Transplanting umbilical cord and menstrual blood-derived stem cells offer hope for disorders

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Transplanting stem cells derived from umbilical cord blood cells and menstrual blood cells may offer future therapeutic benefit for those suffering from stroke, Alzheimer's disease, and amyotrophic lateral sclerosis (ALS), says a team of neuroscience researchers from the University of South Florida's Department of Neurosurgery and Brain Repair and collaborators from three private-sector research groups, Saneron CCEL Therapeutics, Inc., Tampa, FL, Cryo-Cell International, Inc., Oldsmar, FL, and Cryopraxis, Cell Praxis, BioRio, Rio de Janeiro, Brazil.

Their collective paper outlining the potential benefits of transplanting these stem cells is published in the current issue of *Cell Transplantation* (20:1), now freely available online.

"Umbilical cord blood cells and stem cells derived from menstrual blood are relatively easy to obtain, appear to be able to differentiate into many kinds of cells, and are immunologically immature, offering them the potential to promote cell survival rather than play a cell replacement role when transplanted," said Dr. Paul Sanberg, Distinguished University Professor and executive director of the Center of Excellence on Aging and Brain Repair at the University of South Florida.

According to Dr. Eduardo Cruz, CEO of Cell PRAXIS BioRio, human umbilical cord blood cells (hUCBs) are limited to collection at the time

of birth, but menstrual blood-derived stem cells (MenSCs) could be collected once a month for 40 years from women during their reproductive stage.

"Both hUCBs and MenSCs have been used successfully in laboratory experiments with animal models of diseases," noted Dr. Cruz.

MenSCs have been transplanted into animal models of stroke and have been shown to be able to differentiate into a number of neural cell types. Transplanting hUCBs into animal models of stroke, Alzheimer's disease, and ALS has demonstrated their therapeutic potential for reducing inflammation, a key component of many neurodegenerative diseases.

According to Mercedes Walton, CEO of Cryo-Cell International, Inc., stem cell science and stem cell therapies are emerging with amazing speed in the last several years. "Our breakthrough discovery that menstrual blood cells contain proliferative stem cells that can differentiate into many different types of cells, including cardiac and neural cells, has opened new therapy possibilities," she said.

Stroke

Studies examining transplantation of MenSCs into laboratory cultures and animal models (in vitro and in vivo) of stroke have demonstrated a potential for protection against oxygen-glucose deprivation.

"Factors secreted by the transplanted cells were able to offer a neuroprotective effect," said Dr. Cesar Borlongan, a professor in the Department of Neurosurgery and Brain Repair. "This may relate to the cells secreting vascular endothelial growth factors (VEGF), brain-derived growth factors (BDNF), and neurotrophin-3 (NT-3), all of which have potential benefits for the treatment of stroke."

A decade of studies using animal models of stroke has found that in many cases hUCBs failed to enter the brain following transplantation, yet behaviorial improvements were often observed, said Dr. Borlongan.

"These cells have anti-inflammatory properties and are pro-angiogenic, that is, they encourage cell growth and tissue repair," he said.

Alzheimer's disease

Similarly, studies using animal models of Alzheimer's disease have found that hUCBs also play an anti-inflammatory role. According to Dr. Jun Tan, professor of psychiatry and Robert A. Silver chair at the Rashid Laboratory for Developmental Neurobiology, USF Silver Child Development Center, one of the major causes of AD is the deposition of amyloid beta (AB), a chemical that activates the immune response in a number of key brain cell types, and this leads to an inflammatory state.

"It is likely that hUCBs can modify this inflammatory response and provide beneficial effects in animal models of AD," said Dr. Tan, who recently completed a study in which the brain-to-blood clearance of AB was demonstrated. Based on the findings of this research, Dr. Tan is developing clinical protocols with Saneron CCEL Therapeutics, Inc. and the USF Health Byrd Alzheimer's Institute.

"Our immediate goal is to move our beneficial findings with cord blood cells into clinical trials for patients with mild to moderate Alzheimer's disease," said Dr. Tan.

This research is part of an ongoing research partnership between USF and Saneron*, Cryo-Cell and Cryopraxis aimed at determining the therapeutic benefits hUCBs present for a variety of neurological diseases, including Parkinson's disease, Lou Gehrig's disease (ALS), Alzheimer's disease, and stroke.

"Our next stage of research is translational, with the goal of bringing these advancements to the patient bedside," said Nicole Kuzmin-Nichols, president and chief operating officer of Saneron. "Saneron is very pleased and excited that our long-standing research partnership with USF has provided to further the technology developed at USF and transferred to Saneron for further development."

ALS

When hUCB transplantation was studied in animal models of ALS, also a neurodegenerative disease with an inflammatory component, hUCB transplantation was shown to help regulate the inflammatory response by reducing the number of microglia - brain cells that initiate an inflammatory response. In this case, the benefits of injected hUCBs were dose-related.

"In contrast to when hUCBs were transplanted into animal models of stroke and AD, a considerable number of hUCBs were detected within the spinal cord in animal models of ALS," said Dr. Svitlana Garbuzova-Davis, an assistant professor in the USF Department of Neurosurgery and Brain Repair. "A relatively high dose was necessary, however."

For Cryo-Cell's Mercedes Walton, the synergy of collaboration is driving the future of stem cell transplantation technologies. "Cryo-Cell is extraordinarily fortunate to partner with some of the world's most distinguished stem cell researchers," she concluded.

More information: Sanberg, P. R.; Eve, D. J.; Willing, A. E.; Garbuzova-Davis, S.; Tan, J.;, Sanberg, C. D.; Allickson, J. G.;, Cruz,, L. E.; Borlongan,, C. V. The treatment of neurodegenerative disorders using umbilical cord blood and menstrual blood-derived stem cells. Cell Transplant. 20(1):85-94; 2011.

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