while the red blood cells are returned to the donor. The stem cells are then given to the patient as a transfusion. The benefits of this method are that the donor does not become anaemic and more cells can be given to the patient.

A third option is to use umbilical cells from a newborn baby. The advantage of this is that not such a close tissue match is needed when the stem cells come from umbilical blood.

It takes about two to three weeks for the transplanted stem cells to produce sufficient numbers of blood cells for this to be detected in the patient's blood. During this period the patient is highly susceptible to infection because the chemotherapy and radiotherapy before the transplant wipe out the body's own immune system. This increased sensitivity to infection can persist for a long time after transplantation, in some cases several years, as the newly formed immune defence needs time to mature.

#### SIDE-EFFECTS

It is unusual for the body to reject the transplanted cells. If this does happen, the patient has to be given another transplant, either from the same donor or from a different donor.