NEURAL STEM CELL TRANSPLANTATION FOR NEURODEGENERATIVE DISEASES

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Background. Neurodegenerative diseases, including Alzheimer's disease, Parkinson's disease, Huntington's disease, and amyotrophic lateral sclerosis, are severely disabling and ultimately fatal conditions that affect millions of individuals worldwide. Stem cell transplantation is emerging as a promising therapeutic approach due to its potential to facilitate multiple reparative processes within the central nervous system, such as cell replacement and paracrine effects.

Objective of the study. To evaluate the potential of neural stem cell (NSC) transplantation as a therapeutic approach for neurodegenerative diseases and identify the key mechanisms through which NSCs exert their effects.

Material and Methods. This study represents a literature synthesis based on articles published in the period 2020-2025, selected from the databases PubMed, NCBI, MPDI, Springer Ling, UpTodate.

Results. Studies have shown that neural stem cell transplantation can have a positive impact on neurodegeneration through various mechanisms, including neurotrophic factor production, reduced neuroinflammation, enhanced neuroplasticity, and cell replacement. To fully harness the potential of NSCs, it is crucial to investigate their biological characteristics, such as subpopulation markers, secretome, which is responsible for the regulation of intercellular communication, neuroprotection, and immunomodulation, and ability to migrate and integrate into NSC neuronal networks. Recent advances in gene editing and cellular engineering offer opportunities to enhance their therapeutic effects.

Conclusion. Neural stem cell transplantation offers significant potential for treating neurodegenerative diseases. It is necessary to standardize protocols, ensure control of secondary effects such as tumor formation and immune rejection. Further research is needed to optimize cell sourcing, improve long-term outcomes, and minimize risks.

Keywords: neuronal stem cells, neurodegenerative disease, cell therapy.