Stem cell transplant in mouse embryo yields heart protection in adulthood

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Stem cells play a role in heart muscle rejuvenation by attracting cells from the body that develop into heart muscle cells. They have been successfully used to halt or reverse cardiac injury following heart attack, but not to prevent injury before it occurs.

A new study that delivered embryonic stem cells to mouse embryos in the earliest stages of development found that the resulting mice demonstrated a capacity to recover from cardiac injury in adulthood. The study, which provides the first evidence that preventive regenerative medicine can successfully be used to treat myocardial infarction through prophylactic intervention, is published in Stem Cells.

Led by Dr. Andre Terzic of the Mayo Clinic, researchers injected mouse embryos with embryonic stem cells that had been used to successfully treat ischemic heart disease following heart attack. The resulting animals incorporated between five and 20 percent of labeled stem cell-derived tissue. They were born with no apparent abnormalities, and the tested and control groups had similar overall baseline cardiac disease risk profiles. They also demonstrated similar cardiac performance during the one year follow-up.

Researchers induced cardiac injury in both groups by tying off the left anterior artery, causing complete coronary blockage. The group that had received the embryonic stem cell treatment recovered cardiac function, while the other group deteriorated, demonstrating ischemic myopathy, myocardial scarring and significant pulmonary congestion, which are typically seen in the progression towards heart failure. Overall, the group treated with stem cells displayed a favorable disease course, with superior exercise workload capacity and stress test performance, as well as increased survival.

"Preemptive stem cell-based intervention in utero thus provides a strategy to engineer tolerance, and prevent incidence of life-threatening organ failure in the adult,"the authors state. In utero therapy was introduced 30 years ago to treat congenital defects and has been used successfully since then to improve outcomes after birth, but this study takes the concept one step further.

"In this way, prenatal transplantation of embryonic stem cells expands the scope of traditional retrospective therapy to the previously unexplored prospective protection,"the authors note. They conclude that beyond reconstructive surgery, stem cell transplantation in prenatal development could offer an innovative approach for preventing disease.

"This study expands the scope of stem cell therapy including traditional retrospective and preventive cell therapy,"says Miodrag Stojković, co-editor of the journal.