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Recovery from spinal cord injury improved with acute transplantation of mesenchymal stem cell through modulation of astrogliosis

Abstract

Background

Although the mesenchymal stem cells (MSCs) had been treated for spinal cord injury (SCI), their mechanisms to SCI have not been confirmed except inhibiting inflammation, astrogliosis. On the contrary of previous belief, several reports had been published on the protective role of acute astrogliosis. Here we presented that transplantation of mesenchymal stem cell (MSC) at acute stage could improve the outcome of SCI through modulating astrogliosis.

Methods

For the comparison of behavioral and pathological outcome, female SD rats were anesthetized and exposed to severe SCI using the clipping compression technique. Bone marrow derived rat MSCs were induced neural differentiation and transplanted at acute SCI rats. Matrix metalloproteinase (MMP) and neuro-inflammatory pathway were analyzed for acute astrogliosis at 1, 3 and 7 d after SCI in RT-PCR- and western blot analysis. Functional outcome was assessed serially at postoperative 1 d and weekly for 4 weeks. Histopathologic analysis was undertaken at 7 and 28 d following injury in immunohistochemistry.

Results

In RT-PCR analysis, mRNA levels of MMP2 was significantly increased in MSC transplanted rats at 1st day after SCI. All neuroinflammatory markers decreased or decreased tendency with MSC treatment except STAT3 pathway. At 7th days, area of lesion core, the number of astrocytes and microglial cells increased at MSC treatment group. In immunohistochemistry, MSC transplantation increased acute astrogliosis whereas attenuated scar formation with increased sparing white matter of spinal cord lesions. In BBB locomotor scale, the rats of MSC treated group exhibited improvement of functional recovery.

The rats of MSC treated group had better the behavioral outcome from 21 days after SCI. MSC transplanted rats had more spared white matter at 28days after SCI.

Conclusion

MSC transplantation increased acute astrogliosis by acutely increased MMP2 and decreased glial scar at 28 days after SCI. Acute MSC transplantation improved SCI outcome through modulation of astrogliosis..