Researchers develop a way to monitor engineered blood vessels as they grow in patients

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Using magnetic resonance imaging (MRI) and nanoparticle technology, researchers from Yale have devised a way to monitor the growth of laboratory-engineered blood vessels after they have been implanted in patients. This advance represents an important step toward ensuring that blood vessels, and possibly other tissues engineered from a patient's own biological material, are taking hold and working as expected. Until now, there has been no way to monitor the growth and progress of engineered tissues once they were implanted. This research was published in the December 2011 issue of the *FASEB Journal*.

"We hope that the important findings from our study will serve as a valuable tool for physicians and scientists working to better understand the biological mechanisms involved in tissue engineering," said Christopher K. Breuer, M.D., co-author of the study from the Interdepartmental Program in Vascular Biology and Therapeutics at Yale University School of Medicine in New Haven, CT. "Resulting advances will hopefully usher in a new era of personalized medical treatments where replacement vessels are specifically designed for each patient suffering from cardiac anomalies and disease."

To make this advance, scientists used two different groups of cells to make tissue-engineered blood vessels. In the first group, the cells were labeled with the MRI contrast agent. In the second group, the cells were normal and did not have an MRI label. Cells from each group were then

used to create separate laboratory-engineered blood vessels, which were implanted into mice. The purpose was to see whether the laboratory-engineered blood vessels made from cells that were labeled with the contrast agent would indeed be visible on MRI and to make sure that the addition of the contrast agent did not negatively affect the cells or the function of the laboratory-engineered vessels. Researchers imaged the mice with MRI and found that it was possible to track the cells labeled with contrast agent, but not possible to track the cells that were not labeled. This suggests that using MRI and cellular contrast agents to study cellular changes in the tissue-engineered blood vessels after they are implanted is an effective way to monitor these types of vessels.

"This is great news for patients with congenital heart defects, who have to undergo tissue grafting, but that's only the tip of the scalpel," said Gerald Weissmann, M.D., Editor-in-Chief of the FASEB Journal. "As we progress toward an era of personalized medicine—where patients' own tissues and cells will be re-engineered into replacement organs and treatments—we will need noninvasive ways to monitor what happens inside the body in real time. This technique fulfills another promise of nanobiology."

More information: Jamie K. Harrington, Halima Chahboune, Jason M. Criscione, Alice Y. Li, Narutoshi Hibino, Tai Yi, Gustavo A. Villalona, Serge Kobsa, Dane Meijas, Daniel R. Duncan, Lesley Devine, Xenophon Papademetri, Toshiharu Shin'oka, Tarek M. Fahmy, and Christopher K. Breuer. Determining the fate of seeded cells in venous tissue-engineered vascular grafts using serial MRI. FASEB J. December 2011 25:4150-4161; doi:10.1096/fj.11-185140

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