Stem cell therapy for age-related macular degeneration -- a step closer to reality

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The notion of transplanting adult stem cells to treat or even cure age-related macular degeneration has taken a significant step toward becoming a reality. In a study published today in *Stem Cells,* Georgetown University Medical Center researchers have demonstrated, for the first time, the ability to create retinal cells derived from human-induced pluripotent stem cells that mimic the eye cells that die and cause loss of sight.

Age-related macular degeneration (AMD) is a leading cause of visual impairment and blindness in older Americans and worldwide. AMD gradually destroys sharp, central vision needed for seeing objects clearly and for common daily tasks such as reading and driving. AMD progresses with death of retinal pigment epithelium (RPE), a dark color layer of cells which nourishes the visual cells in the retina.

While some treatments can help slow its progression, there is no cure. The discovery of human induced pluripotent stem (hiPS) cells has opened a new avenue for the treatment of degenerative diseases, like AMD, by using a patient's own stem cells to generate tissues and cells for transplantation.

For transplantation to be viable in age-related macular degeneration, researchers have to first figure out how to program the naïve hiPS cells to function and possess the characteristics of the native retinal pigment epithelium, RPE, the cells that die off and lead to AMD.

The research conducted by the Georgetown scientists shows that this critical step in regenerative medicine for AMD has greatly progressed.

"This is the first time that hiPS-RPE cells have been produced with the characteristics and functioning of the RPE cells in the eye. That makes these cells promising candidates for retinal regeneration therapies in age-related macular degeneration," says the study's lead author Nady Golestaneh, Ph.D., assistant professor in GUMC's Department of Biochemistry and Molecular & Cellular Biology.

Using an established laboratory stem cell line, Golestaneh and her colleagues show that RPE generated from hiPS cells under defined conditions exhibit ion transport, membrane potential, polarized VEGF secretion and gene expression profile similar to those of a normal eye's RPE.

"This isn't ready for prime time though. We also identified some issues that need to be worked out before these cells are ready for transplantation but overall, this is a tremendous step forward in regenerative medicine," Golestaneh adds.

She explains that the hiPS-derived RPE cells show rapid telomere shortening, DNA chromosomal damage and increased p21 expression that cause cell growth arrest. This might be due to the random integration of viruses in the genome of skin fibroblasts during the reprogramming of iPS cells. Therefore, generation of viral-free iPS cells and their differentiation into RPE will be a necessary step towards implementation of these cells in clinical application, Golestaneh says.

"The next step in this research is to focus on a generation of 'safe' as well as
viable hiPS-derived somatic cells," Golestaneh concludes.

Provided by Georgetown University Medical Center