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Evaluation of the use of human umbilical cord for in-utero spina bifida repair

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In a study to be presented Saturday, Jan. 28, in the oral concurrent session, at the Society for Maternal-Fetal Medicine's annual meeting, The Pregnancy Meeting, researchers evaluated a possible regenerative patch by using human umbilical cord in two studies titled Cryopreserved Human Umbilical Cord (HUC) vs Acellular Dermal Matrix (ADM) for In-Utero Spina Bifida Repair and the study Conventional vs cryopreserved human umbilical cord (HUC) patch based on repair for in-utero spina bifida in a sheep model.

Spina Bifida is a birth defect where there is an incomplete closure of the backbone and the coverings around the spinal cord. It affects more than 4,000 children born each year in the United States and is associated with hydrocephalus (fluid in the brain), developmental delay, lifelong disability and death.

Spina Bifida is also associated with a need for shunt placement. In-utero surgery has been shown to reduce the need for shunting of hydrocephalus and to improve a child's ability to walk. However, more than half of the children who undergo such surgery do not benefit from the in-utero repair, which failure has been attributed to suboptimal repair leading to persistent leakage of cerebrospinal fluid and spinal cord scar formation at the repair site.

Researchers are trying to identify a regenerative patch material for repair that would further reduce morbidity after repair through decreased spinal cord damage from reduced inflammation and scar

formation.

In the first study, conducted in a pregnant rat model, the researchers sought to compare two types of patches: a cryopreserved human umbilical cord patch and an acellular dermal matrix, a currently used graft material in clinical practice. The scientists aimed to explore the cellular response in both inflammatory and regenerative properties after in-utero repair in a fetus. The cryopreserved human umbilical cord patch was determined to promote organized cellular migration of epidermal and meningeal cells and decrease acute inflammatory response and cell death compared to the acellular dermal matrix.

In the second study, conducted in a pregnant sheep model, the researchers compared the cryopreserved human umbilical cord patch to the current method of closure using sutures on the defect to test the functional and structural preservation of spinal cord at the repair site. The lambs repaired using cryopreserved human umbilical cord showed improved spinal cord function with decreased meningeal scar formation and better preservation of the spinal cord tracts.

Although these studies were preclinical, the human umbilical cord patch shows promising results to improve outcomes in spina bifida birth defects. Researchers worked with experienced veterinary staff who observed the animals daily for any complications. These animal studies were reviewed and approved by The University of Texas Health Science Center at Houston (UTHealth) Animal Welfare Committee as scientifically justified and appropriate.

"The unmet clinical need in in-utero spina bifida repair is the optimal closure method to reduce the ongoing damage to the spinal cord from inflammation and scar formation and to promote continued fetal spinal cord development. Based on the safety and efficacy of the cryopreserved human umbilical cord patch for in-utero spina bifida in pregnant rats and

sheep, we have performed four cases of in-utero human repair under FDA approval. The early results have been promising, and the studies are ongoing to evaluate the long-term benefits in these patients. We believe that this is an initial step toward a safe and minimally invasive in-utero spina bifida repair," said Ramesha Papanna, M.D., M.P.H., the principal investigator of the projects at The Fetal Center at Children's Memorial Hermann Hospital and McGovern Medical School at UTHealth, who is also the presenter of one of the studies at the SMFM annual conference.

Lovepreet Mann, M.B.B.S., is a research instructor in the department of obstetrics and gynecology at McGovern Medical School and the co-investigator and the primary author who conducted experiments in the pregnant rat model in collaboration with Papanna. Mann will present one of the studies at the SMFM annual meeting.

More information: Abstract #84: Cryopreserved human umbilical cord (HUC) vs acellular dermal matrix (ADM) for in-utero spina bifida repair, The Pregnancy Meeting, 2017.

Provided by Society for Maternal-Fetal Medicine