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Cord Blood with Low Cell Count: Re-Use, Rather than Discard

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Short Communication

Single cell technology has been widely used in developmental and stem cell biology. Umbilical Cord Blood (UCB) has been accepted as a rich source of stem cells for treating various hematological diseases. Its unique therapeutic potential has sparked enormous scientific interest and business opportunity to establish cord blood banks to cryopreserve UCB cells for future use.

Umbilical Cord Blood (UCB) has been accepted as a rich source of stem cells for treating various hematological diseases. Its unique therapeutic potential has sparked enormous scientific interest and business opportunity to establish cord blood banks to cryopreserve UCB cells for future use. However, the clinical efficacy with regards to improved engraftment and reduced graft failure is reliant upon cell dosage, measured by the total nucleated cell count, the proportion of CD34+ cells, the colony-forming units, and the total volume of the each transplanted UCB unit [1,2]. This finding has also become the basis of cryopreservation criteria in most public cord blood banks after UCB collection from donors, as an established checkpoint prior to further processing for cryopreservation [3]. UCB units that fail to meet such criteria are discarded. Although the checkpoint criteria mitigate risk and further costs, unfortunately about 36% to 39% of the total collected UCB is discarded, which incurs substantial economics and depletion of resources [3-5].

It is likely that unwanted UCB units can be re-directed to laboratories for further processing and manipulations to improve their quality, making them favorable for clinical use instead of disposal. Studies have shown that mesenchymal stem cells (MSCs), a subset of plastic-adherent, multipotent regenerative cells which are capable of differentiation into osteo-, chondro- and adipo- lineages, can also be isolated from UCB in addition to CD34+ hematopoietic stem cells (HSCs) [6]. MSCs are not only a proven valuable therapeutic biologic source to regenerate tissues, but they also hold the key to address the cell dose in each UCB unit. Evidence has shown that the total nucleated cells in UCB can be markedly increased by co-culturing with MSCs [7, 8]. Such manipulation does not seem to affect the function of CD34+ HSCs, including its red blood cell differentiation capability [7]. Moreover, co-transplantation of UCB and expanded UCB with MSCs in co-culture in patients with hematological cancers has revealed a shorter neutrophil and platelet recovery time, as compared to patients who received two unmanipulated UCB units [9]. These results suggest an alternate transplantation strategy in lieu of UCB with low cell dose.

With current advances in stem cell technologies, the use of UCB is no longer limited to treating blood disorders. Rather, UCB can now reprogrammed to generate induced pluripotent stem (IPS) cells [10], which serve as precursors for differentiating multiple cell types necessary for most tissue engineering and regenerative medicine efforts. Hence, collaborations between UCB banks and research institutions should be fostered to exploit UCB, and it should be a better option than discarding potentially life-saving, regenerative cells to the trash.

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