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Umbilical cord preservation- A Review

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Abstract

Umbilical cord (UC) is the main connection between mother and the growing fetus. It acts as the career of nutrients helps in exchange of gases etc. The length of the UC is approximately 20 inches. UC is of main interest for researchers in the recent times. The umbilical cord blood (UCB) has been fruitful source of Stem Cells. UCB helps in the reformation of different blood components. The umbilical cord provides the growing embryo with oxygen, nutrient-rich blood from the placenta. In the same manner, the fetal heart pumps deoxygenated, nutrient-depleted blood through the umbilical arteries back to the placenta.

***Keywords:** Umbilical cord; Umbilical cord blood; Stem cells*

Introduction

"The umbilical cord blood (UCB) has been used progressively as a reservoir of stem cells for hematogenic reconstitution as an alternate to bone marrow or peripheral blood progenitor cells. Related and unrelated transplants of UCB are used for kids suffering with any malignant or non-malignant disease. Transplantation of umbilical cord blood has been used with successful results for the treatment of diseases like leukaemia, lymphoma, myelodysplasia, aplastic anemia (AA), hemoglobinopathies, metabolic storage diseases and immunodeficiencies.

There is still research going on in many parts of the world to know more uses of the UCB. The main emphasis is on the treatment of fatal diseases without the use of harmful medicines. Such technique provides an opportunity to repair the system naturally. The research works focus mainly on finding the use of UCB to cure damages caused due to heart disease, brain trauma, diabetes mellitus, and spine injury.

UCB is that the blood that remains inside the umbilical canal after the baby is born and cord being cut. In past, the umbilical cord, its blood and placenta was considered as a clinical/hospital waste, and were ultimately disposed of. Since the discovery that cord blood may be a reservoir of hemopoietic stem cells and since the primary transplant in 1988, this valuable source of stem cells is no longer thought of as a clinical waste. Public and family banks were created to process and cryopreserve this blood for future use.

Cord blood contains all the traditional components of blood - red blood cells, white blood cells, platelets and plasma. It is also made in hemopoietic (blood-forming) stem cells, similar to those found in bone marrow. The Haematopoietic (progenitor) stem cells area unit set in the liver and spleen of each embryo. Just before labour, migration of these cells via

blood stream begins from the liver to the bones for bone marrow formation. The umbilical cord can be removed either after the birth of the baby and expulsion of the placenta (placenta is outside the uterus attached with the baby) or after the birth of the baby and before the expulsion of the placenta (baby is born but the placenta remains inside the uterus).
Cord blood will be used for transplantation as another to bone marrow cells. Compared with adult peripheral blood or bone marrow, cord blood contains a larger proportion of extremely proliferative hemopoietic root cells. Most cord blood transplants have been done to treat diseases of the blood and system. It has also been accustomed restore the useful deficiencies of many genetic metabolic diseases. To date, more than seventy totally different diseases are treated with wire blood transplants.

The number of transplantations mistreatment duct cells is rising each year. Since 2005 allogeneic umbilical wire transplants in kids number the transplantations of bone marrow cells.
The positive outcomes from cord blood analysis and applications have led to new experimental applications for the treatment of different serious conditions. Scientists are investigation the chance that stem cells in wire blood could also be ready to replace cells of different tissues like nerve or heart cells.

Researchers and scientists accept that future therapies can be supported stem cells from numerous sources together with wire blood. Research is in progress in various centres for therapies of presently incurable diseases such as sclerosis and Alzheimers'.

Components of Umbilical Cord Blood:

The cellular component of UCB is primarily comprised of lymphocytes and monocytes. It has a comparable B-lymphocyte population and a lower absolute number of T-lymphocytes (CD3+) however a better CD4+/CD8+ quantitative relation compared to APB. UCB also has higher numbers of NK cells whereas lower numbers of CD56+ cytotoxic T-lymphocytes. UCB's relative immaturity compared to adult cell sources is more classified as showing a higher proportion of immature T-lymphocytes (CB45RA+) and reduced numbers of mature memory T-lymphocytes (CD45RO+). UCB cells also turn out fewer absolute levels of cytokines than adult cell sources. Furthermore, of the mRNA that is expressed in UCB, the anti-inflammatory cytokines interferon-γ (INF-γ), interleukin (IL)-4 and IL-10 aradditional well-endowed than for the unhealthy protein IL-2. This lack of mature immune function is attributed to UCB's low incidence of GvHD and microorganism transmission. Such cellular constitution could enable for less tight donor–recipient matching necessities, hence leading to shorter waiting amount for treatment. Rocha found that GvHD incidence was significantly lower in kids receiving UCB transplants compared to BM recipients once the supply was from associate degree HLA-identical relation. Rocha also incontestable a lower GvHD incidence in unrelated HLA-mismatched UCB recipients compared to HLA-identical BM recipients.
The enthusiasm over UCB began when it absolutely was found to contain an outsized population of haematogenic stem/progenitor cells compared to adult sources. These easily procured, low immunogenic sources of multipotential cells are thought to have the potential to become any form of cell within the body below specific conditions. Not only will the MNF contain roughly one hundred and twenty fifth CD34+ cells, a marker designated for its role in early haemopoiesis, but these cells appeared to be additional immature than those found in BM. In general, the level of maturity of a cell is identified by the cell's presence of or lack of a mixture of cell surface antigens. For instance, the CD34+ population in UCB can be outlined as

additional primitive than those found in BM as a result ofa better proportion (4×) of them ar negative for CD38, a marker for pre-lymphoid cells. Another subset of CD34+ cells found in comparatively high numbers in UCB ar the additional primitive CD133+ cells. CD133+ cells have been identified in foetal brain and during this space ar thought-about to be neural stem cells (NSC) (67,70). However, it is not yet notable whether or not the CD133+ cells found in UCB ar phenotypically and functionally a twin of the NSC found in foetal brain.

Non-hematopoietic stem cell (a type of mesenchymal stem cell) has also been found in the UCB, but lesser in number when compared to Bone Marrow Cells (BM/BMC).

The mesenchymal stem cell (MSC) produces much large amount of osteoblast, adipocytes, astrocytes, neurons, chondroblasts and hematopoietic cells. Yang et al. characterized the master's degree as having positive markers for CD13, CD29, CD44, and CD90 and negative markers for CD14, CD31, CD34, CD45, CD51/61, CD64, CD106, and HLA-DR, while Robinson et al. defined the master's degree as positive for CD73, CD90, CD105, and CD166 and negative for CD31, CD34, CD45, CD80, and HLA-DR. Universal agreement on a phenotype of these cells has to initial be reached before their true abundance in UCB will be notable. Regardless, it is of a general consensus that there are way fewer master's degrees in UCB compared to BM.

Types of stem cells:

1. Embryonic stem cells:

These include cells that are found within the embryo, the foetus or the umbilical cord blood depending upon when they are harvested, embryonic stem cells can give rise to just about any cell in the human body.

2. Adult stem cells:

These are found in infants, children and adults; found in already developed tissues such as heart, brain and kidney. They usually give birth to cells within their resident organs.

3. Induced pluripotent stem cells (IPSC):

These stem cells are mature/adult, differentiated cells that have been experimentally “reprogrammed” into a stem cell-like

Process of umbilical cord preservation

- Normal process of umbilical cord preservation is as follows:
- The umbilical cord is acquired before or after the expulsion of the placenta.
- The cord is cut and its blood is collected
- Segments of the cord is cleaned, cut and put in container with antibiotics
- The cord is then transferred to laboratory for further use.

Why are Umbilical cord stem cells beneficial? (http://www.cryoviva.in/banking-benefits/why-store-umbilical-cord/)

a. Rich Source of Stem Cells:

When compared to bone marrow, cord blood contains 10 times more number of stem cells, when both taken in equal proportion.

b. Regenerative Source:

The cord blood cells being younger have higher proliferating property as compared to stem cells found in bone marrow, and hence have a regenerative capacity.

c. Availability:

There are approximately 25000 individuals who are diagnosed with diseases that can be cured with stem cell therapy. Sometimes these sufferers do no find a perfect donor or have to pay a huge amount for the other treatment. In case of severe diseases as anemia, where the patient has to suffer blood deficiency and infections, for such sufferers cord blood banking is a

boon. Cord blood banking can be used for self and for other patients as well, since it is promptly available for transplant. This helps in saving many lives.

d. Pain:

Cord blood transplantation is a painless and a rapid process. It is so because the stem cells are separated from the umbilical cord beforehand. The whole procedure requires general anesthesia. When compared to extraction from bone marrow, it is a painful procedure because it is to be removed from hind end of the pelvic bone through a series of injections.

List of companies for preserving Umbilical Cord:

1. Cord Blood Registry California, USA,
2. ViaCord Massachusetts, USA
3. Cryo-Cell Florida, USA
4. China Cord Blood Corporation Beijing, China
5. Cryo-Save Netherlands
6. New York Cord Blood Program New York City,
7. CordVida São Paulo, Brazil,
8. Americord New York City,
9. CryoHoldco Latin America
10. Vita34 Leipzig, Germany,
11. LifeCell across india
12. Cordlife Sciences Kolkata India Pvt. Limited India
13. BabyCell Lonavala in Maharashtra india

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