

New challenges for stem cell-based therapies both for spinal cord and brain injury

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Adult bone marrow stromal cells (BMSC) may represent a paracrine support for the treatment of neurological diseases. The preclinical use of such cells during brain ischemia is well supported by the literature. Spinal cord injury (SCI) results in loss of nervous tissue and consequently loss of motor and sensory function. There is no treatment available that restores the injury-induced loss of function to a degree that an independent life can be guaranteed. Interestingly, some authors suggested the possible use of BMSC for the treatment of paraplegia based on a possible neural transdifferentiation of BMSC after these mesenchymal stem cells are transplanted into injured spinal cord tissue. Although adult stem-cell therapy for nervous system repair is beginning BMSC transplantation offers new hope for the treatment of traumatic paraplegia in humans. Furthermore, it seems possible to generate functional dopaminergic or striatal neurons from a variety of embryonic or neural stem cells as well as induced pluripotent stem cells. Fetal neural tissues, such as ventral mesencephalon, striatum, and Schwann cells, were investigated for neurodegenerative diseases or spinal cord injury. A number of studies focused on novel methods for drug monitoring or graft tracking, and combination therapy with stem cells and medicine, such as cytokines or trophic factors. Cells derived from rodent sources have been the most extensively studied, while only few studies reported the transplantation of human cells mainly BMSC. The majority of studies have been conducted in rodent models of injury, and few studies have investigated cell transplantation in larger mammals or primates. With respect to the timing of intervention, nearly all of the studies reviewed were conducted with transplantations occurring subacutely and acutely, while chronic treatments were rare and often failed to yield functional benefits. First clinical trials using neural stem cell or embryonic-stem-cell-derived tissue are approved or already under way. However, there are still issues related to stem cell transplantation that need to be resolved, including bioethical regulatory processes.