https://doi.org/10.48047/AFJBS.6.15.2024.1-11

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Umbilical Cord Blood Banking

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Volume 6, Issue 15, Sep 2024

Received: 15 July 2024

Accepted: 25 Aug 2024

Published: 03 Sep 2024

doi: 10.48047/AFJBS.6.15.2024.1-11

ABSTRACT

The maintenance of one's health is a vital component of life that must be prioritised at all times and under all circumstances. Science is undergoing a great deal of change on a daily basis. This novel method of extracting stem cells from cord blood has been found by researchers in the field of science. It is possible for stem cells to renew and store themselves in a variety of tissues. Retrieving and conserving a person's umbilical cord and placenta stem cells for possible use in the future is what cord blood banking is all about. Stem cells are abundant in cord blood, and they have the ability to differentiate into a wide variety of blood cells. These blood cells may be used for the treatment of a variety of illnesses that affect the immune system and blood, including leukaemia and certain malignancies, sickle cell anaemia, and some metabolic disorders. Stem cells that have been transplanted from cord blood have the potential to assist in the regeneration of healthy blood cells after chemotherapy. It has been shown that cord blood has certain characteristics that are comparable to those of bone marrow, and it is a rich source of stem and progenitor cells that may be used in a transplant procedure. Additionally, it has been proposed that cord blood could be a viable alternative to bone marrow for the purpose of stem cell transplantation.

KEYWORDS: "Cord Blood Banking, Leukemia, Cancer, Chemotherapy, Bone Marrow, Stem Cell Transplantation"

INTRODUCTION:

A new life is born into the world at the same time as an opportunity to save others lives (Amin et al., 2016). There is an inseparable connection between mother and child symbolised by the umbilical chord, which is both physically and emotionally present. According to Kumarasamy and Muthulakshmi (2010), "the term cord blood refers to the blood that stays in the umbilical cord and placenta after a baby is born".

Once thought of as a byproduct of childbirth, the stem cell richness of umbilical cord blood has made it a valuable commodity. The immune system and blood are both composed of stem cells. Storing valuable cells after the kid is born might become a significant medical resource for their family in the future, since stem cells in cord blood haven't been exposed to detrimental substances that damage them (Biocell Cord Blood Awareness Month, 2020).

CONCEPT OF UMBILICAL CORD BLOOD BANKING:

Over 200 different kinds of mature cells, each with its own specific role, make up the human body. Stem cells vary from our more developed functional cells in that they possess the incredible capacity to divide and grow into new tissues, in addition to the ability to multiply themselves. Among contemporary medicine's crowning achievements was the identification of stem cells (Patyal et al., 2018).

Umbilical cord blood was formerly thought of as medical trash, but that was before the 1990s. On the other hand, hematopoietic stem cells—cells that produce blood—are abundant in the "umbilical cord blood". It is possible to profit from "umbilical cord blood" stem cells by collecting them from the cord

after the infant is born. Neither the mother nor the baby will be harmed in the slightest by this procedure. All through life, our bodies rely on hematopoietic stem cells to keep the blood supply steady. They have the ability to produce all three types of blood cells: “red blood cells”, “white blood cells”, and “platelets” (Life cell2022)

It was originally suggested in 1974 that human cord blood included stem and progenitor cells; in 1983, the idea of utilising “umbilical cord blood” as a stem cell transplant source was advanced. A six-year-old child in Paris, France, who was suffering from Fanconi's anaemia, had the “first successful cord blood transplant in 1988”. The procedure aimed to replenish the baby's blood and immune system cells (Gluckman et al., 2005).

Umbilical cord blood is now something parents save for their newborn since it has the potential to differentiate into various cell types that may aid in the repair of damaged tissues, organs, and blood vessels as well as the treatment of serious and even fatal disorders (Cryocellinternational, “https://www.cryo-cell.com/cord-blood-banking”)

More than 25,000 transplants have been documented, and there are now more than “1,000,000 units stored in allogeneic and private cord blood banks” across the globe. Donor safety, ease of use, and less public concerns about ethics are just a few of the many advantages that cord blood offers as an alternative source of stem cells.

DEFINITION:

The term "cord blood banking" refers to the practice of collecting, separating, and then cryogenically freezing the immune system cells and stem cells found in umbilical cord blood for possible future medicinal use. Stem cells abound in cord blood (Cryocellinternational, “https://www.cryo-cell.com/cord-blood-banking”).

TYPES OF CORD BLOOD BANK:

Up until recently, the idea of storing cord blood stem cells was completely alien to the Indian populace. But more and more parents are choosing to keep their unborn child's stem cells because of the growing field of regenerative medicine. Community stem cell banks, publicly-owned banks, and privately-held banks in India provide stem cell banking services **(**Life Cell (2020)

ADVANTAGES:

Cord blood banking has many benefits, such as:

Less need for stringent antigen typing:

The use of “cord blood stem cell” transplants, rather than bone marrow transplants, is on the rise. This is because cord blood, in contrast to bone marrow, does not need a specific genetic match between the donor and the receiver.

Less chance for rejection:

In contrast to stem cells taken from bone marrow, the body is less likely to reject those taken from cord blood. Immune system defence against cancer might benefit from cord blood stem cells. Using bone marrow stem cells in this way is not going to work for people (Sullivan, 2008).

Ease of collection:

Collecting cord blood is simple, painless, and less complicated for the donor than collecting bone marrow.

No risk for mother or child:

There is no risk to the newborn or mother.

Less time needed for processing:

It is possible to keep cord blood in a cord blood bank and then utilise it whenever needed by freezing it.

Less costly than bone marrow collection:

"Donation to public cord blood banks may help to save the lives of others".

Reducing the potential for infection spread:

There is less chance for transmission of infection.

DISEASES CAN BE TREATED BY CORD BLOOD STEM CELLS:

Transplants of stem cells derived from "umbilical cord blood" have shown promise in the treatment of many cancer, genetic, hemologic, and immunological diseases. The illnesses of the blood and bone marrow include leukaemia,

lymphoma, and other types of anaemia; disorders of the bone marrow include fanconi's anaemia, aplastic anaemia, thalassemia, and sickle cell disease; disorders of the immune system and metabolism include leukodystrophies and Hurler syndrome (Paul L martin et al 2011)

Experimental treatments for a variety of ailments are being developed using cord blood. These include: Type I diabetes, heart problems, Parkinson's disease, cerebral palsy, brain traumas, pancreatitis, and other autoimmune disorders (Zach Smith-Nurse grid by Health stream 2018)

BLOOD VOLUME TO BE COLLECTED:

The recommended volume of cord blood for family banks is 60 millilitres, or 2 ounces. Even though it's only a little sample, the blood includes a whopping 470 million TNC, or “1.8 million cells that have tested positive for the stem cell marker CD34” (Benjamin Greene 2019).

CORD BLOOD BANKING PROCESS:

The medical professional draws blood from the umbilical cord of the newborn just after birth, before to the delivery of the placenta. A few ounces of blood are drawn from the umbilical vein after the chord is clamped; the area is then cleaned with antiseptic. In addition, microbial contamination testing is performed on each cord blood sample after collection. The cells may survive the freezing procedure with the help of a cryopreserving. To preserve cell viability during freezing, a gradual freezing procedure is necessary. The viability and quality are unaffected by the duration of cryopreservation. The total stem cell counts (“white blood cell count, CD34+ cell count, and ABO

type") will be maintained, and the family will get written confirmation of the findings and a preservation certificate within four to six weeks after collection. (www.cryocell.com)

ETHICAL AND LEGAL ASPECTS OF "CORD BLOOD BANKING":

This procedure is widely accepted and does not raise any ethical concerns, since no lives are being endangered or taken.

Some of the legal aspects are

Informed Consent:

Donating a cord blood unit requires obtaining informed permission, regardless of when the unit is collected or what it might be used for.

Confidentiality:

It is essential to provide donor anonymity protection in order to contemplate cord blood usage in research.

Safety:

To guarantee the safety of transplantable goods and patients undergoing transplants, it is necessary to create secure connections between donor medical information and stored cord blood. With the full backing of the law, these documents must remain secret.

Maintenance of donor records/patient privacy:

The privacy of donor medical records is an essential element in cord blood banking.

Cord blood research:

Although stem cells derived from cord blood units are mostly stored for transplantation, they may also be used for scientific inquiry (E Gluckman2000).

Evidence-Based Practice on Umbilical "Cord Blood Banking":

In order to establish standards for the banking of umbilical cords in India, Sachdeva et al. (2016) relied on a consensus statement from the Indian Academy of Paediatrics in Pune. Many hereditary metabolic problems, haematological diseases, immunological disorders, and cancers have found a treatment by stem cell transplantation from umbilical cord blood, even in cases where there is partial HLA (Human Leukocyte Antigen) mismatch. Both the mother and the baby will be protected during the collecting process. Instead of promoting private banking, public cord blood banks should be encouraged. If a current family member is ill with a condition that is authorised to be healed by allogenic stem cell transplantation, such as a parent or sibling, it is strongly encouraged to bank their cord blood privately. Umbilical cord blood transplantation has a reduced risk of "Graft versus Host disease", a complication found following allogenic HSCT, in comparison to "bone marrow and peripheral blood HSCT".

The usual components of blood are all present in cord blood, including plasma, white blood cells, platelets, and red blood cells. Like bone marrow, it has an abundance of hematopoietic stem cells. In a study titled "Umbilical Cord Blood banking and its Therapeutic uses," Ambika Nand la et al. (2021) found that these cells have the potential to cure certain blood and immune system illnesses. A six-year-old kid with Fanconi's anaemia was successfully treated in 1988 by a team led by Dr. E. Gluckman. They used hematopoietic stem cells transplanted from cord blood. For the treatment of haematological malignancies, immune system disorders, blood disorders, and metabolic disorders, over 35,500 transplants have been performed on both adults and children. Children with

cancer, hemoglobinopathies, metabolic diseases, immune deficiencies, or who might benefit from regenerative treatments have new hope with cord blood transplants.

According to William T. Shearer et al. (2018), the American Academy of Paediatrics (AAP) has updated its guideline on "Cord Blood Banking for Potential Future Transplantation," which discusses the novel uses for hematopoietic cells in cord blood transplants. As of 2013, “more than 30,000 hematopoietic stem cell transplants (HSCTs) were performed worldwide using cord blood as a stem cell source. Here is the breakdown of illnesses: cancer accounted for 57% of cases, hemoglobinopathies for 32.5%, severe combined immunodeficiency disorder (SCID) or related T-lymphocyte diseases for 6%, and other disorders accounted for 1.5%”. In public cord blood banks, over 8,000 units are now on hand, whereas private cord blood banks have over 5,000 units. There has been a steady rise over the last decade in the amount of cord blood units donated to patients older than 16 years. Because of this recent breakthrough, researchers are looking for a more practical HSCT approach that may be used using cord blood.

Conclusion:

Cord blood has been recognised as a viable option to bone marrow transplants since the first transplant using umbilical cord blood occurred in 1988. Cord blood offers a number of benefits over bone marrow, such as being readily available, posing less danger to the donor, and requiring less strict HLA matching. The number of cord blood transplants conducted globally, regardless of relationship, exceeds twenty thousand. Cord blood is more readily accessible than bone marrow or peripheral stem cells, and it is linked to a reduced incidence

of graft-versus-host disease in transplant patients.Therefore, stem cells found in cord blood may help shield future generations from potentially fatal diseases.Hematopoietic stem cells may repair damaged blood cells of any kind, saving the lives of youngsters afflicted with cancer and other deadly disorders.

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