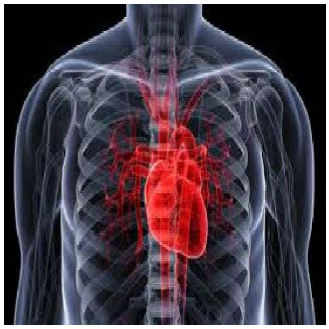
Heart Attack: Stem Cells May Enhance Cardiac Repair



Stem cell factor (SCF) delivered directly into damaged heart muscle after a heart attack may help repair and regenerate injured tissue, according to a study by Icahn School of Medicine at Mount Sinai in New York. Researchers administered SCF by gene transfer shortly after inducing heart attacks in pre-clinical models, delivering SCF directly into damaged heart tissue to test its regenerative repair response.

In the study, a novel SCF gene transfer delivery system induced the recruitment and expansion of adult c-Kit positive (cKit+) cardiac stem cells to injury sites that reversed heart attack damage. The gene therapy also improved cardiac function, decreased heart muscle cell death, increased regeneration of heart tissue blood vessels, and reduced the formation of heart tissue scarring.

cKit+ cells are a critical cardiac cytokine, or protein receptor, that bond to stem cell factors. They naturally increase after myocardial infarction and through cell proliferation are involved in cardiac repair, the researchers said.

“Our discoveries offer insight into the power of stem cells to regenerate damaged muscle after a heart attack,” said lead study author Kenneth Fish, PhD, Director of the Cardiology Laboratory for Translational Research, Cardiovascular Research Center, Mount Sinai Heart, Icahn School of Medicine at Mount Sinai. The findings were presented at the American Heart Association Scientific Sessions 2014 in Chicago, Illinois.

The expression of SCF gene results in the generation of specific signals to neighbouring cells in the damaged heart, leading to improved outcomes at the molecular, cellular, and organ levels, explained Roger J. Hajjar, MD, senior study author and Director of the Cardiovascular Research Center at Mount Sinai. “Thus, while still in the early stages of investigation, there is evidence that recruiting this small group of stem cells to the heart could be the basis of novel therapies for halting the clinical deterioration in patients with advanced heart failure.”

According to researchers, there has been a need for the development of interventional strategies for cardiomyopathy and preventing its progression to heart failure. Heart disease is the number one cause of death in the United States, with cardiomyopathy or an enlarged heart from heart attack or poor blood supply due to clogged arteries being the most common causes of the condition. Cardiomyopathy also causes a loss of cardiomyocyte cells that control heartbeat, and changes in heart shape, which lead to the heart’s decreased pumping efficiency.

“Our study shows our SCF gene transfer strategy can mobilise a promising adult stem cell type to the damaged region of the heart to improve cardiac pumping function and reduce myocardial infarction sizes resulting in improved cardiac performance and potentially increase long-term survival and improve quality of life in patients at risk of progressing to heart failure,” Dr. Fish pointed out.

The study provides further evidence that a small population of adult stem cells can be recruited to the damaged areas of the heart and improve clinical outcomes, added Dr. Hajjar.

This research project was done in collaboration with the Celladon Corporation in San Diego, California. Dr. Hajjar is the scientific cofounder of Celladon, which is developing his AAV1/SERCA2a gene therapy for the treatment of heart failure. He holds equity in Celladon and receives financial compensation as a member of its advisory board.

Source: Newswise.com
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Published on : Wed, 3 Dec 2014

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