

Bone marrow mesenchymal stem cell applications in treatment of traumatic brain injury following intraperitoneal Silymarin injection in a rat model

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Background: Traumatic brain injury (TBI) is one of the most common causes of death in people under 44 years and often results in hospitalization and disabilities such as cognitive deficits and hemiplegia. The main obstacle after TBI is partial loss of brain parenchyma that leads to primary and secondary damage. Nowadays different lines of stem cells are used in the treatment of TBI, among which mesenchymal stem cells (MSCs) (due to their ease of isolation from various tissues), especially from bone marrow are among the most important.

Objectives: This study investigates the effects of intravenous administration of bone marrow MSCs on cellular proliferation after TBI following intraperitoneal Silymarin injection.

Materials and Methods: After isolation and culturing rat bone marrow MSCs, flow cytometry was performed to examine the expression of cell markers. TBI model (Marmarou's method) was induced in 40 adult Wistar rats. The animals were randomly divided into 4 groups (n= 10) as follows: GI (control): did not receive anything; GII: only received rBMMSCs; GIII: received Silymarin; and GIV: received BMMSCs and Silymarin; 3×10^6 BMMSCs and $0.5\mu\text{g/mL}$ Silymarin (for 7-days) were injected intravenously 1-day after TBI. Rats were sacrificed on days 5, 10, 15, and 30 after TBI and coronal brain sections were stained immunohistochemically to study the distribution of BMMSCs and newly generated cells into neurons.

Results: Expression of CD29 and CD90 markers that are characteristic of BMMSCs were confirmed by flow cytometry experiments. The data demonstrated that proliferation and number of progenitor cells in Group IV significantly increased the sub-ventricular zone and the boundary zone of lesions when compared with other groups. The immunohistochemical results in Group IV other than in Group II and III on day 76 after injection showed that the lesion cells expressed beta tubulin III, i.e. a marker of neurons ($P < 0.05$).

Conclusions: According to our results ,Silymarin injection caused significant differentiation of MSCs to neurons and neuroglia that could be a promising approach for treating a variety of brain injuries.

Keywords: Trauma, Brain injury, mesenchymal stem cells, cell proliferation, cell therapy, Silymarin.
