



Workshop:

Ethical aspects of stem cell repositories and stem cell databases  
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### **STEM CELLS IN CORD BLOOD BANKS: Eliane Gluckman**

Cord blood cells have been shown to contain a high number of haematopoietic stem cells that can be used for allogeneic transplant to treat many kinds of haematopoietic disorders. Cord blood also contains non-haematopoietic stem cells, which can be used in the future for tissue or organ replacement.

There are two ways of using the cells:

- autograft (transplanting the patient's own cells after radiological treatment). The autograft method is used for treating malignant diseases and non-hereditary diseases. Using autograft method mortality is less than 5%.
- allograft (transplanting from a donor, e.g. a family member, to the patient). This method is used to treat both malignant and non-malignant diseases. Mortality is 15-30%, due to rejection. Most transplantations are performed with allogenic donors.

The sources of haematopoietic stem cells are:

- foetal liver from aborted foetuses
- cord blood collected at birth from placenta
- bone marrow collected under general anaesthesia from adults and children
- mobilised peripheral blood after stimulation by growth factors and cytopheresis.

The donor must be carefully selected, taking age and other factors into consideration. Younger cells, for example, have a greater capacity of engraftment, live longer and cause less immune adverse reactions.

#### **Cord blood banking - advantages**

Cord blood banking has many advantages. For the recipient, the time required to find a donor is reduced, there is no risk of last-minute consent refusal, and there are high numbers of potential donors. There is also a decreased risk of graft versus host diseases as well as decreased risk of transmission of infectious diseases. In addition, the use of HLA mismatched donors is possible.

Cord blood banking also has the advantages for the donor. The process of collecting cord blood is very easy and generally considered harmless to both the woman and the baby. The Commission did once receive a letter from a midwife, arguing that there were risks for the donor. She argued that collection of this blood could result in brain damage, since the baby would be deprived of the resource so important for its wellbeing. It is not necessary to use the early clamping method, however. The first priority is a healthy delivery and a healthy baby, and nothing is done that could harm the baby. It must be noted that paediatricians and obstetricians have no consensus on whether this is good or bad for the baby (as it removes some cells that the baby will not need). To ensure that the procedure is harmless the selection of donors must be very careful: only in-term deliveries and healthy babies may be chosen. It is important to focus on quality rather than on quantity. It can be argued that cord blood collection in the developing countries of Africa and Asia could be problematic, since people suffer from malnutrition.

Besides the safe collection procedure, another advantage to the donor is that there are no risks related to anaesthesia. Cord blood is collected in a bag after the cutting of the cord. The advantages of this method are the easy access, the large number of donors, low risk of contamination and direct availability for transplantation purposes. Yet another advantage of cord blood banking is the diminution of the psychological stress to the child donor.

### **Cord blood banking - disadvantages**

Using cord blood also has some disadvantages both for the recipient and the donor. The disadvantages for the recipient are the delay of engraftments; too few stem cells in the cord blood (insufficient to treat adults); a delay of immune system reconstitution and a lesser antitumor effect as well as the risk of transmission of hereditary disorders undiagnosed at birth.

For the donor, in related cord blood transplants there is the problem of children conceived for the purpose of becoming donors for their sick siblings as well as the problem of pre-implantation diagnosis and selection of embryos that would be compatible donors for the sick sibling. There is also the problem of autologous use of cord blood for commercial purposes as well as commercialisation and patenting of stem cell lines from cord blood.

### **Cord blood banking - history**

The first cord blood transplant was carried out in 1989. In 1992-1993 the first cord blood banks were established in New York, Paris, Milan and Düsseldorf. The Eurocord group was established in 1995. In 2002 the cord blood cells were first used in adults with promising results and in 2003 the criteria of cord blood choice and indications were established.

Cord blood cells are contemporarily used in treatment of leukaemia and lymphoma, and there are plans for use in gene therapy.

### **Eurocord & Netcord**

The task of the Eurocord is to develop cord blood transplantation and to establish the European registry (Eurocord registry) of patients treated with cord blood cells.

The Netcord public cord blood bank organisation takes care that the international exchange is of best quality and matches the international set of Netcord standards. Netcord also manages a virtual office to search the web for matches. Netcord also closely collaborates with Eurocord, which works with banks, transplantation centres and is responsible for dissemination of results and quality control.

Cord blood banks currently exist in Australia (AusCord), in Barcelona, in Düsseldorf, in France (FranceCord), in Helsinki, Jerusalem, Leiden, Leuven, Liege, London, Milan, New York, Prague, Telhashomer, and Tokyo. The biggest one is in New York. However, this cannot be considered as a complete list, as many cord blood banks are not yet part of a network. This has to be compared with the worldwide unrelated bone marrow donors' registries: there are a total of 3 million unrelated bone marrow donors in Europe and 8 million worldwide. The median search time to find a compatible bone marrow donor is three months.

When cord blood is banked the potential donors are identified (only normal pregnancies and healthy, big babies are selected, thus causing no harm to the donor), the informed consent of the donor is obtained, the cord blood collected after the cutting of the cord. Then the blood is transported to the laboratories, where some cells are removed for further testing. Special sample testing is performed and the matches made.

There were three cord blood banks in France in 2003: in St Louis, in Besancon and in Bordeaux. Belgium leads the world in the number of cord blood bank units per capita: there are 7.4 units for every 10 000 inhabitants.

### **Public or private?**

For allogeneic transplants public cord blood banks are used whereas private ones tend to be used for autologous transplantations. The public cord blood banks are used for haematological transplantations. They are founded by political decision, financed by public funding and need to be accredited to be able to function. The disadvantage is that the number of donors is insufficient. The private banks are financed by private funding and are candidates for accreditation. Their disadvantages are the limited indications of autologous transplants.

There are more public than private cord blood banks in the United States and in Europe, but in Australia there are more private than public ones, and in Asia the situation is similar. In general, the private sector is increasing very rapidly. Italy is the only country to explicitly forbid private banking. Only France and Canada refer explicitly to the status of cord blood (whether it is an organ, or a tissue, or *res nullus*).

Only the therapeutic use of cord blood has been regulated so far. Its scientific and industrial use have not yet been regulated. Nor has the obtaining of informed consent (who should be asked and when), nor the issue of property (who should be the owner of the cord blood – the parents or the bank).

Cord blood is a unique biological resource for haematopoietic transplantations - for regenerative medicine as well as for scientific research. There is therefore a

need for increasing the number of units stored. The organisation and collaboration between public, mixed or private sector must also be discussed in the future.