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INTRODUCTION

Cord blood is the blood from the new born baby that is left in the umbilical cord and placenta after birth. It contains special cells called hematopoietic stem cells. Cord blood collection begins at the start of the third stage of labor, immediately after delivery of the infant irrespective of vaginal or caesarean section delivery. It is collected by inserting a sterile needle into the umbilical vein and allowing gravity to drain the blood into a collection bag (FDA approved and heparin free). The collection bag is a closed system which minimizes the risk of bacterial and fungal contamination. The entire collection process takes approximately 5 to 10 minutes and on an average 75ml of blood is collected. A small segment is placed into the provided collection jar after cleaning the umbilical cord. Three tubes of maternal blood are also collected. Cord blood and cord tissue can be kept at room temperature. They are safe to remain in the collection kit for up to 72 hours prior to arriving for processing. Before the cord blood is stored it undergoes viral testing, including tests for HIV and Hepatitis B and C, and tissue typing to determine Human Leukocyte Antigen type, nucleated cell count, cell viability, blood group antigen ABO & Rh blood group system, molecule cluster, and bacterial and fungal growth. After processing the cord blood is cryopreserved. Cord blood can be saved indefinitely.

Cord blood may not be collected if mother has known hereditary diseases, specifically involving hematopoiesis in the family or if severe disabilities or diseases are identified in the donor foetus before birth, presence of infectious diseases e.g., HIV, hepatitis in the mother, severe pregnancy related complications or premature delivery with birth weight less than 1,500 g or if perinatal asphyxia is present.

HISTORICAL ASPECT

Dr. Hal Broxmeyer discovered the presence of hematopoietic stem and progenitor cells in human cord blood in 1985. First successful related cord blood transplant was conducted in Paris, France, on a six-year-old male patient from Duke suffering from a blood disorder called Fanconi's Anemia in 1988. First public bank for umbilical cord blood was established by Dr. Pablo Rubinstein at the New York Blood Center through funding provided by the National Heart, Lung and Blood Institute (NHLBI) of the National Institutes of Health (NIH) in 1992. First unrelated cord blood transplant in the world was performed by Dr. Joanne Kurtzberg at Duke University's pediatric Blood and Marrow Program in

1993. FDA launched an Investigational New Drug (IND) for cord blood under the Cord Blood Transplantation Study (COBLT). The study was sponsored by the National Heart Lung and Blood Institute (NHLBI) in 1996. National Marrow Donor Program (NMDP) launched cord blood program in 1998. U.S. Congress passed national cord blood legislation, The Stem Cell Research and Therapeutic Act of 2005 (H.R. 2520), to create a national inventory of 150,000 diverse, high-quality cord blood samples in 2005. A total of 31 UCBTs were performed, mainly in paediatric and adolescent patients; only four UCBTs were performed in adults by the end of 2008. Over 30,000 unrelated cord blood transplants performed by 2012.

BENEFITS OF SAVING CORD BLOOD

Umbilical cord blood (UCB) contain hematopoietic stem cells (HSC) and it is recognised as an alternative source of HSC after bone marrow. UCB HSC have greater proliferative and colony forming capacity, and are more responsive to some growth factors. Because they are more 'naïve' than proliferative cells from bone marrow, they seem to produce fewer complications associated with HSC transplantation. The major clinical use of cord blood has been for haematological malignancy mostly in children. In a survey from the International Bone Marrow Transplantation

Registry (IBMTR) estimated that since 1998, one-fifth of stem cell transplants performed for patients less than 20 years old are cord blood transplants, mostly for acute lymphoblastic leukaemia or acute myeloblastic leukaemia. For treating cancer, as per studies, the transplant dose should be at least 25 million TNC per kilogram of patient body weight (1 kilogram equals 2.2 pounds). The average cord blood collection holds 8.6 million TNC per ml.

To overcome the low cell content of single UCB units, various alternatives have been used. Multidonor UCBTs of up to 12 units have shown that crossed immunological reaction between the units does not occur. The simultaneous transplantation of 2 partially HLA-matched umbilical cord blood units (double umbilical cord blood transplantation, dUCBT) has also been used to overcome cell dose limitations. The first dUCBT was performed in Europe in 1999 on 2 adults with acute lymphoid and chronic myelogenous leukemia. From 1999 to March 2010, 1,152 dUCBTs, combined with conditioning of various intensities, have been performed in patients with hematologic malignancies who could not find suitable unrelated donors. There is little published evidence is currently available on the long-term immune

reconstitution and clinical benefit of dUCBT. A reasonable limitation of dUCBT is the cost of 2 umbilical cord blood units, especially from unrelated donors, and the costs of hospitalization due to the low engraftment rate.

ADVANTAGES OF CORD BLOOD

- It is a readily available source of hematopoietic stem cells.
- It is an alternative to bone marrow or peripheral stem cell transplantation to treat malignant and non-malignant conditions in children and adults.
- Lower incidence and severity of graft versus host disease.
- Lower incidence of viral transmission: in particular, cytomegalovirus and Epstein-Barr virus.
- Faster availability- patients on average receive cord blood transplantation earlier than those receiving conventional bone marrow grafts.
- It is harder to collect bone marrow than it is to collect cord blood. Collecting bone marrow poses some risks and can be painful for the donor.
- Cord blood transplantation tolerates a mismatch of tissue types between donor and the recipient greater than is acceptable with bone marrow or peripheral blood.
- Because of the ethnic diversity of donors of cord blood, there is a higher frequency of non-Caucasoid HLA haplotypes available compared with bone marrow registries
- Bone marrow donors may change their mind over time or may no longer be available.
- In case of related donors, HLA-identical sibling cord blood transplantation has been performed almost exclusively in children. The lower risk of both treatment-related mortality and chronic graft versus host disease makes cord blood transplantation a particularly successful option for children with haemoglobinopathies.
- Cord blood transplants from unrelated donors for children has been associated with sustained engraftment, a low incidence of graft versus host disease and no higher risk of leukemic relapse.
- There is a theoretical hope that stem cells will be a crucial part of future treatments for diabetes, Alzheimers, spinal cord injuries, heart failure, stroke etc.

DISADVANTAGES OF CORD BLOOD

- Low numbers of haemopoietin progenitor cells and stem cells in each cord blood donation, may cause delayed engraftment.
- Cord blood has a limited number of stem cells, not enough to treat most adults.
- Lack of availability of subsequent donations of

stem cells and/or lymphocytes from the graft donor in graft failure or disease relapse.

- Own cells may be inappropriate in genetic conditions including some leukaemia's, because they may carry leukaemogenic mutations.
- Only half to a third of samples yield mesenchymal stem cells and clinical uses for mesenchymal cells are speculative.
- Child may never need it and possible benefits are too remote to justify the costs.

CORD BLOOD BANKING

Cord blood banking is a personal decision of parents. Some people feel that the potential benefits are too few to justify the money. Others believe that it's a worthwhile investment. Cord blood stored in private banks are used for either autologous or allogeneic transplants for the infant donor or related family member. Cord blood is considered a treatment option in pediatric and adult patients with hematologic malignancies and disorders (leukemia, thalassemia, sickle cell disease, etc.) bone marrow failures, inherited metabolic disorders, immunological defects and other genetic diseases. More than 25,000 allogeneic cord blood transplantations have been performed worldwide since the first cord blood transplantation in 1988. In an autologous transplant, the cord blood collected at birth is used by the same child. This type of transplant is rare because a child's stem cells cannot be used to treat genetic diseases in that child as all of the stem cells have the same genes that cause the disease. In an allogeneic transplant, the donor can be a relative or be unrelated to the child. For an allogeneic transplant to work, there has to be a good match between donor and recipient.

Two types of cord blood banks are available-public and private and accreditation of FDA, ISO is mandatory. Public cord blood banks accept donations to be used for anyone in need and use national registries to find recipients for their samples. Private cord blood banks store cord blood solely for potential use by the donor or donor's family. Cord blood transplantation doesn't require an exact genetic match, which makes it easier to provide patients samples form unrelated donors. Private banks, in USA e.g. Viacord, CBR, and Americord, charge around \$2,000 for the collection and around \$200 a year for storage which is not covered by insurance. But private storage of one's own cord blood is unlawful in Italy and France, and it is also discouraged in some other European countries.

Public and private both cord blood banks takes care of the costs involved in the collection, transport, processing and storage. As public banks accepts donations of cord blood it is done at free of cost but private banks charges vary from 70,000/- to 90,000/- per year and EMI,s are available just as insurance companies. Private cord blood banks are available in Ahmedabad, Bengaluru, Chandigarh, Chennai, Hyderabad, Jaipur, Kolkata, Lucknow, Mumbai, New Delhi and Pune in India. A free e-book of list of these banks is made available on www.superbabyonline.com.

408 The most important debatable question is “Is it worth spending on cord blood storage which might never be used?” Considering all the above facts donations of cord blood to public cord blood banks for the purpose of treatment and research should be promoted.

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