MedicalXpress

Researchers successfully perform first injection of cultured red blood cells in human donor

September 1 2011

For the first time, researchers have successfully injected cultured red blood cells (cRBCs) created from human hematopoietic stem cells (HSCs) into a human donor, according to study results published today in *Blood*, the Journal of the American Society of Hematology (ASH). As the global need for blood continues to increase while the number of blood donors is decreasing, these study results provide hope that one day patients in need of a blood transfusion might become their own donors.

Using HSCs (stem cells that form all blood cell types) from one human donor, a Paris-based research team successfully generated billions of cRBCs in a petri dish with the aid of specific growth factors that regulate the proliferation and maturation of HSCs into red blood cells. Seeking to prove that the cRBCs were capable of reaching full maturation in the body, the researchers then injected the cells into four mouse models and confirmed that the cells were able to progress through the full maturation process. Using a volunteer donor, the researchers then repeated the process of creating another set of cRBCs and injected the cells back into the donor's own body to assess their survival in a human. After five days, the survival rate of the cRBCs in the donor's bloodstream was between 94 and 100 percent and, after 26 days, the rate was between 41 and 63 percent, comparable to the average 28-day half-life of normal native red blood cells. These results demonstrate that the lifespan and survival rate of cultured cells are similar to conventional red blood cells, further supporting their validity as a possible source of

transfusion.

"Although previous research has shown that HSCs can be developed into fully matured red blood cells, this is the first study that has proven that they are capable of survival in the human body, a major breakthrough for the transplant community," said Luc Douay, MD, PhD, senior study author and Professor of Hematology at Université Pierre et Marie Curie in Paris, France. "There is a dire need for an alternative source of transfusable blood products, especially with the risk of infection from emergent new viruses that comes with traditional transfusion. Producing red blood cells in culture is promising since other efforts to create alternative sources have not yet been as successful as once hoped."

These results are especially timely, as blood donation organizations such as the American Red Cross have recently declared a critical nationwide blood shortage. Globally, the World Health Organization (WHO) recently reported donation rates of less than 1 percent of the population in more than 70 countries. Many of these countries are considered developing or transitional and have substantial transfusion needs due to high prevalence of maternal morbidity, childhood malnutrition, trauma casualties, and infectious disease.[1]

"The results from our study establish the feasibility of the concept of transfusing cRBCs and show promise that an unlimited blood reserve is within reach," said Professor Douay. "Although the full-scale production of these cells will require additional technological advances in cell engineering, we believe cRBCs could prove to be a valid alternative to classic transfusion products that will not only provide an adequate supply of blood, but reduce the risk of life-threatening complications and infections that can accompany traditional transfusion."

Provided by American Society of Hematology