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Scientists develop MRI-guided neural stem cell delivery method

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A national science publication has featured the work of San Antonio scientists aiming to develop a more effective method for delivering neural stem cells to the brain in an effort to move forward stem cell therapies to treat neurological disorders.

Dr. Marcel Daadi, Associate Scientist and Director of the Regenerative Medicine and Aging Unit at Texas Biomedical Research Institute's Southwest National Primate Research Center (SNPRC), along with his colleagues at the Research Imaging Institute at the University of Texas Health Science Center at San Antonio (UTHSCSA) and MRI-Interventions Inc. in Irvine, CA published a paper this month in the journal *Stem Cells Translational Medicine* titled, "MRI Guided Delivery of Neural Stem Cells into the Basal Ganglia of Nonhuman Primates Reveals a Pulsatile Mode of Cell Dispersion."

Daadi and his colleagues are developing this technology in an effort to treat patients suffering from neurological disorders, like Parkinson's disease, stroke and traumatic brain injury. His research has already developed stem cells capable of becoming dopaminergic cells, which are the cells Parkinson's patients lose over time. An MRI-guided technique to implant these cells would move scientists one step closer to delivery of this therapy to patients.

In the paper, Daadi explains, "Stem cell-based therapy is emerging as a promising treatment for a variety of diseases and injuries. The first step in evaluating the potential of different therapeutic stem cell lines is to

develop a safe and effectively reproducible delivery system."

He writes that injection parameters have been well studied in drug delivery methods; however, they simply cannot be directly applied to stem cell-based therapy and the technology for stem cell delivery is undeveloped and limited. Current limitations include inconsistent cell survival, injection site inaccuracy and the inability to avoid puncturing structures like blood vessels, which causes hemorrhages during brain penetration.

He and his colleagues, including Dr. Geoffrey Clarke and Dr. Peter Fox of the Research Imaging Institute at UTHSCSA and the MRI Interventions Inc. team, developed an operational technique for delivering stem cells with low invasiveness and high accuracy in placement of the stem cells to the basal ganglia part of the brain. The basal ganglia controls motor skills compromised in Parkinson's disease.

The team tested the technique on baboons at the SNPRC and not only showed effective targeted delivery but also revealed a pulsatile dispersion of injected cells, meaning cells were not released at a steady rate but instead dispersed in small bursts. This is a significant finding as it demonstrated how injected cells disperse in the host brain and stimulates new ideas on how we can prepare the cells to function at their best.

"We wouldn't have been able to see this phenomenon using standard stereotaxic delivery," said Dr. Daadi. "With iMRI, we can visualize in real time the cells being injected to the target area. A non-invasive iMRI approach is becoming a necessity in clinical applications to enhance the safety of patients and the efficacy of the therapeutic approach. We can create the best cells, but if we can't transplant them to the patient in a consistent and predictable way so that the patient can accept and thrive from them, then the therapy is simply ineffective."

Dr. Daadi was able to complete his study thanks to funds received from private donors to Texas Biomedical Research Institute and The Perry & Ruby Stevens Charitable Foundation. Dr. Daadi's work is also supported by the Robert J., Jr. and Helen C. Kleberg Foundation and the William and Ella Owens Medical Research Foundation. Research at the Southwest National Primate Research Center is supported by a grant from the Office of Research Infrastructure Programs, National Institutes of Health P51 OD011133.

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