Stem-cell experiment on pigs seen as step forward in repairing heart damage

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A medical research team led by University of Miami doctors injected stem cells into the hearts of pigs that had been damaged by heart attacks. Within two months, the doctors said, the stem cells made the pigs' hearts good as new.

For humans, the research represents another promising step toward healing the damage from heart attacks, the No. 1 cause of death in the United States, killing more than 800,000 people a year.

The treatment resulted in rapid healing in the pigs, said Dr. Joshua Hare, a cardiologist at UM Medical School and director of its Interdisciplinary Stem Cell Institute, where research was done.

"In two weeks, their heart function was almost back to normal. In two months, they were absolutely back to normal," he said. "If we can achieve even 50 percent of that in humans, it will have a major impact."

Hare said he hopes that within a decade, the procedure might be routine in humans, and that similar therapy might be available for the liver, kidney, pancreas, brain, even for strokes and limbs badly injured in battle.

The new study, published in the July 29 issue of *Circulation Research*, a journal of the American Heart Association, builds on another UM study published in December. In that study, immature "mesenchymnal" human stem cells extracted from bone marrow and infused into the hearts of

human heart-attack victims made their hearts less prone to dangerous arrhythmias and better able to pump blood.

That study prompted widespread debate among scientists over how the stem cells were able to promote healing in the heart. The greatest significance of the new research that it explains the healing process, Hare says.

"Scientists always want to know why," he said. "You can't really go forward with research unless you understand what's going on."

Dr. Robert Simari, vice chairman of cardiology at the Mayo Clinic in Rochester, Minn., who had read the study but did not take part in it, supported its significance.

"This is a unique insight," he said. "The field has been hindered by a lack of understanding of this mechanism. This shines new light on how these things work."

The new UM study found that the stem cells helped the heart in two ways. First, some of the stem cells -- injected into the heart via catheter into the groin and up the femoral artery -- actually turned into new, healthy heart cells themselves. They replaced heart tissue killed by the heart attack, and became part of the heart muscle that contracts and beats to circulate the blood.

Another part of the injected stem cells didn't turn into new heart cells but instead induced stem cells already existing in the heart to greatly multiply, building more heart muscle.

Doctors had known the human heart contained some of its own stem cells, whose function is to repair and regenerate the heart. The heart's stem cells work like the stem cells in hair follicles, which induce the hair

to grow back after a haircut, Hare said. But the heart was thought to have too few of them to fully repair itself.

In the new experiment, the injected stem cells caused an explosion of growth in the heart's own stem cells, which turned into heart muscle cells.

"They helped create 20 times the number of the body's own heart stem cells," Hare said.

The study demonstrates another way to use immature human stem cells that avoids the use of embryonic stem cells, which are controversial because creating them destroys human embryos.

Another advantage is that the experiment worked with stem cells from the bone marrow of unrelated donors, which -- for reasons not entirely clear yet -- do not seem to carry the same risk of rejection by the recipient's body, which is a serious problem with heart and kidney transplants.

Stem cells extracted from the patient's own bone marrow also can be used, but they need three weeks of purification and proliferation to be ready, delaying treatment for the ailing heart.

New studies are under way to see which method -- using cells from a donor or the patient -- works better, Hare said.