Experimental stem cell treatment arrests acute lung injury in mice

February 3 2010

A new study by Rick Wetsel, Ph.D., left and Dachun Wang, M.D., of the University of Texas Health Science Center at Houston, explores the potential use of transplantable lung cells derived from human embryonic stem cells to treat respiratory disease. Credit: The University of Texas Health Science Center at Houston

Stem cell researchers exploring a new approach for the care of respiratory diseases report that an experimental treatment involving transplantable lung cells was associated with improved outcomes in tests on mice with acute lung injury. The lung cells were derived from human embryonic stem cells (hESCs). Findings by investigators at The University of Texas Health Science Center at Houston are scheduled to appear in the March issue of *Molecular Therapy*.

Mice receiving the transplantable lung cells lived longer, sustained less scarring in their lungs and had normal amounts of oxygen in their blood,

said Rick Wetsel, Ph.D., the study's senior author and a professor in the university's Brown Foundation Institute of Molecular Medicine for the Prevention of Human Diseases (IMM).

"Respiratory diseases are a major cause of mortality and morbidity worldwide," wrote Wetsel and his colleagues in the paper. "Current treatments offer no prospect of cure or disease reversal. Transplantation of pulmonary progenitor cells derived from human embryonic stem cells may provide a novel approach to regenerate endogenous lung cells destroyed by injury and disease."

Giuseppe N. Colasurdo, M.D., dean of The University of Texas Medical School at Houston and physician-in-chief at Children's Memorial Hermann Hospital, said, "This research work will provide a useful model for studying the pathogenesis and treatment of a variety of lung disorders. I am confident future studies will advance our knowledge on the cellular mechanisms responsible for the improvement observed in the study."

Colasurdo, who specializes in lung disorders in children and infants, said a better understanding of the basic mechanisms involved in the healing phase of lung diseases is critical to the development of treatments. "These are diseases involving a variety of cells and cell products," he said.

Much human embryonic stem cell research is focused on conditions like lung injury in which the body has difficulty healing itself. Because these early stage cells can mature into many different cell types, they are being explored as a way to replace or repair missing or damaged tissue. These cells also divide rapidly providing researchers with a large supply of cells.

Scientists compared the outcomes of mice with damaged lungs receiving

the treatment to those not receiving the treatment.

Researchers reported that the experimental stem cell treatment "not only prevented or reversed visual hallmarks of pulmonary injury, but also restored near normal lung function to mice." Lung cells can be damaged by exposure to pollution and disease agents.

Wetsel and his colleague Dachun Wang, M.D., an IMM instructor, used a genetic selection procedure they created to generate a type of lung cell known as alveolar epithelial type II, which secretes surfactant, a substance that keeps the lung inflated, and can turn into another important lung cell that regulates the transfer of oxygen into the blood and the removal of carbon dioxide. Human embryonic stem cells in the research were approved by the National Institutes of Health (NIH) for study.

Wetsel called the results "promising" but added that additional tests in other animal models and eventually humans will be needed before these cell transplants can be used to treat respiratory diseases.

The scientists used mice with weakened immune systems to reduce the possibility that the human cells would be rejected. Should research proceed to the clinical trial stage, there are at least two ways to address rejection issues, Wetsel said. Patients could be treated with immunosuppressive drugs. Scientists may also be able to take one of the patient's own skin cells and convert it into "induced pluripotent stem cells" or iPS cells, which are believed to have many of the same capabilities as human embryonic stem cells.

More information: The study is titled "Transplantation of Human Embryonic Stem Cell-Derived Alveolar Epithelial Type II Cells Abrogates Acute Lung Injury in Mice."

Provided by University of Texas Health Science Center at Houston