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An Animal Model of Brain Injury for Evaluation of Tissue Engineering Treatment Strategies

Hadi Aligholi[1, 2*], Maryam Safahani[1, 3]

[1]Shefa Neuroscience Research Center, Khatam Alanbia Hospital, Tehran, Iran.
[2]Department of Neuroscience, School of Advanced Technologies in Medicine, Tehran University of Medical Sciences, Tehran, Iran.
[3]Department of Nutrition, Tehran University of Medical Sciences, Tehran, Iran.

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Abstract

Brain injury is a complex event leading to tissue damage and functional deficits by primary and secondary mechanisms. Since the application of tissue engineering approaches is a new topic in the treatment of brain injury, producing a proper experimental model to evaluate the effects of tissue engineering products on damaged brain tissue is required. In the present study, a simple and reproducible model of brain injury was introduced. Adult Wistar rats were anesthetized by ketamine and xylazine and their heads were fixed in stereotaxic device. Then, after prep and drape, a midline incision was made in the skull skin by surgical knife. Using a dental drill, a rectangle window was made in the left side of the skull bone. After removing the dura mater by a micro scissors, a defined cavity was created in the cortex of the left hemisphere by slowly inserting a rotary biopsy punch with 2 mm diameter into the cortex. Following performing treatments (neural stem cells+a hydrogel scaffold), to repair of the dura and consequently prevent leakage of materials, we used a piece of the loose connective tissue located between skull bone and skin as well as a piece of dural path. Finally, the skin was closed by 2-0 surgical suture. Neurological evaluations were performed using modified neurological severity score for 28 days. Histological analysis was done after one month. This method produced a mild brain injury model and created a defined cavity in the brain cortex. The cells transplanted in the cavity survived after 28 days. We introduced an applied animal model of brain injury for evaluation of tissue engineering treatment strategies.

Keywords: Brain Injury, Tissue Engineering, Animal Models.

Corresponding Author: Hadi Aligholi

E-mail: *aligholihadi@gmail.com*