TISSUE BANKING – A NEW HOPE FOR RENERATIVE MEDICINE

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Abstract
Cells, tissues and organs banks are specialised facilities in hospitals or medical institutions performing processing, preservation, banking and distribution activities of human morphological components. The authorisation criterias of such facilities are established according to the legislation regarding the human cells, tissues and organs transplantation (the law no. 48/2008 of the Romanian Parliament).
Those „cells and tissues banks" are obliged to respect the instructions reguardind the donation, testing, processing, storage, distribution, encoding and trasability of the tissues and cells of human origin, used for therapeutical purposes, as well as the notification of the severe accidents and side effects during the transplantation process.
The prelevation, embeding, labeling and transportation of human cells and tissues are performed according to the technical specifications in order to minimise the risk of biological contamination and only after obtaining the informed consent of the living donor and strictely respecting the legal aspects on the decesed donor.

Keywords: cord blood, stem cells, tissue bank.

1. INTRODUCTION

Umbilical cord blood is the blood collected from the umbilical cord immediately following the birth of a child. Umbilical cord blood is rich in multipotent hematopoietic "stem cells" (or blood stem cells). These cord blood stem cells produce the cellular ingredients necessary for the blood and the immune system. When the umbilical cord blood cells are transplanted into patients, they can help restore the immune and blood systems to help fight diseases and replace diseased blood. Research with blood/tissue can help to find out more about what causes certain diseases, how to prevent them, and how to treat them. Research using tissue can also answer other health questions. Researchers from universities, hospitals, and other health organizations conduct research using tissue. They contact the Tissue Bank and request samples for their studies. The Tissue Bank reviews the way that these studies will be done, and decides if any of the samples can be used. The Tissue Bank gets the tissue and health information about potential donnors from the medical authorities, and sends the tissue samples and some information about them to the researcher. Using human morphologic material from Tissue Banks some researchers may develop new tests to find diseases. Others may develop new ways to treat or even cure diseases. In the future, some of the research may help to develop new products, such as tests and drugs. Some research looks at diseases that are passed on in families (genetic research). Research done with blood/tissue samples form the Tissue Banks may look for genetic causes and signs of disease. People who are trained to handle tissue and protect the donor's rights make sure that the highest standards are followed. In order to be sure on the safety of the tissue sampling the information that will be given to the researcher includes age, sex, race, diagnosis, treatments, and possibly some family history of the donnor. This information is collected by the hospital from health record of the donnor and sent to the Tissue Bank, but without the name or other identifying information, just a code of the donor. Institutions that conduct research tissue banking should have in place transparent and appropriate systems and standards for the proper ethical, legal and operational governance of research tissue banking. Both cord blood and umbilical cord tissue have been shown to be rich sources of Mesenchymal Stem Cells (MSCs). Whereas cord blood is exceptionally rich in hematopoietic (leading to blood and immunological cells) stem cells, cord tissue carries a more dense concentration of the MSCs. These cells have the ability to differentiate into a variety of different

cell types, including bone cells (osteoblasts), chondroyctes (cartilage cells), ligament and tendon cells. Although there are no current medical therapies using stem cells derived from umbilical cord tissues, there is ongoing research for their use in treatment of:

- Diabetes
- Heart disease
- Liver Disease
- Cartilage Injuries

2. MATERIAL AND METHOD

Collection of Cord Blood

There are a variety of methods used to collect cord blood (CB), although primarily either large syringes (60 cc) or small bags (approximately 400 cc) are used.
Both types of collection kits are provided in a sterile condition for use during surgical deliveries, as well as being pre-anticoagulated and containing all necessary shipping materials. These kits meet all regulatory requirements for shipping blood, including double containment and a crush-resistant container. Furthermore, the collection kits are insulated and padded for safety during transport.

Routinely, collections are completed within 5 minutes (prior to placental expulsion).
At the same time, or prior to the CB collection, blood samples are obtained from the mother for infectious disease marker (IDM) testing, a regulatory requirement, using the provided vacutainers.
For all samples, the average range is 70 to 80 cc in size, regardless of the birthing situation (vaginal or surgical deliveries). Cord blood collections from twin and triplet births are smaller, as expected (as the newborns are generally smaller), but are routinely large enough for clinical use.
All collections, regardless of size, are processed, frozen, and banked as the majority will be clinically useful for both transplant and regenerative medicine applications.

Processing of Cord Blood

Presently, the vast majority of CB collections are red blood cell (RBC) reduced prior to cryopreservation. Several methods are in use to accomplish this goal, including Hespan sedimentation to obtain a modified buffy coat, density gradient centrifugation (Ficoll) to obtain enriched mononuclear cells (MNC), and 2 automated processes (Sepax and automated processing platform [AXP]) that result in a buffy coat product. The Hespan, Sepax, and AXP processing methods result in cord blood products composed of all nucleated cell populations found in the original collection (MNC, neutrophils, some RBCs), while the Ficoll method enriches for the stem-cell-containing MNC subpopulation (generally greater than 85% MNC with a few contaminating neutrophils and nucleated RBC). Cell counts obtained in the final Ficoll product are generally half the cell counts found in the other processes for this reason, although the stem cell recovery may be similar.
Both methods reproducibly recover greater than 95% of the cord blood stem cells in a typical collection and result in a reduced final volume of approximately 20 cc for final storage.

Cryopreservation of Cord Blood

Cord blood samples are cryopreserved using an automated, cell freezer. The CB cells are resuspended in ice-cold autologous plasma. An equal volume of cryopreservative solution containing autologous plasma and the cryoprotectant is added slowly over the course of approximately 20 minutes. The cryopreservation protocol uses a controlled-rate freezing process to slowly reduce the temperature to –180°C. At the end of the freezing procedure the cells are stored in a specially constructed liquid nitrogen freezer that allows for vapor storage at liquid nitrogen temperatures. Other methods, such as methanol immersion are in use.
Vapor phase storage prevents cross-sample contamination, especially if samples are to be banked for indefinite periods.

Banking of Cord Blood

The CB samples are stored in the vapor phase of the largest liquid nitrogen. These devices will maintain their –196°C temperatures.

3. RESULTS AND DISCUSSIONS

In addition to the storage of cord blood, the Tissue Bank is interested to offer parents the option of storing their child's umbilical cord tissue as well. Once the baby has been delivered by either vaginal or caesarian section birth, the umbilical cord is normally discarded as a waste product. If the cord tissue is to be banked, after the cord blood is collected, the cord itself is clamped. A 7 – 10 cm section of the cord is cut and placed in the cup provided and sent to the Tissue Bank processing laboratory in the same kit as the cord blood. The cord tissue is minced and mixed with a cryoprotectant, separated into several vials, frozen and then stored in cryo tanks until if and when needed. A unique code of indentification is associated to the donor, as well as to the tissues and cells donated in order to provide the correct identification and trasability of the sample. The coded datas are recorded in a special register in order to assure their safety. The laboratory tests are necesary for all donors. The Transplantation National Agency will look after the safety of the entire procedure reguarding the prelevation and recieving of the tissue samples, acording to the legal specifications.

The Tissue Bank must provide procedures of immediate informing the Transplantation National Agency on any suspicion of adverse reaction or severe incident concerning their biological material.

4. CONCLUSIONS

Collecting the child's umbilical cord blood and saving it in a cord blood bank provides parents with insurance in case their child develops any of the illnesses where cord blood is used in treatment. It was assumed that these hematopoietic stem cells, obtained from cord blood, could only be used as building blocks for blood cells. These stem cells were thought to be useful only in treating blood diseases. The list of current treatments for which hematopoietic stem cells are used, are merely diseases of the blood. The blood colected is not ready for transplant at this stage and must be cultured and expanded when needed. The cells are quite hardy and based on current research seem very easy to culture. Although studies are ongoing, there is no guarantee that the cord tissue will be useable in the future. Any transplant need must be determined by the patient's own physician.

In Romania the activity of tissue banking is only at the begining. There is few education concerning the organ and tissue donation. There is a lack of techniqual means, of specialists and the legislation is poor, but with the help of UE founding the regenerative medicine based on stem cell preservation and transplantology gives us hope to give more chances to fight against the degenerative and malignant conditions in pacients.

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