Neural stem cell transplants for spinal cord injury maximized by combined, complimentary therapies

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Combined, complimentary therapies have the ability to maximize the benefits of neural stem cell (NSC) transplantation for spinal cord repair in rat models, according to a study carried out by a team of Korean researchers who published in a recent issue of Cell Transplantation (20:9), now freely available on-line.

"When transplanted, neural stem cells have demonstrated their therapeutic potential to reverse complex pathological processes following spinal cord injury," said study corresponding author Dr. Byung G. Kim of the Ajou University School of Medicine's Brain Disease Research Center and Department of Neurology, Republic of Korea. "However, many obstacles cannot be overcome by NSC transplant alone."

Their study demonstrated that a combination of treatment strategies - a polymer scaffold, neurotrophin-3 (NT3) and chondroitinase (an enzyme which helps digest the glial scar that formed after a spinal cord injury) - provided added therapeutic benefits to NSC transplantation. The implantation of a polymer scaffold designed to bridge lesion cavities, created a favorable tissue environment for nerve growth. Incorporating the NT3 gene into the transplanted cells improved cell survival and migration while the addition of chondroitinase positively affected neural activity between the scaffold and the spinal cord.

"The poly (ε-caprolactone) [PCL] scaffold in our study appeared to function like a reservoir supplying migratory NSCs to the spinal cord," said Dr. Kim. "The NSCs grafted with the scaffolds survived the transplantation and migrated to the host spinal cord."

The study included four animal groups, only one of which received the full combination of therapies. Rats in the full combination therapy group were found to have some restored neuroplasticity and enhanced remyelation of contralateral white matter. All four groups subsequently underwent functional testing for locomotor recovery.

"Rats in the full combination group attained well-coordinated plantar stepping accompanied by improved ankle positioning and toe clearance and reduced paw placement errors," explained Dr. Kim. "Furthermore, animals with the full complement of combination strategies responded to transcranial magnetic stimulation."

The researchers concluded that, given their success, similar treatment for humans should be carried out in a chronic injury setting.

"We believe that our results have important clinical implications regarding the future design of NSC-based therapeutic strategies for human victims of traumatic spinal cord injury," concluded Dr. Kim and co-authors.

"The use of multiple strategies to treat spinal cord injury, could prove to be more effective than any single treatment." Cell Transplantation section editor Dr. John Sladek, professor of neurology and pediatrics at the University of Colorado School of Medicine. "Changing the hostile environment post spinal cord injury by the use of scaffolds, neurotrophins and breakdown of the glial scar creates a favorable milieu for NSCs to be able to exert benefit".

More information: Hwang, D. H.; Kim, H. M.; Kang, Y. M.; Joo, I. S.; Cho, C. S.; Yoon, B. W.; Kim, S. U.; Kim, B. G. Combination of multifaceted strategies to maximize the therapeutic benefits of neural stem cell transplantation for spinal cord repair. *Cell Transplant.* 20(9):1361-1379; 2011.