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Electrophysiological, morphological, and ultrastructural features of the injured spinal cord tissue after transplantation of human umbilical cord blood mononuclear cells genetically modified with the VEGF and GDNF genes

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Abstract

© 2017 Y. O. Mukhamedshina et al. In this study, we examined the efficacy of human umbilical cord blood mononuclear cells (hUCB-MCs), genetically modified with the VEGF and GDNF genes using adenoviral vectors, on posttraumatic regeneration after transplantation into the site of spinal cord injury (SCI) in rats. Thirty days after SCI, followed by transplantation of nontransduced hUCB-MCs, we observed an improvement in H (latency period, LP) and M(Amax) waves, compared to the group without therapy after SCI. For genetically modified hUCB-MCs, there was improvement in Amax of M wave and LP of both the M and H waves. The ratio between Amax of the H and M waves (Hmax/Mmax) demonstrated that transplantation into the area of SCI of genetically modified hUCB-MCs was more effective than nontransduced hUCB-MCs. Spared tissue and myelinated fibers were increased at day 30 after SCI and transplantation of hUCB-MCs in the lateral and ventral funiculi 2.5 mm from the lesion epicenter. Transplantation of hUCB-MCs genetically modified with the VEGF and GNDF genes significantly increased the number of spared myelinated fibers (22-fold, $P > 0.01$) in the main corticospinal tract compared to the nontransduced ones. HNA + cells with the morphology of phagocytes and microglia-like cells were found as compact clusters or cell bridges within the traumatic cavities that were lined by GFAP + host astrocytes. Our results show that hUCB-MCs transplanted into the site of SCI improved regeneration and that hUCB-MCs genetically modified with the VEGF and GNDF genes were more effective than nontransduced hUCB-MCs.

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