

Positive Effects of Aerobic Exercise after Bone Marrow Stem Cell Transplantation on Recovery of Dopaminergic Neurons and Promotion of Angiogenesis Markers in the Striatum of Parkinsonian Rats

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Abstract : Introduction: Parkinson's disease (PD) is a progressive neurodegenerative in the central nervous system characterized by the loss of dopaminergic neurons in the substantia nigra resulting in loss of dopamine release in the striatum. Non-drug treatment options such as Stem cell transplantation and exercise have been considered for treatment of Parkinson's disease. Purpose: The purpose of this study was to evaluate the effect of aerobic exercise after bone marrow stem cells transplantation on recovery of dopaminergic neurons and promotion of angiogenesis markers in the striatum of parkinsonian rats. Materials and Methods: 42 male Wistar rats were divided randomly into six groups: Normal (N), Sham (S), Parkinson's (P), Stem cells transplanted Parkinson's (SP), Exercised Parkinson's (EP) and Stem cells transplanted + Exercised Parkinson's (SEP). To create a model of Parkinson's, the striatum was destroyed by injection of 6-hydroxy-dopamine into the striatum through stereotaxic apparatus. Stem cells were derived from the bone marrow of femur and tibia of male rats with 6-8 weeks old. After cultivation, approximately 5×10^5 cells in 5 microliter of medium were injected into the striatum of rats through the channel. Aerobic exercise was included 8 weeks of running on the treadmill with a speed of 15 meters per minute. At the end, all subjects were decapitated and striatum tissues were separately isolated for measurement of vascular endothelial growth factor (VEGF), dopamine (DA) and tyrosine hydroxylase (TH) levels. Results: VEGF, DA and TH levels in the striatum of parkinsonian rats significantly increased in treatment groups (SP, EP and SEP), especially in SEP group compared to P group after treatment ($P < 0.05$). Conclusion: The findings implicate that the BMSCs transplantation in combination with exercise would have synergistic effects leading to functional recovery, dopaminergic neurons recovery and promotion of angiogenesis marker in the striatum of parkinsonian rats.

Keywords : stem cells, treadmill training, neurotrophic factors, Parkinson

Conference Title : ICTERM 2015 : International Conference on Tissue Engineering and Regenerative Medicine

Conference Location : Paris, France

Conference Dates : July 20-21, 2015