Nanomagnets guide stem cells to damaged tissue

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Microscopic magnetic particles have been used to bring stem cells to sites of cardiovascular injury in a new method designed to increase the capacity of cells to repair damaged tissue, UCL scientists announced today.

The cross disciplinary research, published in *The Journal of the American College of Cardiology: Cardiovascular Interventions,* demonstrates a technique where endothelial progenitor cells - a type of stem cell shown to be important in vascular healing processes - have been magnetically tagged with a tiny iron-containing clinical agent, then successfully targeted to a site of arterial injury using a magnet positioned outside the body.

Following magnetic targeting, there was a five-fold increase in cell localisation at a site of vascular injury in rats. The team also demonstrated a six-fold increase in cell capture in an in vitro flow system (where microscopic particles are suspended in a stream of fluid and examined to see how they behave).

Although magnetic fields have been used to guide cellular therapies, this is the first time cells have been targeted using a method directly applicable to clinical practice. The technique uses an FDA (U.S. Food and Drug Administration) approved agent that is already used to monitor cells in humans using MRI (magnetic resonance imaging).

Dr Mark Lythgoe, UCL Centre for Advanced Biomedical Imaging, the

senior author on the study, said: "Because the material we used in this method is already FDA approved we could see this technology being applied in human clinical trials within 3-5 years. It's feasible that heart attacks and other vascular injuries could eventually be treated using regular injections of magnetised stem cells. The technology could be adapted to localise cells in other organs and provide a useful tool for the systemic injection of all manner of cell therapies. And it's not just limited to cells - by focusing tagged antibodies or viruses using this method, cancerous tumours could be much more specifically targeted"

Panagiotis Kyrtatos, also from the UCL Centre for Advanced Biomedical Imaging and lead researcher of the study, added: "This research tackles one of the most critical challenges in the biomedical sciences today: ensuring the effective delivery and retention of cellular therapies to specific targets within the body.

"Cell therapies could greatly benefit from nano-magnetic techniques which concentrate cells where they are needed most. The nano-magnets not only assist with the targeting, but with the aid of MRI also allow us to observe how the cells behave once they're injected."

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More information: The paper "Magnetic tagging increases delivery of circulating progenitors in vascular injury" is published online ahead of print in *The Journal of the American College of Cardiology: Cardiovascular Interventions*.

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