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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 cause 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 about the process of collecting and banking of umbilical cord blood (UCB)-derived cells. These blood cells are collected and preserved just after the birth of the baby, this procedure is known as Cord blood banking. 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

Umbilical Cord Blood (UCB) is the most abundant and important 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 that migrate from tissues to blood is actually stem cell. 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 ON THE BASIS OF POTENCY.

- Totipotent,
- Pluripotent,
- Multipotent or unipotent

Stem cells can be also categorized on the basis of source of origin or the location of their formation:

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

Blood found in Umblical Cord is the major source for transplantation of haemopoietic stem cells. The embryo is attached via connecting stalk to form placenta from the third week of embryo development which later metamorphose into umblical cord. The stem cells comes from the umbilical cord through blood present 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 in it (Forraz and McGuckin, 60-62).

Umbilical Cord Blood Banking

Umbilical cord blood are thought to be very much helpful in curing a 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.UCB is very helpful in cure lethal genetic diseases. 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 sample is placed 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 depend on the the time and external conditions (Roura *et al*., 2015). The packaging and transportation temperature should be sustained 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. 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 is a boon to medical and health care sectors. 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 ailments like as cancer Arthritis, Alzheimer's, Diabetes, Asthma, Heart disease, Strokes and blood disorders can be entirely 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

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

Review of Literature

Forraz and McGuckin, 2010 established that the umbilical and placental derived tissues must be considered for use. There is no moral disputes in cthe gathering 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 advance and expand the technical services 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.

Babu, 2017 discussed in his review study that stem cells plays an important role for reformative 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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