



C-Obs 18

Umbilical Cord Blood Banking

Umbilical Cord blood represents a rich source of Haemopoetic Stem Cells (HSC). The major clinical use of cord blood stem cells has been in the treatment of haematological malignancy in children. Currently about 20% of stem cell transplants for young patients are cord blood transplants. Umbilical cord blood (UCB) as an alternative to bone marrow as a source of HSC for allogeneic transplantation has a number of potential advantages for both adults and children including availability, extension of the donor pool, lower incidence of graft versus host disease, can be transplanted with a higher degree of HLA mismatch, and lower incidence of viral transmission.

Current uses of umbilical cord blood include

1. *Cord blood transplants (CBT) from related donors*
Cord blood transplantation is particularly useful for treating children with haemoglobinopathies
2. *Cord blood transplants in children from unrelated donors*
CBT is a good option for children with haematological malignancy who lack a related donor.
3. *Cord blood transplants in adults from unrelated donors*
Results of HSC transplants in adults with haematological malignancy are encouraging

There is substantial speculation about the use of cord blood non-HSC in treatment of a variety of acute and chronic conditions and there is increasing interest in the use of fetal-derived stem cells in the treatment of neurological and other disorders. This interest in umbilical cord blood stem cells has arisen for two reasons. First, recent research has established that UCB stem cells can demonstrate plasticity (i.e. the ability under the correct conditions to differentiate into a variety of cells other than blood cells, such as neural cell, cardiac cells and osteoblasts), suggesting a role for them in the treatment of diseases such as diabetes, cerebral vascular disease and Parkinson's disease. Second as the collection and use of UCB cells does not involve the destruction of an embryo, their use in research and therapy avoids many of the moral concerns raised by embryonic stem cell research.

In 2000, the Commonwealth Government assisted in the establishment of an Australian National Cord Blood Collection Network (NCBCN). The Australian Bone Marrow Donor Registry (ABMDR) was contracted to manage the (four year) "Development Phase" of the National Cord Blood Collection Network.

The network was officially launched under the name "AusCord" in September 2002. Australia now has three public UBC banks (including 11 collection centres), located in Sydney, Melbourne and Brisbane and nationally coordinated by AusCord.

The main objectives of the network is to collect, process and store 22,000 searchable, TGA compliant Cord Blood Units, (including 2,000 indigenous units) for the purpose of transplantation and to establish a computerised national registry of Cord Blood Units for the purpose of searching, matching and distributing Cord Blood Units.

In New Zealand the government has been lobbied to establish a public UCB bank, but so far have declined to fund this initiative. Private UCB banking is available.

Types of Cord Blood Donation

4. *Altruistic (non directed) donations*

Thirty percent (30 percent) of Australian patients in need of an allogeneic bone marrow transplant have a suitable family donor, that is, 5 or 6 out of 6 Human Leucocyte Antigen (HLA) matched close relative. Of the remaining 70 percent of patients, only 20 – 25 percent are able to find an unrelated bone marrow donor on the existing registries. Therefore, over 50 percent of patients in need of an allogeneic transplant do not have a histocompatible related or unrelated donor. This same group may be eligible for a cord blood transplant as it is known that the degree of compatibility between the patient and the cord unit does not need to be as stringent as in bone marrow transplantation, with matching acceptable to a level of 4 out of 6 match. This is because graft-versus-host disease is lower in cord blood transplants at a given level of match, thereby increasing an individual's chances of finding a suitable cord blood donation at an acceptable level of match. The main indication for cord blood transplantation is relapsed acute lymphoblastic leukaemia in children.

Following the experience at the New York Cord Blood Bank and the National Marrow Donor Program in the United States in identifying suitably matched donors (5 out of 6 and 6 out of 6 HLA matches) for patients, the NCBCN expect that a collection of 20,000 cord blood units will enable 80 – 90% of Australian requests to be met.

5. *Directed donations in at risk families*

The collection of cord blood units for use by siblings born into a family where there is a known genetic disease amenable to HSC transplant remains a recommendation. If the cells are HLA-compatible they may be used for an affected child. If not, they may be useable for a future HLA-compatible sibling.

6. *Directed donations in low-risk families*

It is estimated that of approximately 200,000 placental blood units stored for the exclusive use of the baby from whose birth the placental blood was obtained, at most, 74 units (and this is very likely a gross overestimate) might "possibly" be used and 199,926 would be taken out of circulation for use by patients who require an allogeneic transplant¹.

This is a rapidly progressive area of clinical medicine. It is possible that future advances may attach considerable value to these cells, in the event of childhood or adult-onset disease in the individual from whom the stem cells were obtained.

On the other hand, it is also possible that parallel advances in genetic manipulation of donor stem cells may render the expense of a directed donation unnecessary.

If a donor developed a haematological malignancy and required a transplant in the future their own stored cord blood is generally not recommended to treat their subsequent malignancy. The use of that cord blood for an HLA-compatible relative is theoretically acceptable if permitted in the contract with the private facility storing the stem cells.

At this stage, each individual should make a decision, weighing the considerable cost of directed donation against an uncertain probability of future benefit.

Practical implications of cord blood collection

A limited number of hospitals are funded to arrange altruistic cord blood collections for AusCord. There are a number of challenges that remain. Collection and storing UCB is expensive and logistically complex. Also public UCB banks are still characterised by under-representation of many ethnic groups, particularly Aboriginal Australians and Pacific Islanders.

Cord blood collection for private UCB banks does impose some burden on obstetricians and midwives, including:

- Completion of associated paperwork.
- Interference in the management of the third stage to allow cord blood collection at a time when the mother is at risk of postpartum haemorrhage.
- Pressure to collect sufficiently large volume of blood as there is a minimum requirement in the volume of blood that can be stored.
- The requirement for adequate aseptic technique.
- The necessity for staff in public hospitals to be trained to perform cord blood collection.

The ethics and clinical usefulness of private UCB banks has been questioned. A number of professional groups have raised concerns about the marketing campaigns used by private UCB banks, arguing that these banks frequently use powerful advertising designed to sell possible, rather than real, applications of UCB, to capitalise on parental anxiety about their child's future, and on hopes that stem cells will soon deliver therapeutic applications. Hospitals need to develop their own policy on how to respond to prenatal request for cord blood storage through commercial providers.

Recommendations

The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) supports the collection of altruistic and directed cord blood donations in at risk families.

The routine collection of directed donations in low-risk families (private UCB banking) must consider both the cost and an uncertain probability of future benefit.

References

1. Placental Blood Transplant and Autologous Banking – Caveat Emptor Johnson, F.L. *Journal of Paediatric Haematology / Oncology*, Volume 19 (3); 183 – 186.
2. Umbilical cord blood banking: public good or private benefit? Samuel GN, Kerridge IH, O'Brien TA. *Med J Aust* 2008 May 5;188(9):533-5. Review

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