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Protective and therapeutic benefits of adipose stem cells in animal models of Alzheimer's disease and experimental cerebral palsy

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Accumulating evidence indicates that adipose stem cells (ASCs) show potential for neural differentiation and an ability to protect neural cells in animal models of central nervous system (CNS) injury. Thus, these cells represent a new approach to cell-based therapies. The present study examined whether human ASCs (hASCs) could protect a mouse model of Alzheimer's disease from further neurological degeneration and improve the physical activity of rats with experimentally-induced cerebral palsy. hASCs were infused into 3-month-old Tg2576 mice (Alzheimer's disease mouse model) via the tail vein at 2 weeks intervals over a period of 7 months. Compared with non-treated Tg2576 mice, mice injected with hASCs showed reduced formation of amyloid plaques in the cortex and recorded significantly improved scores in the Morris water maze test and Y-maze test. Immunohistochemical analysis with an anti-human nuclear antibody confirmed localization of hASCs within the hippocampal region of Tg2576 mice sacrificed 4 months after the final tail vein injection. Furthermore, differentiation of hASCs into neural cells was confirmed by the expression of human-Nestin within the mouse brain.

Experimental cerebral palsy was induced in Day 7 post-natal Sprague-Dawley rats by hypoxia-ischemia-lipopolysaccharide-reperfusion (HILR). HILR-induced rats were treated four times with the 1×10^6 hASCs via the tail vein at 1 weeks intervals. Intravenous infusion of hASCs improved both physical activity and cognitive defects. hASCs secrete growth and neurotrophic factors, which protect the myelin sheaths of the oligodendrocytes. The white matter of the HILR-induced hASC-treated rats sacrificed 7 days after the final injection was subjected to double immunohistochemical staining with an anti-hMito antibody. The results showed that the infused hASCs differentiated into oligodendrocyte lineage (Olig2) and neuronal cells (NF), but not into astrocytes (GFAP). The mature oligodendrocytes (differentiated from hASCs) produced myelin basic protein. In conclusion, repeated treatment with an adequate number of ASCs prevents further neurological damage and restores physical ability in animal models of neurodegenerative disease. Therefore, it is expected that ASCs will be useful for the treatment of cerebral nerve injuries.

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