APPLICATIONS OF NEURAL STEM CELLS-LITERATURE REVIEW

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Background. Neural stem cells (NSCs) are multipotent progenitor cells capable of self-renewal and differentiation into the principal cellular components of the central nervous system, including neurons, astrocytes, and oligodendrocytes. In the adult brain, NSCs are primarily located in the subventricular zone and the hippocampal dentate gyrus, where they contribute to limited physiological neurogenesis. Advances in stem cell biology, molecular neuroscience, and regenerative medicine have significantly increased interest in the therapeutic potential of neural stem cells. Numerous experimental studies and emerging clinical trials have explored the capacity of NSCs to promote neural regeneration and functional recovery in a wide range of neurological disorders. The unique biological properties of neural stem cells, including their proliferative capacity, migratory behavior, and ability to integrate into neural circuits, make them promising candidates for cell-based therapies aimed at restoring damaged nervous tissue.
Aim of the study. The aim of this literature review is to analyze current scientific evidence regarding the applications of neural stem cells in regenerative medicine and neurological disease treatment, with emphasis on their mechanisms of action and therapeutic potential.
Results. The reviewed literature demonstrates that neural stem cells have been investigated in several neurological conditions, including neurodegenerative diseases, cerebrovascular disorders, traumatic injuries, and demyelinating diseases. In neurodegenerative disorders such as Parkinson's disease, Alzheimer's disease, Huntington's disease, and amyotrophic lateral sclerosis, NSCs have shown the potential to replace damaged neurons and provide neuroprotective support through the secretion of trophic factors. In stroke and traumatic brain injury models, neural stem cell transplantation has been associated with improved functional recovery by stimulating endogenous neurogenesis, promoting angiogenesis, and reducing inflammatory responses. In spinal cord injury, NSCs may contribute to neuronal replacement, remyelination, and reconstruction of neural pathways. Furthermore, research suggests that neural stem cells can play a role in the treatment of demyelinating diseases such as multiple sclerosis by differentiating into oligodendrocytes and promoting remyelination. In addition to therapeutic applications, NSCs are widely used in disease modeling, drug screening, and neural tissue engineering.
Conclusion. Neural stem cells represent a promising strategy for the treatment of various neurological disorders due to their regenerative and neuroprotective properties. Although preclinical and early clinical studies demonstrate encouraging outcomes, further research and well-designed clinical trials are required to establish the safety, efficacy, and long-term therapeutic benefits of neural stem cell–based therapies.