

EXCLUSIVE REPORTS

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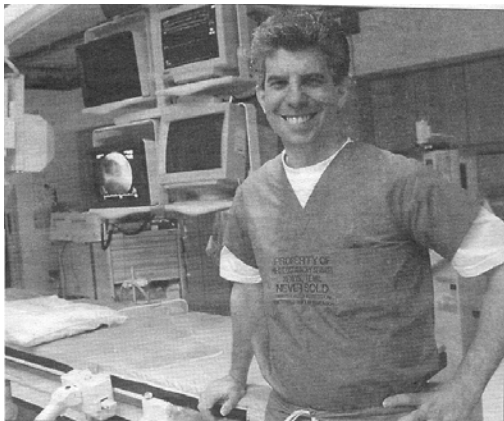
Researchers develop heart regeneration technique

Scott Shepard

Regenerating heart tissue damaged in a heart attack could soon be available with a simple, outpatient procedure, and if it is successful, the technique could make most heart transplants unnecessary, as well as many other cardiac procedures and medications.

Researchers last week in Memphis took a critical step toward this breakthrough with the world's first-ever injection of immature human muscle cells into the heart of a living pig. It was such a success that human trials could begin in Memphis within six months.

"We sacrificed the pig at the end of the experiment just to see where the cells took," says Joseph Weinstein, an interventional cardiologist with Cardiovascular Physicians of Memphis. "We wanted to make sure that we didn't lacerate the artery and that we got the cells into the myocardium where we wanted them, without perforating the heart. We found that this could be done safely."



Weinstein is a co-principal investigator of the technique, along with interventional radiologist Scott Williams, and Peter Law, a neurological researcher. Williams is director of the Medical Education and Research Institute, where the live pig experiment took

place. Law is founder and chairman of the Cell Therapy Research Foundation in Memphis and inventor of the myoblast treatment used in the experiment.

Myoblast was originally developed as a treatment for muscular dystrophy, patented by Law and cleared by the FDA in 1994 as a safe procedure. Cardiac regeneration was always considered the next frontier.

In myoblast, immature muscle cells grown in a culture are injected into a target muscle, where they fuse with existing cells, share genetic information and mature. In treating muscular dystrophy, the myoblast cells deliver the missing genes that diseased muscles lack.

In cardiac regeneration, it's expected that the myoblast cells will assume the identity of healthy heart cells as they mature, turning into new, fresh heart tissue. Earlier tests injecting animal myoblast into the same animal's heart indicate that the immature cells conform to the surrounding cells. Weinstein equates it with adopting a child as an infant and rearing it as one's own.

"The beauty of the myoblast is that once it goes into the host it fuses with the patient's cells and loses its identity," Law says. "Once that happens these cells are no longer recognized as foreign."

Therefore, unlike heart transplant recipients, myoblast patients would not need to take immune-suppressing drugs the rest of their lives nor undergo 10-20 biopsies each year.

Pigs are used because their anatomy is similar to humans. The first experiment was to practice the technique, which uses a Johnson & Johnson NOGA injection system. It involves inserting a catheter into a main blood vessel in the groin, threading it up to the heart and using that to guide a tiny needle into specific points in the heart muscle.

The NOGA system is approved for imaging uses and is investigational for gene therapy. This is the first time it has been used for an injection procedure like this. Johnson & Johnson officials were on hand to observe.

"It worked much better than we expected," Weinstein says. "It's a tiny needle so it can be safely deployed to the heart."

He injected about 500 million immature cells into 20-40 injection points in the heart. That's about four cubic centimeters of fluid. Human cells were used so they would be easier to identify after the organ was dissected. The first test animal died on the table from complications related to the anesthesia before the procedure began.

"We didn't have any complications from the procedure," Weinstein says. "We checked the viability of the myoblast before and after and there was no loss of viability of the cells that we used. We learned that we could inject the amount that Dr. Law feels is necessary without causing damage."

The next experiment, which will take place in three weeks, will begin by inducing a heart attack in a test animal, causing a measurable amount of damage. Then, myoblast will be injected into healthy cells at the periphery of the damaged area. Law believes these cells will grow using the damaged areas as a matrix.

Cells are damaged in a heart attack because blood supply is cut off. However, heart cells have the ability to regenerate blood vessels to healthy cells, if there's a demand.

Unlike skeletal muscles, heart muscle does not have the ability to produce new cells.

"Before a baby is born, the number of cardiac myocytes that will grow into the heart is already set, which is why heart does not regenerate like other muscles," Weinstein says.

The investigators are already consulting with local transplant surgeons, looking for human myoblast candidates.

"We hope the first human trials are those awaiting a transplant," Weinstein says. "We already know those hearts have to come out."

When transplant patients reach the point that they need a ventricular assist device implanted, Weinstein plans to inject myoblast then, while the chest is open. Once the person receives a new heart, the treated organ can then be studied.

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