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# Study on Umbilical Cord Blood Banking for Stem Cells and its Associated Therapeutic Uses

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## Abstract:

*In current scenario, number of fatal diseases are increasing drastically which can not be cure by normal treatments. These fatal diseases now can be treated by umbilical cord blood, the richest source of haematopoietic stem cells. Stem cells have the potency of converting itself into any type of organ specific cells and then forming organ specific tissues therefore helpful in healing the damaging tissues or curing the fatal diseases. The present study is discussing about the umbilical cord blood banking for stem cells and its associated therapeutic uses. Collection and banking of umbilical cord blood (UCB)-derived cells have become a popular option worldwide. Cord blood banking is the preservation of the umbilical cord blood which is collected just after the baby birth. Due to the involvement of the professional organizations and their published standards, UCB banking has very much improved with the passage of time.*

***Keywords:*** *Stem Cells, Umbilical Cord Blood, Cord Blood Banking, Pluripotent, Therapeutic Uses.*

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**Introduction**

In the world of new findings and around more than 130 million global annual births, Umbilical Cord Blood (UCB) is the most plentiful source of the stem cells having the potential of regeneration for clinical significance. It provides effective cure by the spectrum of diseases and mostly used against the blood disorders (Roura *et al.*, 2015). Although the technologies have been advanced in the field of stem cells, still there are many people unaware about the stem cells, and its technologies, developed for the health care worldwide.

**Stem Cells**

In 1900s, Maximow proposed that the lymphocytes migrated through tissues to form blood circulation components and acted as common stem cells. In 1960s, the research on stem cells cleared its beginning as known today. Stem cells can be defined as the cell having the capacity to divide and make its copy or may transform into any type of cells. Stem cells can be classified as totipotent, pluripotent, multipotent or unipotent depending on its potency. Stem cells can be categorized according to its source of origin that from which tissue it is obtained named as Embryonic Stem Cells, Adult Stem Cells, Induced Pluripotent Stem Cells, Neonatal Stem Cells and Umbilical cord blood stem cells.

**The umbilical cord as a source of stem cells**

Since 20 years, umbilical cord blood has been used clinically as a source of haematopoietic stem cells transplantation. The embryo attached via connecting stalk to form placenta from the third week of developmental process which transforms into the umbilical cord afterwards. The stem cells can be provided by the umbilical cord through blood running in the umbilical vessels, walls surrounding the vessels and from the Wharton's jelly, which are collected at the time of birth using sterile collection kit having anticoagulant (usually citrate or heparin) in it (Forraz and McGuckin, 60-62).

**Umbilical Cord Blood Banking**

Umbilical cord blood are thought to be very much helpful in curing thr number of genetic diseases, cancer, blood malignancies, inherited metabolic disorders, bone marrow failures and immune deficiencies, as it is the rich source of stem cells. UCB contains many life saving cells therefore it is very useful to preserve them by UCB banking. Main significance of the UCB banking is to treat the genetic diseases which cannot be treated by the normal treatment. UCB donors need to sign the consent form before collecting the blood. Collection can be done by simple matter of venipuncture and drainage to the sterile container (Roura *et al.*, 2015). Cord blood is collected in collection bag using gravity, when the placenta is still inside the uterus by puncturing the umbilical vein (Sivakumaran *et al.*, 163). After the collection, blood is sample is place in sterile bag of approximately 250 ml in size and place in extraction kit in which temperature, pH, $CO_2$ and $O_2$ levels should be depend on the the time and external conditions (Roura *et al.*, 2015). The storage and transport temperature should be maintained at $22° \pm 4°C$ and blood must be labeled, volume recorded and weighed excluding the weight of bag (Butler and Menitove, 2011). For the cryopreservation of the cord blood, UCB is placed in an automated microprocessor-controlled rate freezer. The cold freezing cryopreservative solution containing 60% DMSO should be added after the WBCis chilled. Cryopreservation of methodology involves 1ºC/min cooling down to -60ºC, and then a drop to -120ºC, 5ºC/min. At last of this procedure it must be stored in liquid nitrogen freezer (Sivakumaran *et al.*, 163).

**Therapeutic Uses of Umbilical Cord Blood**

UCB of human provide unresolved health treatment because of having rich source of hematopoietic stem cells, totipotent cells and pluripotent cells. Cord blood is termed as regenerative medicine as it has the capability to develop into organ specific cells to form organ specific tissues. Some fatal diseases such as cancer Alzheimer's, Arthritis, Asthma, Diabetes, Heart disease, Strokes and blood disorders can be completely cured by UCB. Following are some examples of diseases treated with UCB transplant.

**Table 1: Examples of Diseases Treated with UCB Transplant**

| Cancers | Blood Disorders | Congenital Metabolic Disorders | Immunodeficiencies |
|---|---|---|---|
| Acute Lymphocytic Leukemia | Sickle-Cell Anemia | Adrenoleukodystrophy | Adenosine Deaminase Deficiency |
| Acute Myelogenous Leukemia | Fanconi's Anemia | Gunther's Disease | Wiskott-Aldrich's Syndrome |
| Chronic Myelogenous Leukemia | Thalassemia | Gaucher's Disease | Duncan's Disease |
| Myelodysplastic Syndrome | Evan's Syndrome | Hurler's Syndrome | Ataxia-Telangiectasia |
| Neuroblastoma | Congenital Cytopeni1a | Hunter's Syndrome | Digeorge's Syndrome |
| Hodgkin's Disease | Aplastic Anemia | Krabbe's Disease | Myelokathexis |
| Non–Hodgkin's Lymphoma | Diamond–Blackfananemia | Sanfilippo's Syndrome | Hypogammaglobuline Mia |
| Burkitt's Lymphoma | Amegakaryocytic Thrombocytopenia | Tay-Sachs' Disease | Severe Combined Immunodeficiency |

**Source: (Sivakumaran *et al.*, 166, 167).**

**Review of Literature**

**Forraz and McGuckin, 2010** proven that the placental and umbilical derived tissues must be considered for use. There is no ethical controversies in cthe collection of these umbilical cord only is the matter about is potential for defined clinical trials. The also stated that government need to be ready for the cell therapy to allow rapid transition of cells to hospital and clinics.

**Butler and Menitove, 2011** continued to calculate the efficacy of cord blood cells in the treatmet of human diseases including heart diseases, strokes, brain or spinal cord injuries and cancer. The review gives the summary of status of umbilical cord blood banking, history and current uses in curing the human disease.

**Ding *et al*., 2015** concluded that Human umbilical cord mesenchymal stem cells has many effective advantages such as it is a noninvasive collection procedure and have lower risk of infection. It has also a nontumorigenesis, multipotency and low immunogenicity. Although it is best for the clinical use, still not known.

**Lopes *et al*., 2016** identified factors related to the quality of UCPB specimens defined best method of their collection within an UCPBB. According to them, there is need to develop and improve the technical skills of the obstetrical team. The practices listed in this study is proved to be helpful in obstetrical professionals.

**Nasadyuk, 2016** studied at the objective umbilical cord stem cells: biological characteristics, approaches to banking and clinical application and stated about the importance of umbilical cord in clinical applications and biobanking.

**Kowsari *et al*., 2017** concluded that in future there will be vast need and demand of the umbilical cord blood stem cells. It is demonstrated by the recent medical progress that these cells could be used to treat the disease because the haematopoietic stem cells are available in bone marrow. These cells are now being used for the treatment of approximately 80 diseases including cancer, immune deficiencies, cardiovascular diseases, neurological disorders and blood diseases.

**Babu, 2017** discussed in his review study that stem cells plays an important role for regenerative medicine and contribute in natural healing of damaged tissues and give a huge amount of therapeutic potential. Study on treating more diseases with cord blood is still going on by many scientists like many researchers are doing trials for cerebral palsy and hypoxic ischemic encephalopathy by using patient's own cord blood.

**Conclusion**

The present study is on review study of umbilical cord blood banking for stem cells and its associated therapeutic uses. In this review, it is discussed that umbilical cord blood banking is very much significant for the need of stem cells in future for curing fatal diseases. There are many therapeutic uses of umbilical cord blood in the treatment of genetic fatal diseases which are also enlightened in present review study.

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