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What Are the Effects of Using Adult Neural Precursor Cells on Demyelinated Brains?

What is this research about?

Cerebral palsy (CP), spinal cord injuries (SCIs), and multiple sclerosis (MS) are neurological conditions that are linked with a complex set of characters. These characters are: demyelination (the loss of myelin), axonal dysfunction and disruption, and neuromotor impairments. Neural precursor cells (NPCs) are one potential source to replace cells and remyelinate damaged subcortical structures. But there is a lack of research on the functional impact of NPC-induced myelin. For children with CP, the infant brain is highly plastic and ideal for cell survival. NPCs may be ideal for use to treat CP-natured injuries. But preclinical trials show that the optimal time for transplanting NPCs is on the day of human birth (the equivalent of day 7 for mice). This is far in advance of the usual age of diagnosis for CP, which is 2 years for infants. What possible impacts can NPC-induced myelin have on the brain?

What did the researchers do?

The researcher focused specifically on the corpus callosum (CC) of the brain. The CC transfers and integrates sensorimotor and cognitive information to the brain's interhemisphere. It is usually impacted early by demyelination. It is also an easy source to observe distinct profiles of brain axons that may remyelinate with NPCs. Previous research has focused mostly on the impact of myelin on a few phenotype changes. However, the study looked more thoroughly at the links between myelin and functional improvement in the brain. A brief review on the study's detailed methods includes these steps:

- Breeding: 53 shiverer (shi/shi) mice and 9 wild type (WT) mice were inbred and used.
- Isolating and processing adult NPCs: Taken from adult mouse brains with enhanced yellow fluorescence protein (YFP).
- Transplanting the adult NPCs: 250,000 NPCs were distributed over 5 injection sites in the CC. This was done on mice at birth (P0), at 7 days old (P7) and at 21 days old (P21).
- Perfusion: Mice were killed at 45 days, perfused with a wash, and with their brain extracted and treated to study immunohistochemistry.
- Immunohistochemistry: The brain tissue was sliced and frozen into slides, that were then washed, treated and incubated for study.
- Measuring YFP in cells: The phenotypes and capacity for cell differentiation was calculated.
- Quantifying NPC differentiation: The number of YFP cells with a nucleus was calculated among YFP cells in each cell marker.
- An electron microscopy was performed.
- A computer model was used to estimate the

What you need to know:

Based on cell replacement therapy done on mice, there is a great potential for adult neural precursor cells to treat brain injuries from demyelination. This may result in positive outcomes for function and resilience to brain injuries.

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effect of myelin layer change after the NPCs were transplanted. This was done using a transmission electron microscopy (TEM).
- Compound action potential (CAP) was recorded, and descriptive statistics were made based on cell differentiation.

What did the researchers find?

The researcher found that:

- Transplanted adult NPCs survived and located to white matter tracts in the CC and hippocampal fimbria.
- Adult NPCs became myelinating oligodendrocytes (OLs) that associate with axons.
- The growth of myelin led to greater functional recovery. This resulted in: greater conduction velocity, a lower threshold for activation, less refractory materials, improved response to high frequency stimulation, and greater tolerance to ischemia.

With their findings, the researchers were able to establish a computer model that would help uncover the functional properties of myelinated axons. They found that cell replacement therapy may help rescue these properties for damaged cells.

How can you use this research?

Pediatricians and other clinical personnel working with those with CP may find this research useful. It offers insight on the current work being done to discern the potential of cell replacement therapy for people with CP.

Policymakers may also find this study relevant. It offers insight on future funding priorities to apply findings in a clinical trial setting.

Finally, health researchers may also build on this study's model by exploring the details and potential for using adult NPCs. It also sheds insight on the ideal time on using cell replacement therapy.

About the Researchers

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