

Hydrogel-Assisted Brain Transplantation of HOXA3-Expressing Endothelial Progenitor Cells for Brain Repair After Stroke

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Stroke is the leading cause of disability in the United States and the fifth leading cause of death worldwide. An ischemic stroke occurs when a blockage cuts off the blood supply in the brain, leaving behind an empty cavity. While the severity of stroke may be mitigated using tissue plasminogen activator, a chemical dissolvent, or mechanically retrieving the blood clot with endovascular stents, there are no FDA-approved treatments that completely remove the resultant neurological deficits. These limitations urge the need to explore therapeutic solutions outside conventional practices in neuroscience. It has been recently found that post-stroke angiogenesis plays a major role in endogenous repair mechanisms. Additionally, HOXA3, a gene expressed during embryonic development, has been shown to assist in the rapid development of a vascular network. Here, we propose to engineer HOXA3-expressing endothelial progenitor cells and hypothesize that it will increase vascular sprouting and therefore enhance brain repair. To evaluate the impact of HOXA3 on endothelial progenitor cells, an optimized three-dimensional engineered system was used to observe and promote angiogenesis in vitro using Human Umbilical Vein Endothelial Cells (HUVECs) coated on dextran beads that have been suspended in a fibrin scaffold. Two groups were tested: HUVECs and HOXA3-expressing HUVECs. It was found that HOXA3-expressing HUVECs showed enhanced vascular area, longer sprouts, and a higher degree of anastomosis, or connection between blood vessels. These findings support the hypothesis that HOXA3 creates a more robust vascular plexus, advancing understanding of the therapeutic potential of HOXA3 on stem cell-based treatments for stroke.

Awards Won:

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