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Researchers grow human blood vessels in mice from adult progenitor cells

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For the first time, researchers have successfully grown functional human blood vessels in mice using cells from adult human donors — an important step in developing clinical strategies to grow tissue, researchers report in *Circulation Research: Journal of the American Heart Association*.

"What's really significant about our study is that we are using human cells that can be obtained from blood or bone marrow rather than removing and using fully developed blood vessels," said Joyce Bischoff, Ph.D., senior author of the study and associate professor at Harvard Medical School and Children's Hospital Boston.

The researchers combined two different types of progenitor cells in a culture dish of nutrients and growth factors, then washed off the nutrients and implanted the cells into mice with weakened immune systems. Once implanted, the progenitor cell mixture grew and differentiated into a small ball of healthy blood vessels.

Progenitor cells are similar to stem cells but can only differentiate into specific cells, while stem cells can differentiate into practically any cell in the body.

In the study, researchers used two different kinds of progenitor cells to grow blood vessels: the endothelial progenitor cells (EPCs), which become cells that line the vessels, and mesenchymal progenitor cells (MPCs), which differentiate into the cells that surround the lining and

provide stability.

The researchers used different combinations of the two types of progenitor cells. They found that a mixture of adult blood- and adult bone marrow-derived progenitor cells or a combination of umbilical cord blood-derived and adult bone marrow-derived cells resulted in the greatest density of new blood vessel formation.

The ability to rapidly grow two-layered blood vessels without using embryonic or umbilical cord blood stem cells could skirt many ethical concerns, Bischoff said. It would also solve a persistent problem in treating several medical conditions that result from ischemia — the inability of oxygen-rich blood to reach an organ or tissue — such as heart attacks, wound healing and many acute injuries.

"What we are most interested in right now is speeding up the vascularization (the formation of blood vessels)," Bischoff said. "We see very good and extensive vasculature in seven days and we'd like to see that in 24 or 48 hours. If you have an ischemic tissue, it's dying tissue, so the faster you can establish blood flow the better."

If researchers can develop ways to speed the growth of the vessels, non-surgical cardiac bypass procedures could potentially grow new vessels around those blocked by atherosclerosis.

Bischoff said other findings include:

-- The cells created a vigorous network of vessels that connected to one another and to the vessels of the host mouse within seven days and continued to transport blood during the four-week study.

-- Once combined and implanted, the two progenitor cells arranged themselves into vessels with minimal outside help, i.e., without any

genetic alteration or manipulation to improve their growth. This is important because many growth-promoting genes are the same genes that become activated in cancer.

-- Mixtures of EPCs and MPCs from adult donors were as effective at generating vessels as those made from a mixture of cord blood EPCs and adult bone marrow MPCs. That finding increases the likelihood of someday being able to easily find clinically useful amounts of progenitor cells.

The research could also enhance tissue engineering — growing new organs for later implantation into patients, another medical research field that needs good sources of microvascularization to develop, Bischoff said.

Source: American Heart Association