

Umbilical cord blood (ucb) banking: which one to choose?

Abstract

This article focuses the pros and cons of various UCB banking models. We also discuss here the recommendation by various medical societies in this regard as well as the future direction in the subject of UCB banking. On the practical grounds education of general population, obstetrical care providers and paediatricians on the current banking strategies and potential uses of UCB is essential. While providing this education it has to be kept in mind the limited number of public UCB banks in many countries across the world; declaring an urgent need to simultaneously have government policies to make such banking services available to the potential donors.

Keywords: umbilical cord blood banking, public UCB banks, private UCB banks, hybrid banks

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Abbreviations: UCB, umbilical cord blood; GVHD, graft-versus-host disease; ACOG, American College of Obstetricians and Gynecologists; ACP, American Academy of Pediatrics; ASBMT, American Society of Bone Marrow Transplant

Introduction

Umbilical Cord Blood (UCB) stem cells which are the naive mesenchymal stem cells in the umbilical cord blood of a new-born which can be retrieved and stored from the segment of the cord attached to the placenta after the childbirth. These stem cells are unique and have many promising uses for the future.

Though there are multiple other sources of adult stem cells, bone marrow being the most versatile and widely used source. But the major hurdle to bone marrow stem cell transplantation is - donor availability. In more than 50% of cases, it is not possible to identify a suitable adult stem cell donor in a timely fashion. Banked UCB, on the other hand is prospectively HLA typed and screened for infections and other risk factors and is readily available for transplantation. The average time from the onset of a search to identification of a compatible umbilical CBU (including screening of enzyme activity, when applicable) is around 15 days.¹ Hence banked UCB stem cells have the potential advantage of rapid availability, a lower risk of viral contamination, and a lower risk of graft-versus-host disease (GVHD), and thus need of less stringent HLA matching.²⁻⁴

UCB can be banked in two ways:

- Private UCB banks-wherein the UCB of a new-born is stored at a certain cost. These UCB can be used only by the child or his family if a need arises.
- Public UCB banks-these are exactly similar to blood-banks. Here any pregnant woman can enrol to donate UCB at the time of child birth free of cost, and anyone in need can utilize it at a certain cost.⁵ There exists one more entity in between these two models - hybrid or cross-over banks. These banks as the name suggest have the facilities of both the private and public use. In these banks priority is given to the family, but the donation can be moved to public use if it is not needed by the family.⁶

This article focuses the pros and cons of various UCB banking models. We also discuss here the recommendation by various medical societies in this regard as well as the future direction in the subject of UCB banking.

Methodology

This review includes a search of electronic resources, namely Medline, PubMed, CINAHL, the Cochrane Library, Current Contents, and EMBASE. The Medical Subject Headings (MeSH) including all subheadings and keywords used included "UCB banking," "Stem Cell Banking," "Public UCB Banks," "Private UCB Banks," "Hybrid UCB Banks," "Cross-Over UCB Banks" and "UCB donation". Articles were screened for historical facts as well as recent advances. Web searches were performed using educational sources if appropriate.

Results and discussion

UCB banking

As the new-born is delivered, and the umbilical cord is divided, blood can be collected from the segment of cord which is still attached to the placenta. For centuries this blood within the remaining part of the cord and placenta had been discarded as a medical waste. However it is proven beyond doubts now that this blood is a fabulous repository of stem cells. Though the concept of using these cord blood cells as a source of stem cells was given way back in 1983 by Prof Edward Boyse, it has gained much popularity in recent years.

UCB stem cells are unique, as these cells are naïve, on allogeneic transplantation, they produce an attenuated donor-derived immune response and thus have a lower incidence of graft-versus-host reaction when compared to other sources of stem cells (bone marrow or peripheral cells). Unlike other sources, these can also be transplanted even without an identical HLA match. The collection procedure is easy and without any risk to the donor (mother or baby).⁷

Private UCB banks

Private UCB banks which actually conceptualized after public banks, have gained much popularity.⁸ The first such bank was started

in 1992 in USA. These banks store UCB units for the same family privately for an upfront as well as maintenance fee. Thus it is also known as UCB family- bank. Here the service provider is making money (taken as a fee) in real time and does not have to wait years to break even when units are released for therapy. Not surprisingly, this business model has enabled family banks to propagate much faster than public banks.

In ten years' time (in 2001), there were 17 such banks; 11 in the USA, 2 in Canada and one each in Germany, Hong Kong, Korea and Japan. Today, there are ~ 215 private UCB banks located in 54 countries, plus at least 200 marketing affiliates serving over 70 countries.⁹

Private banks though more popular among the general population have always been a focus for criticism among the experts owing to their limitations and drawbacks. First, the cost of such banking is huge and may not be justified by the potential benefits. The estimated probability that the product will be used ranges between 1 in 2700 and 1 in 250 000,^{10,11} as it is rarely needed to the child or family in general population without the risk factors pertaining to family history of metabolic or haematological disorders or malignancies.¹²

Many professional organisations and experts have expressed concerns that potential donors have insufficient understanding of current accepted indications for, and the likelihood of, UCB use in a private bank setting. Furthermore, these banks wrongly advertise and overemphasise unproven possible future indications of these banked stem cells.^{5,13}

Given the substantial cost and low probability of using the product, currently private banking of UCB is not recommended for unidentified possible future use.⁸ The American College of Obstetricians and Gynaecologists (ACOG), American Academy of Paediatrics (ACP) and American Society of Bone Marrow Transplant (ASBMT) also do not advocate private storage unless there is an identified need in the family in which banked cord blood would offer a benefit.^{7,14-16}

Public UCB banks

To be stored in a public bank parents have to electively decide and donate UCB at the time of birth of the baby. This UCB unit is processed, banked and then listed on a Donor Registry. First such bank was established in 1991, at the New York Blood Centre supported by a pilot grant from the National Heart, Lung and Blood Institute.¹⁷ Now this number has increased to 4160 globally with 730,000 UCB units available for public use.⁸

National Heart, Lung, and Blood Institute-sponsored a multicentre study known as - Cord Blood Transplantation Study (COBLT) study, to determine if banked unrelated donor UCB (principle behind a public UCB bank) could serve as an adequate hematopoietic stem cell source established its usefulness. These studies published in various journal proved the effectiveness of unrelated UCB transplants in paediatric as well as adult cohorts.^{1,4,18}

Private versus public UCB banks

Through the end of 2013, the number of private UCB banks worldwide was found to be ~6 times more than in the number of public UCB banks (4 million versus 0.7 million). But the point to be noted is that public UCB banks have released ~ 30 times more units for therapy (30 000 versus 1000) as compared to the private UCB Banks.⁸

Many criticisms have been made of the establishment of private UCB banks from an ethical point of view based on the requirement or use. However, there is no definitive ethical argument why a couple cannot bank the umbilical cord blood of any of their children in one of these banks, invoking their right to exercise their autonomy and personal freedom. Furthermore, the fact that UCB might be used in future offers the possibility of being used in the field of regenerative and reparatory medicine may also open up further potential for its use.¹⁹ We will have to accept the fact that choice to donate or store cord blood presents a major challenge for prospective parents, consumers, health professionals, and policymakers because it entails choosing between two important competing values related to motherhood and citizenship.²⁰ The way out is to keep the potential donor well informed about the advantages and disadvantages of both the models and help them making a well informed decision on their own.

Hybrid banks

A hybrid (or dual) UCB bank is a new model of UCB banking wherein private and public banking both components coexist. Hybrid or cross-over banks are a middle path between the private and public UCB banks. Here UCB donations can be moved to public use if not needed by a particular family. This kind of banking has been found to be preferred model of banking among actual and potential UCB donors.²¹

With hybrid banking model in place theoretically families have an option of banking a child's UCB which will store the product for the paying consumer, while giving the family the knowledge that an unrelated person might derive benefit from the donation, in case required. According to this model the 'public' portion of the product should be donated if the inventory was searched, a match identified and quality parameters shown to be acceptable.²² Proponents of this concept state that, under the hybrid model, at least some units that would be otherwise unavailable for public consideration in an exclusively private model would now be available the unrelated person in need. Given the higher rate of private UCB banking compared with public banking supporters argue that this is the only way to increase availability of suitable matches without wasting the resources.^{6,23}

Ethically caught into controversy, hybrid banks also provide financial advantages to certain extent for private banking. In actual sense the public resources are supporting a fraction of cost of private banking in this case. The appropriateness of transferring cost in this way from public sources to private clients of hybrid UCB banks is surrounded with debate, in case when the benefits to the public are minimal.²²

However according to the experts' hybrid UCB banks, which market themselves as offering the potential benefits of both options or popularising themselves as 'the best of both worlds,' offer few benefits to the general public and have certain disadvantage for the private recipient.²²

Conclusion

From an ethical point of view, promoting the creation of public UCB banks is the ideal solution as of today. However for private companies that promote the creation of UCB bank, there are no determinant reasons to prevent them from exercising their commercial action freely. However they must not only avoid misinforming their clients but also clients tell them about the limited possibilities for use of autologous blood for medical purposes.

On the practical grounds education of general population, obstetrical care providers and pediatricians on the current banking strategies and potential uses of UCB is essential. While providing this education it has to be kept in mind the limited number of public UCB banks in many countries across the world; declaring an urgent need to simultaneously have government policies to make such banking services available to the potential donors.

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Conflict of interest

The author declares no conflict of interest.

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