The rationale behind collecting umbilical cord blood

Umbilikal kordon kanı toplanmasının altında yatan gerçek

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Abstract

Umbilical cord blood (UCB) is an increasingly important and rich source of stem cells. These cells can be used for the treatment of many diseases, including cancers and immune and genetic disorders. For patients for whom no suitable related donor is available, this source of hematopoietic stem cells offers substantial advantages, notably the relative ease of procurement, the absence of risk to the donor, the small likelihood of transmitting clinically important infections, the low risk of severe graft-versus-host disease (GVHD) and the rapid availability of placental blood for transplantation centers. Even though almost 80 diseases are treatable with cord blood stem cells, 97 percent of cord blood is still disposed of after birth and lost for patients in need! To improve availability of stem cells to a broader community, efforts should be undertaken to collect cord blood and expectant parents should be properly informed of their options with regard to cord blood banking.

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Key words: Stem cell, umbilical cord blood, collection, allogeneic, autologous, transplantation

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Özet

Umbilikal kordon kanı kök hücre zengin bir kök hücre kaynağıdır ve önemi gittikçe artmaktadır. Bu hücreler kanser, immun ve genetik birçok hastalığın tedavisinde kullanılmaktadırlar. Uygun donor bulunamayan hastalar için bu hemopoetik kök hücre kaynağı birçok avantajlar sunar. Bunlar; işleme için kolaylık, donor bulunmama riskinin ortadan kalkması, klinik önemi olan enfeksiyon hastalıklarının bulaşma oranının düşük olması, greft reddi oranının az olması ve plasenta kanının tarnsplantasyon merkezlerine kolayca ulaştırılması gibi. Kordon kanındaki kök hücreler ile şu an yaklaşık olarak 80 kadar hastalık tedavi edilebilirken, ne yazık ki kordon kanlarının %97'si hala atılmakta ve hastalar tedavi şanslarını yitirmektedirler. Kök hücrelerin bulunabilirliğini arttırmak ve tüm topluma ulaştırmak için, kordon kanını toplamak ve çiftleri kordon kanı bankacılığı hakkında yeterli bilgilendirmek için çaba harcanmalıdır.

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Anahtar kelimeler: Kök hücre, umbilikal kord kanı, toplama, allojenik, otolog, transplantasyon

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Introduction

Bone marrow (BM) and peripheral blood (PB) stem cell (SC) transplantations from human leukocyte antigen (HLA)-identical sibling donors have been used for many years in the treatment of hematological malignancies, BM failure syndromes, selected hereditary immunodeficiencies and metabolic disorders. A higher probability of successful engraftment and a reduction in the risk of potentially fatal graft-versus-host disease (GVHD) is conferred with close matching. Unfortunately, there is only a 25-30% chance of identifying a full sibling donor HLA match (1, 2). An alternative to a related donor involves seeking unrelated HLA-matched adult allogeneic donors outside the family. Today more than 13 million potential unrelated volunteer adult donors are registered in the Bone Marrow Donor Worldwide registry (3). However, more than 50% of all patients are unable to find a suitable adult donor in a timely manner (4) and only 30-40% of donor searches result in unrelated donor SC transplantation (5). Non-caucasians have an overall lower chance of identifying a fully matched unrelated adult donor because of genetic heterogeneity and under-representation of non-white donors in the registries (6).

Umbilical cord blood transplantation for children and adults

Umbilical cord blood (UCB) has been evaluated by clinical investigators as an alternate source for SC transplantation in an attempt to increase the availability of suitable donors and reduce the morbidity and mortality associated with allogeneic BM- and PB-SC transplantation (7-11). Many patients who are unable to identify a BM- or PB-SC donor can now benefit from a partially or fully matched UCB due to advances in the clinical practice of cord blood transplantation. Initially, UCB-SC

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transplantation using allogeneic UCB was performed in small children. However, in the meantime it has been proven that older children, adolescents, and adults can also be successfully transplanted with unrelated allogeneic UCB (12) In fact, almost 50% of the transplanted allogeneic UCB units facilitated by the National Marrow Donor Program in 2008 were for adults (13). Furthermore, recently, the first child with leukaemia was successfully treated with her own UCB (14).

Umbilical cord blood for regenerative medicine

Additionally, SC from UCB may serve as a stem cell source for future cellular therapy for tissue repair and tissue regeneration. In particular, promising results from in- vitro studies using cord blood for engineering blood vessels and heart valves (15) point in this direction (16). Furthermore, in human and animal studies, such cells seem to provide disease-ameliorating effects in conditions such as urinary stress incontinence (17), Alzheimer's disease (18), Huntington's disease (19), amyotrophic lateral sclerosis (20), spinal cord injury (21) diabetes (22, 23) myocardial infarction (24-27), to name just a few. The value and power of UCB-SC and the potential they possess for medical treatment and cures is creating a new paradigm for the future. There are already more than 138 clinical trials listed in the U.S under the National Institute of Health for various diseases (28). To date, more than 73 diseases were successfully treated using adult SC (29) with more than 20.000 UCB-SC transplants performed for a variety of malignant and non-malignant diseases, mainly due to the fact that they are a rich and readily available source of adult SC (30). The number of children who have received autologous CB treatment is more than 100 to date (31). The developments in the direction of autologous UCB treatments for diseases, which have a much higher incidence than those requiring allogeneic donors, is supported by research and clinical trials in areas such as neurological disorders (32) and diabetes (33). In contrast to the increasing use of SC such as from UCB to treat various diseases, not a single clinical application is currently available for embryonic stem cells.

Cord blood has advantages over bone marrow

Advantages of UCB over SCs from the BM or PB of related or unrelated donors include the fact that it is readily available, carries less risk of transmission of blood-borne infectious diseases, and is transplantable across HLA barriers with a diminished risk of GVHD (34, 35).

Despite the high value of SC from UCB for clinical applications as well as for research, more than 97 percent are still being discarded. The reasons are manifold, most prominent because their therapeutic potential is still underestimated and undervalued even though they show better results for allogeneic use compared with SC from BM or PB (36-38). Additionally, autologous clinical applications are underrepresented, because most potential recipients are still in their infancy and severe diseases in this phase of life are relatively rare.

Furthermore, most patients who could potentially benefit from an autologous or allogeneic stem cell treatment have no chance to receive their own UCB or UCB from a donor. This is mainly due to the fact that doctors are still reluctant to tell pregnant women of the possibility of storing their child's UCB in a private family bank or to donate it to a public bank.

Conclusion

It has been estimated that the lifetime probability of undergoing an autologous or allogeneic UCB-SC transplantation is almost 1:200 if only 50% of all haematopoietic diseases, which are treatable with SC, were treated with UCB-SC (not including all other potential non-hematopoietic conditions!) (39). Considering this perspective it seems that all expectant parents should be advised properly by their doctors with complete and up-to-date information, thus helping the parents to make a sound decision regarding whether to store the CB of their baby in a private family bank or to donate it to a public bank. The only wrong decision that actually can be made is throwing away this life saving material.

Conflict of interest

None declared

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