



Volunteer cord blood banking and transplantation

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Cord blood banking is a prerequisite for cord blood transplantation,¹ which is used increasingly (mainly in children) to treat serious diseases of the bone marrow, blood, and immune system.

Excellent outcomes are achieved using family or unrelated donations similar to allogeneic haemopoietic transplants from other sources (bone marrow or peripheral blood stem cells).^{2,3} Placental blood has advantages; these include easy and prompt access, the absence of risk in the donation procedure (mother and baby), the need for less rigorous HLA-matching (improving the odds of matching for minority populations under-represented on adult donor registries), and reduced risks from transmitted viruses and graft versus host disease.¹⁻³

Trained personnel are needed to collect >80 ml of placental blood for banking—at least 2×10^7 nucleated cells/kg recipient's weight are necessary in allogeneic transplantation to reduce the risk of rejection and disease relapse; the more the better.⁴ Cord blood cells are viable after 15 years of storage⁵—however it is predicted that these will survive longer if kept under the right conditions.

The success of paediatric cord blood transplantation has led to the development of at least 37 volunteer cord blood banks in 21 countries, funded to varying degrees by governments and/or public donations. Accredited registries must comply to minimum standards and codes of conduct of their umbrella organisations, the Foundation for the Accreditation of Cellular Therapies and NETCORD. In this country, these are accessed for patients by the government-funded New Zealand Bone Marrow Donor Registry (NZBMDR)⁶ through Bone Marrow Donors Worldwide (BMDW).

In recent years, New Zealand patients have been treated using cord blood donations imported from the USA, Australia, Italy, Spain, and Japan. The Ministry of Health (MoH) and the NZ Blood Service (NZBS) have been reviewing the need for a national volunteer Cord Blood Bank since a proposal was submitted by the Leukaemia and Blood Foundation of NZ in 1999 (L Teague)—an outcome is still awaited. One aim was to increase potential donors for Maori and Pacific Islanders, children of mixed ancestry, and ethnic minorities who do not have a family donor. Such patients are less likely than Europeans to have a matched donor on the international bone marrow and cord registries, which allow access to more than 9 million marrow and cord donors currently. However, the recruitment of more than 7,000 healthy Maori and Pacific Island volunteer adults by the NZBMDR has improved the availability of unrelated donors for Polynesian patients.

Some cord blood units contain insufficient cells to treat an adult. Thus cord blood transplantation has only been used in a small number of adults with high-risk disease lacking a histocompatible family or unrelated donor. There is ongoing research using multiple cord blood donations for one adult recipient (producing sustained donor

chimerism)⁷, and *ex-vivo* cell expansion devices to increase the stem cell dose.⁸ Recent studies conclude that HLA-mismatched cord blood should be considered an acceptable source of stem-cells for adult transplantation in the absence of an HLA-matched adult donor.⁹ NZ adult patients with of relatively unique mixed ancestry are sometimes impossible to match locally or from the BMDW, and in those instances rapid access to single or multiple mildly incompatible cord units would be an advantage.

Some patients have received a cord blood transplant from a healthy sibling (not affected by the same condition) usually born after the initial diagnosis. This includes children with familial disorders (such as thalassaemia, immunodeficiency, and inborn errors of metabolism) as well as acquired serious conditions (such as aplastic anaemia and acute leukaemia). This clinical need has led to the development of sibling-donor cord blood programmes.¹⁰ Also, there are increasing situations where pre-implantation genetic diagnosis or HLA typing is performed to produce healthy histocompatible offspring (designer babies) as potential donors for affected siblings.¹¹

In genetic blood disorders, the patient's own stem cells are usually unsuitable for transplant. This is also the situation in a number of acquired diseases including some cases of leukaemia where the malignant cells may be present in the blood in the neonatal period, even though the condition is not apparent for months or years.¹² It is also relevant that many children with serious stem cell defects can be successfully treated without stem cell transplantation—e.g. more than 75% of children with acute lymphoblastic leukaemia are cured using modern chemotherapy.¹³

New Zealand legislation allows umbilical cord blood to be used only to treat the child from whom the stem cells were harvested. However, parents can apply to the MoH for an individual exemption to this rule. The current MoH/NZBS review should include guidelines to store cord blood from healthy children born into a family with a specific medical need requiring transplant,¹⁰ with careful attention to collection and storage standards as well as ethical issues such as the ownership of the cells.

Currently, in New Zealand and internationally, storage of cord blood for future use of that baby is done by several private for-profit cord blood banks for a collection fee and an ongoing annual cost. Although cord blood banks are an option for those who can afford them, the probability that a child will use their own banked cord blood at the current time is extremely low. The most active United States (US) private registry has stated (in September 2005) that it has provided stem cells for 34 clients (mostly siblings of donors) from 250,000 units stored.¹⁴

Because of the proliferation of private cord blood banks in the US of varying standards, the American Academy of Pediatrics issued the following statement:

Given the difficulty of making an accurate estimate of the need for autologous transplantation and the ready availability of allogeneic transplantation, private storage of cord blood as "biological insurance" is unwise. However banking should be considered if there is a family member with a current or potential need to undergo stem cell transplantation¹⁵

Controversies related to private cord banks are further discussed in the accompanying article by Sullivan et al. (Sullivan M, Browett P, Patton N. Private umbilical cord blood banking: a biological insurance of dubious future benefit! URL: <http://www.nzma.org.nz/journal/118-1208/1260>).

Private cord blood storage is also stimulated by research that stem cells can potentially grow into other tissues such as heart muscle and neurones.¹⁶ Such treatment options remain experimental at present—but, in the future, stem cells from a patient's own blood or bone marrow and/or unrelated cord blood might be appropriate treatments. The field of stem cell research and transplantation is rapidly changing and health policy must consider how the medical demand for cord blood may evolve in the future.

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