Gene and stem cell therapy combination could aid wound healing

October 9 2013

Johns Hopkins researchers, working with elderly mice, have determined that combining gene therapy with an extra boost of the same stem cells the body already uses to repair itself leads to faster healing of burns and greater blood flow to the site of the wound.

Their findings offer insight into why older people with burns fail to heal as well as younger patients, and how to potentially harness the power of the body's own bone marrow stem cells to reverse this age-related discrepancy.

"As we get older, it is harder for our wounds to heal," says John W. Harmon, M.D., a professor of surgery at the Johns Hopkins University School of Medicine, who will present his findings to the American College of Surgeons' Surgical Biology Club on Sunday. "Our research suggests there may be a way to remedy that."

To heal burns or other wounds, stem cells from the bone marrow rush into action, homing to the wound where they can become blood vessels, skin and other reparative tissue. The migration and homing of the stem cells is organized by a protein called Hypoxia-Inducible Factor-1 (HIF-1). In older people, Harmon says, fewer of these stem cells are released from the bone marrow and there is a deficiency of HIF-1. The protein was first discovered about 15 years ago at Johns Hopkins by Gregg L. Semenza, M.D., Ph.D., one of Harmon's collaborators.

Harmon and his colleagues first attempted to boost the healing process in

mice with burn wounds by increasing levels of HIF-1 using gene therapy, a process that included injecting the rodents with a better working copy of the gene that codes for the protein. That had worked to improve healing of wounds in diabetic animals, but the burn wound is particularly difficult to heal, and that approach was insufficient. So they supplemented the gene therapy by removing bone marrow from a young mouse and growing out the needed stem cells in the lab. When they had enough, they injected those supercharged cells back into the mice.

After 17 days, there were significantly more mice with completely healed burns in the group treated with the combination therapy than in the other groups, Harmon says. The animals that got the combination therapy also showed better blood flow and more blood vessels supplying the wounds.

Harmon says a wound treatment like this that uses a patient's own cells is promising because the patient would be less likely to reject them as they would cells from someone else. Meanwhile, he says, HIF-1 gene therapy has been safely used in humans with sudden lack of blood flow to a limb.

"It's not a stretch of the imagination to think this could someday be used in elderly people with burns or other difficult wounds," Harmon says.

Provided by Johns Hopkins University School of Medicine