Hydrogel-Assisted Neural Stem Cell Transplantation for Brain Repair After Stroke

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Stroke is a leading cause of long-term disability in the United States, and no clinical trials to date have successfully reduced neurological impairment in stroke survivors. While stem cell transplantation has shown promise in activating brain repair mechanisms in preclinical animal models of cerebral ischemia, its clinical translation has been limited by poor cell survival. We believe that this limitation could be overcome by transplanting cells within a protective material to facilitate cell proliferation and integration with the injured brain. In addition, we believe that including pro-vascular capabilities to this material will enhance vascular infiltration in the implant, re-routing blood flow, and providing oxygen, glucose, and nutrients to the implanted cells. We have recently developed a Hyaluronic Acid (HA)-based engineered implant specifically designed to 1) encapsulate stem cells to enhance their survival post-implantation, 2) be injected directly in the stroke lesion site throughout a small craniotomy puncture in the skull, 3) solidify in situ to mimic natural brain tissue, and 4) promote vascular infiltration in the lesion site, subsequently leading to tissue repair. We hypothesize that this implant can enhance regeneration of the lost tissue and promote recovery of the lost function. This project aims to evaluate the implant's capacity to achieve these outcomes and to compare its effects with those of simpler, less sophisticated implants lacking stem cells and vascular properties.

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