Stem cell study aims to reduce amputations

March 9 2011

UC Davis Vascular Center researchers have embarked on a highly anticipated study that involves using a patient's own stem cells to increase blood circulation to the lower leg with the hope of preventing amputation due to severe arterial disease or diabetes.

"Losing a limb is a devastating complication of advanced vascular disease," said John Laird, medical director of the vascular center and a principal investigator of the study. "We are deeply committed to finding alternatives to amputations that save lives and improve quality of life for vascular patients."

An estimated 85,000 leg amputations are performed each year in the U.S. due to advanced atherosclerosis — also known as critical limb ischemia — which occurs when the buildup of fatty deposits, calcium and plaque in arteries greatly reduces blood flow to lower extremities. Current treatments for the condition include opening blockages with balloon angioplasty, bolstering weakened arteries with metal stents or bypassing damaged arteries with vein grafts. When the disease progresses to the point of limb-threatening ischemia and when angioplasty, stents or surgery are not viable, amputation becomes the only option.

"Many patients require limb amputation because angioplasty or surgery is either not successful or not possible," said Laird. "Stem cell therapies could provide less-invasive options for these desperate patients and may offer a more permanent way to restore circulation."

The study involves a one- to two-hour surgical procedure during which bone marrow is harvested from the pelvis and spun in a centrifuge to separate mononuclear cells. These cells consist of white blood cells and mononuclear stem cells containing concentrations of endothelial progenitor cells — the stem cells responsible for initially forming blood vessels in utero. The separated stem cells are injected at multiple points into the muscle of the leg at risk for amputation. The cells are also tested for sterility and quality in the new UC Davis Good Manufacturing Practice Facility that was funded by the California Institute for Regenerative Medicine (CIRM).

"The hope is that what these cells do in the very early stages of life can be repeated much later in life by producing new blood vessels that circumvent damaged ones altogether," said Laird.

The entire process requires one operating room procedure and involves minimal discomfort. Patients remain in the hospital overnight and are expected to return to the UC Davis Vascular Center in Sacramento for a series of five follow-up visits over the course of a year.

The trial sponsor, Biomet Biologics of Warsaw, Ind., manufactures the specialized equipment — called MarrowStim — used to extract blood cells from bone marrow along with the high-speed, table-top centrifuge that separates and concentrates the mononuclear cells, making it easy to deliver them to treatment targets. The company recently completed a Phase I safety study of the technology, and the results were used to refine the technology and launch the new national FDA-approved trial.

The study initiates the stem cell research program of the vascular center, which is currently the only West Coast site for this investigation. UC Davis was selected to participate because of its vascular and bone-marrow harvest expertise in addition to the resources of its Institute for Regenerative Cures, where team-oriented science is advancing

breakthrough discoveries in stem cell therapies.

"Our own research in mice has shown that adult human stem cells are very efficient at targeting areas of low oxygen and promoting the formation of new blood vessels," said Jan Nolta, director of the UC Davis Stem Cell Program and Institute for Regenerative Cures. "This next stage of our research will determine if the treatment truly offers hope for people without other options and who are at risk of losing a limb."

Provided by UC Davis