Medical Xpress

Stem cell therapy shows potential to heal intestinal disease in premature infants

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An intestinal bowel disease that affects up to 10 percent of premature infants at a very vulnerable and developmentally crucial time can lead to serious infection and death. Scientists at the Wake Forest Institute for

Regenerative Medicine (WFIRM) are tackling the disease with a human placental-derived stem cell (hPSC) therapy strategy that is showing promising results.

Necrotizing enterocolitis is a life-threatening intestinal disease that is a leading cause of mortality in premature infants and treatment options remain elusive. The cause of the disease is unclear—it is a multi-faceted disease that results from the complex interaction of early bacterial colonization, an exaggerated inflammatory response, and immature intestinal tissue. It occurs when the wall of the intestine is invaded by bacteria which cause infection and inflammation. Developing treatment approaches for this disease would improve both the survival outcomes and the health of these children who have their entire lifetime to protect.

Based on recent cell therapy studies, WFIRM scientists investigated the effect of a human placental-derived stem cell therapy on intestinal damage in a pre-clinical animal model. In 2007, WFIRM scientists were the first to identify and characterize stem cells derived from amniotic fluid and placenta. Stem cells offer great promise for new medical treatments to treat disease and injury.

In the last decade, researchers have made significant advances in identifying important prevention strategies for reducing the risk of necrotizing enterocolitis onset. Unfortunately, few approaches have demonstrated the therapeutic ability to offset established damage. To address this gap, the researchers focused their study on the potential of human placental-derived stem cells for treatment.

"In our recent studies, we demonstrated that a promising placental stem cell therapy could induce repair of established damage caused by the disease. Interestingly, we saw that the predominate repair occurred in the barrier cells that line the intestine, which presents a potential new therapeutic target," said Victoria G. Weis, Ph.D., a lead author of the

paper being published by the *American Journal of Physiology's Gastrointestinal and Liver Physiology* section. The American Physiological Society has also selected the paper to highlight in a special collection that showcases some of the best recently published articles in physiological research.

For the study, the pre-clinical model with induced intestinal damage received injections of either saline or the placental stem cell therapy at 32 and 56 hours following birth directly into the abdominal cavity. At four days, the induced damage was assessed. The researchers found that the placental stem cell therapy stopped disease progression and promoted healing of the intestinal damage at both the cellular and whole tissue levels.

One of the most prominent findings in the study is the significant improvement of the two critical cell populations that are important to the intestine's ability to continuously replenish and sustain the barrier. In necrotizing enterocolitis disease, these intestinal cell populations are significantly lost and the function of the intestinal barrier is drastically compromised. The placental stem cell treatment helped support the re-establishment of these cell populations to healthy levels which allow the intestine to properly form a functioning barrier against further bacterial infection.

"These findings open exciting new avenues for advanced therapeutic development that could hopefully one day contribute to the advancement of medical care for this disease and help set the foundation for a long and healthy life for these babies," Weis said.

Senior study author Anthony Atala, MD, and director of WFIRM, said that human placental-derived stem cells are a novel research tool that can be leveraged to identify ways to repair damage or combat disease altogether.

"Our results show that stem cell treatment can promote intestinal healing. In this disease model, utilizing them as an early intervention may be better tolerated in the infant and, further, may decrease disease progression to advanced stages that require surgery," Atala said.

More information: Victoria G. Weis et al, Human placental-derived stem cell therapy ameliorates experimental necrotizing enterocolitis, *American Journal of Physiology-Gastrointestinal and Liver Physiology* (2021). DOI: 10.1152/ajpgi.00369.2020

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