Researchers find a better way to track stem cells

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A study published in the current issue of *Cell Transplantation* (19:1) has found that using the FDA-approved contrast agent Indocyanine Green (ICG) to label human embryonic stem cell-derived cardiomyocytes (hESC-CMs) substantially improved efforts to optically track stem cells after transplanting them into heart tissues.

The study, carried out by the Departments of Radiology at the University of California and the Technical University of Munich, is freely available on-line at www.ingentaconnect.com/content/cog/ct).

"We found that hESC-CMs labeled with ICG show a significant fluorescence up to 48 hours and can be visualized with optical imaging," said study lead author Dr. Sophie E. Boddington of the UCSF Department of Radiology. "Once more, the labeling procedure did not impair the viability or functional integrity of the cells."

According to the researchers, finding an efficient stem cell delivery technique has been a challenge. Too often, stem cells aimed at myocardial regeneration are "washed away" into noncardiac tissues or they soon die. A 10 percent survival rate for hESC-CMs has been common. Researchers knew that a better way to visualize the transplanted stem cells was needed to help direct and order stem cell delivery, and they also knew that materials used to label the cells had to be maximally fluorescent but not detrimental to the viability of the cells.

"We found the ICG-labeling technique advantageous because it is cost

effective, straightforward and rapid," concluded Dr. Boddington. "Its most noticeable advantage is that it can be used with iron oxide-based nanoparticles for use with MRIs, as it increases single cell sensitivity. This is important because of the unpredictable migrational dynamics of the cells."

The researchers added that although PET techniques are more single cell sensitive than MRI, PET introduces radiation exposure and associated risks. In addition to not involving ionized radiation, optical imaging, using the MRI is quicker, less expensive, easier to perform, and noninvasive. Once more, ICG marking is already FDA-approved and accessible.

An added benefit, said Dr. Boddington, is that ICG is rapidly excreted, which suggests safe elimination.

While the ability of hESCs to regenerate into cells of almost all human tissues has been documented, and this provides a promising therapeutic source for myocardial regeneration after cardiac ischema, few studies have actually demonstrated this potential. Visualizing transplanted stem cells could, however, benefit cell retention and improve cell functional outcomes.

"Our data suggests that hESCs labeled with ICG may be useful in assessing delivery routes to improve the engraftment of transplanted hESC-CMs or other stem cell progenitors," concluded Dr. Boddington.

The study has significance, said Dr. Dwaine Emerich, section editor for Cell Transplantation.

"These studies are an important step forward in the quest for techniques to label and visualize stem cells in vivo," said Dr. Emerich. "The ICG-labeling technique described by Boddington and colleagues provides

several advantages including its straight forward simplicity, reliability, and the fact that the technique can be easily combined with other developing imaging technologies."

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