Human amniotic membrane-derived mesenchymal stem cells combined with nerve growth factor and biologic fibrin glue transplantation in the treatment of bran injury in rats. [Chinese]

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Abstract:

Background: Previous studies are on in vitro culture of mesenchymal stem cell differentiation. Few studies on mesenchymal stem cell differentiation in vivo or effects of cofactor on their differentiation. Objective: To study the amniotic membrane-derived mesenchymal stem cell (AD-MSC) transplantation on behavior, spatial learning and memory in traumatic brain injury rats, and the abilities to nerve growth factor (NGF), biologic fibrin glue (BFG) in AD-MSC transplantation. Design, Time and Setting: The cytology in vivo controlled study was performed at the Medical College of Zhengzhou University from July 2006 to January 2007. Materials: The placenta from healthy normal full-term fetus was obtained from Department of Gynaecology and Obstetrics, First Affiliated Hospital, Zhengzhou University. A total of 90 Wistar rats were equally and randomly assigned into a sham operation group, a model control group, a cell transplantation group, a cell + NGF group, a cell + BFG group. Methods: Fetal amniotic membrane was harvested from the placenta by blunt dissection under a sterile condition, made into monoplast suspension by trypsinization, and purified by adherece. At the third passage, AD-MSCs were used. Rats in the sham operation group underwent perforation. Rats in other groups were established into models of traumatic brain injury using free-failing epidural impact method. At 1 day following model induction, 40 mu L saline was infused into injury sites in the model control group. An equal volume of saline containing 1x10⁷ AD-MSCs were injected into rats in the cell transplantation group. Rats in the cell + NGF group were injected with 1x10⁷ AD-MSCs and 0.5 mu g NGF for

successively for 2 weeks. Rats in the cell + BFG group were infused with AD-MSCs and 40 mu L BFG. Rats in the sham operation group did not receive cell transplantation. Main Outcome Measures: Ethology score; Latency was measured using Morris water maze test. Neuron specific enolase and glial fibrillary acidic protein expression was observed by immunohistochemistry. Results: At 7 days after transplantation, behavior score was significantly higher in the cell transplantation group, cell + NGF group, cell + BFG group compared with the model control group. The increase was significantly lower in the cell transplantation group compared with the cell + NGF group and cell + BFG group ($F=155.322$, $P < 0.05$). At 3 weeks after the transplantation, the latency was significantly shorter in the cell transplantation group, cell + NGF group, cell + BFG group compared with the model control group. The shortened range was significantly smaller in the cell transplantation group compared with the cell + NGF group and cell + BFG group ($F=22.678$, $P < 0.05$). At 4 weeks following transplantation, AD-MSCs could differentiate into nerve cell in damage brain tissue, and express neural specific enolase and glial fibrillary acidic protein following combined transplantation of NGF and BFG ($F=705.406$, $F=424.884$, $P < 0.05$). Conclusion: AD-MSCs can improve behavior and spacial learning and memory abilities, express neural specific enolase and glial fibrillary acidic protein following differentiation. NGF and BFG may enhance efficacy of transplantation.