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Transplantation of human embryonic stem cell-derived neural stem cells with an injectable hyaluronic acid-gelatin hydrogel into contusion model of rat spinal cord injury

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Introduction: Transplantation of neural stem/progenitor cells (NSPCs) and their differentiation potency are promising to preserve or regenerate functional pathways after central nervous system injury. However, reconstruct material that can bridge the injury gap, and regenerating axons remain a challenge in spinal cord injury (SCI). Simple and effective biocompatible materials that mimic the natural extracellular matrix (ECM) have been applied in regenerative medicine and there are loads of previously published data that have been established benefit of these materials for cell growth and differentiation. Injectable biocompatible hydrogels would be desirable in regenerative medicine in order to promote not only cell survival and differentiation, but also the regeneration of descending or ascending nerve fibers. The purpose of this study initially is to increase viability of transplanted cells in injured site in order to efficiently support and guide axonal regeneration, secondly to reduce glial scar formation and cavity size as well.

Methods: Moderate to severe contusive spinal cord injury was performed at T10-T11 level of spinal cord using NYU-impactor (10 g, 25 mm). Rats (Wistar, male, 250-280 g) received daily extensive post-surgery care and were kept for seven weeks. Three transplantation groups contain GFP labeled human embryonic stem cell-derived neural stem cells (hESC-NSC), hESC-NSC cell encapsulated in hyaluronic acid gelatin hydrogel and hydrogel which inject directly to the cavity sub-acute to the injury and control group just receiving needle stress at one week post SCI. For motor function assessment BBB scores were given to each rat hindlimb function from 0 to 21 once a week during the experiment. One week prior to spinal cord injury surgery, rats underwent stereotaxic screws implantation in somatosensory-motor cortex area that allow stimulation and recording of motor and somatosensory evoked potentials (MEPs, SEPs) and control recording is performed. It is then repeated at days 7 after spinal cord injury and also at the end of the experiment.

Conclusions: We use human embryonic stem cell-derived neural stem cells with a hyaluronic acid-gelatin hydrogel in rat model of spinal cord injury and our results demonstrate increasing cell survival and also cell differentiation to all three neural fates and regeneration in corticospinal tract as electrophysiology data confirms and BBB scores shows functional recovery compare to control group.

Biography

Hoda Sadrosadat is a Master's graduate in Medical Physiology. Her thesis was about spinal cord regeneration with biomaterial approach and she is so much interested in Regenerative Medicine. She is currently working at Royan Institute, Iran

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