

Annotation

Mesenchymal stem cells from umbilical cord: Do not discard the cord!

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On 10th February 2007, English entrepreneur Sir Richard Branson, best known for his Virgin brand of over 360 companies, announced the establishment of a cord blood bank, the Virgin Health Bank, in London. What makes this bank different is a dual public–private approach. A fifth of the cord blood would be stored for private use for the child or a family member and the rest would be donated to the public part of the bank which will be accessible to anyone in the world who needs it, at no cost. Additionally, Branson has pledged to donate his 50% of proceeds from Virgin Health Bank to researchers investigating the potential of cord blood stem cells [1].

The idea for the dual bank emerged when he was visited by a senior director of the National Blood Center, asking for his support in a charitable role, because children were dying through lack of umbilical cord blood. Initially Sir Richard offered 3 million pounds to the National Health Service to help them increase their storage capacity for umbilical cord blood, but the center was not comfortable with accepting funds from private sources. So Sir Richard decided to set up a company to do the job.

This is an initiative that should be applauded but we want to draw attention to a very important and urgent aspect. The routine procedure in umbilical cord banks has been to store the blood and discard other tissues, such as the cord and/or placenta, which is a much better source of mesenchymal stem cells than blood [2]. Umbilical cord

blood is rich in haematopoietic stem cells [3–6]. However the successful isolation of mesenchymal stem cells, which are undifferentiated cells able to self-renew, with high proliferative capacity, from the cord blood is controversial [7–13]. These cells comprise a rare population of multipotent precursors that in addition to supporting haematopoiesis are able to differentiate into various cell types such as chondrocytes, osteocytes, adipocytes and myocytes [14–17].

Bone marrow has been considered as one of the main sources of mesenchymal stem cells for both experimental and clinical applications and most of the knowledge concerning these cells came from bone marrow studies. However, obtaining them is painful and yields a low number of cells [18,19]. More recently, human umbilical cord blood taken after full term delivery of the newborn, from a sample that would be inevitably discarded has been regarded as an alternative source for transplantation and therapy because of its haematopoietic and mesenchymal components. However, while some researchers succeeded in the isolation of mesenchymal stem cells from umbilical cord blood [7–10] others failed or obtained low yield [11–13]. More recently, some groups have reported success in isolating and establishing mesenchymal stem cells cultures from umbilical cord vein and UC stroma, also called Wharton's jelly [11,16,20,21]. According to Tondreau et al. [22], these discrepant results might be explained by different isolation and culture methodologies.

In order to address this question we compared, for the first time, the efficiency in obtaining mesenchymal stem cells from 10 match-paired umbilical cord units harvested from the same donors, where the blood and the cord were

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processed simultaneously and under the same culture conditions [2]. Mesenchymal stem cells from blood were obtained from only one among the 10 cord samples collected but we were able to generate large amounts of primary mesenchymal stem cells cultures from all cord samples, with a 100% yield, which showed that the low yield of these progenitor cells in umbilical cord blood is not due to different culture methodologies. These results are in accordance with our previous experience where we observed that the efficiency in isolating mesenchymal stem cells from approximately 100 umbilical cord blood units stands around 10% (unpublished data). These cells isolated by a fast and simple procedure using short enzymatic digestion, may be expanded *in vitro*, cryogenic stored and thawed [2]. Despite the advantages of umbilical cord blood in haematopoietic reconstitution [3–5], results from our study demonstrated that the umbilical cord and not the blood is the best choice for isolating mesenchymal stem cells for future applications.

Storing umbilical cord blood in private or public banks has been recently the subject of many ethical dilemmas. A great obstacle to the altruistic proposal of Sir Richard Branson to split umbilical cord blood samples in both private and public banks is that the number of cells from one umbilical cord blood unit is usually not sufficient for an adult weighing more than 50 kg, which is a main limiting factor. In short, the important take home message is that regardless of being public or private, these banks are discarding the umbilical cord, a precious source of mesenchymal stem cells. Therefore, we suggest storing both the blood and the umbilical cord, which would allow maximum recovery of hematopoietic and mesenchymal stem cells for possible therapeutic applications in the future. Moreover, the possibility of originating different cell lines obtained from umbilical cord of neonates with malformations or genetic disorders, in particular myogenic lineages from patients with mutations responsible for neuromuscular disorders, may open new avenues for research of vast interest in addition to speed up screening process for therapeutic drugs.

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