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Can Stem Cells Be Used to Help Treat Cerebral Palsy?

What is this research about?

Preterm birth survivors make up the largest subgroup of children with cerebral palsy (CP). Within this group, the most common brain injury is periventricular leukomalacia (PVL). PVL may also result in damaged oligodendrocyte cells. However, researchers are looking at how cell replacement therapy can help replace damaged cells in neuromotor tracts of the brain. Preclinical animal data suggest that stem cells can support neurological repair through:

1. Structural support to damaged and surrounding tissue;
2. Reproducing myelin (remyelinate) for damaged axons in nerve cells;
3. Supporting the growth of nerve tissues.

What impact can stem cell therapies have on people with CP?

What did the researchers do?

The researcher reviewed 3 types of cells from previous preclinical trial data.

Neural stem cells:

Neuroprecursor cells (NPCs) create more myelin by replacing lost or damaged oligodendrocytes. However, when NPCs are transplanted from within, the majority will turn into glial subtype cells and add to the structure of neurons in the brain. For people with CP, this may create more neuropathic pain or harm motor function. NPCs show the most potential for improving function, but are not safe yet for humans.

What you need to know:

A combined set of strategies that include stem cell therapy may be useful to treat those with CP. Further research is needed to understand the full impact and benefits that stem cells may have on neural injuries.

Peripheral glial cells (Schwann cells and OEG):

Preclinical and clinical trials often use Schwann cells and OEG to remyleinate and support brain tissue and structure. But the existing results have either been mixed, or difficult to recreate.

Peripheral non-neural cells (Mesenchymal stem cells [MCSs], marrow-derived MSCs and umbilical cord-derived MSCs):

MSCs are the most used in transplant studies. However, the data is too varied. More protocols and cell sources need to be developed to hone in on specific findings that can be replicated. Umbilical cord-derived MSCs also lack enough data to address results that impact motor functions, cell disappearance or worsened injuries

What did the researchers find?

Preclinical trials show success when stem cells are combined with other strategies to treat neural

injuries. However, more research needs to be done to understand the impacts that stem calls may have before considering its use with different methods. There are 8 current phase 1 clinical trials that are testing the use of stem cells in treating those with CP. With 1 trial completed, the results found that the MSCs-treated group showed improved motor and gross motor function. However, more analysis is still needed on the results and their impact.

There is also little data on transplanting NPCs to treat central nervous system disorders, especially on children. Other current challenges for using NPCs are:

1. Differentiation potential: varied trial outcomes are a result of NPCs derived with different sources and cell cultures.

2. Source of NPCs: More research is needed to find the best way to harvest NPCs from pluripotent cell sources for safe use on humans.

3. Transplant survival: Animal trials do not offer enough data to clearly outline the process details for transplanting external NPCs. Also, can this process be copied for humans?

4. Therapy timing and dose: Previous trials have used different time and dosage variables. More data is also needed to clarify the right combination for sensitive uses like treating neural injuries at a young age.

5. Toxicity: MSCs are safe for clinical use, but their benefits are not consistent in preclinical trials. NPCs have shown the most benefits with animal models, but are not yet safe for long term use by humans.

Combined strategies with stem cells would be needed because of the varied causes and nature of CP symptoms.

How can you use this research?

Clinicians may find this research useful. It suggests the potential for future clinical trials that patients might seek for experimental treatment. Health researchers and policymakers may also invest in stem cell therapy in future research for neural disorders like CP.

About the Researchers

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Stem cells, Cerebral palsy, Transplantation, Mesenchymal cells, Neural precursor cells

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