

Nanoparticles plus adult stem cells demolish plaque

July 19 2010

A technique that combines nanotechnology with adult stem cells appears to destroy atherosclerotic plaque and rejuvenate the arteries, according to a study reported at the American Heart Association's Basic Cardiovascular Sciences 2010 Scientific Sessions - Technological and Conceptual Advances in Cardiovascular Disease.

In the study, nanoparticles ([microscopic particles](#) with at least one dimension less than 80 nm) were infused into the heart of pigs along with [adult stem cells](#). After the nanoparticles were heated by [laser light](#), they burned away [arterial plaque](#). However, nanoparticles were less effective at eliminating plaque if not combined with adult stem cells.

"This unique approach holds promise for use in humans for acute care and urgent restoration of blood flow," said Alexandr Kharlamov, M.D., lead author and research manager at the Department of Internal Medicine and Research Center of Regenerative Medicine, Ural State Medical Academy in Yekaterinburg, Russian Federation. "Biophotonics (light therapy), plasmonics (plasma therapy), [stem cell therapy](#) and nanotechnology might someday offer a completely novel treatment to reduce artery plaque build-up."

Unlike angioplasty, a common treatment for atherosclerosis, this new technique seems to actually demolish the plaque, Kharlamov said. In angioplasty, a balloon-tipped catheter is threaded into a blocked artery and the balloon is inflated to restore blood flow. The balloon squeezes plaque against the artery wall, but does not eliminate it.

A treatment group of 19 pigs received silica-gold [nanoshells](#), while 18 animals in a control group received saline solution. The treatment group was subdivided into three subsets that received nanoparticles in one of three ways:

- intracellularly along with adult stem cells infused into the heart;
- via an infusion of gas-filled, protein-coated microbubbles that contained no stem cells; or
- delivered through a bioengineered patch that also contained adult stem cells and was attached to the artery itself through minimally invasive surgery.

The researchers found that plaque volume shrunk considerably in the nanoparticle groups immediately after the procedure (an average of 28.9 percent across the three groups) and six months later plaque volume had declined 56.8 percent on average. In the control group that received only saline, plaque volume increased an average of 4.3 percent, he said.

The greatest reductions in plaque volume occurred in the treatment groups that received stem cells in addition to the nanoparticles. Also, both groups that received stem cells showed signs of new blood vessel growth (neovascularization) and restoration of artery function.

Three cases of blood clots occurred only in the microbubble treatment group, Kharlamov said.

"Nanoburning in combination with stem cell treatment promises demolition of plaque and functional restoration of the vessel wall," Kharlamov added.

Provided by American Heart Association

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