Effect of bone marrow-derived mesenchymal stem cells on congenital hydrocephalus in the hyh mouse

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Background Bone marrow-derived mesenchymal stem cells (BM-MSC) are considered as a potential therapeutic tool for neurodegenerative diseases due to their ability for migrating into damaged tissue. Additionally, these cells have been proven to produce neuroprotective factors when they are transplanted into damaged tissue. In this research we uncover a neuroprotective role of BM-MSC on congenital hydrocephalus and we study the molecular mechanisms behind it. Materials and methods Fluorescent BM-MSC were analyzed by flow-cytometry and multilineage cell differentiation. They were brain-ventricle injected into hyh hydrocephalic mice. Wild-type and saline-injected hyh mice were used as controls. Inmunohistochemical analyses were performed in fixed brain sections. Inflammatory reaction and neuroprotective factors were studied using quantitative RT-PCR. Metabolites and osmolytes related to brain damage were studied by High Resolution Magic Angle Spinning spectroscopy (HRMAS). RT-PCR and HRMAS were performed in fresh tissue. Results Integrated BM-MSC were identified inside the periventricular astrocyte reaction. IL-1alpha/beta and IL6 levels indicated the absence of inflammatory response in the transplanted tissue after BM-MSC integration. BM-MSC were found producing neuroprotective factors, including GDNF, NGF, BDNF and VEGF. Reduction of osmolytes and neural/glial-function related metabolites levels were detected in hyh mice after BM-MSC injection. These levels mimicked the wild-type situation and indicate partial recovery. Conclusions The BM-MSC can play a neuroprotective effect on congenital hydrocephalus in the hyh mouse by the production of neuroprotective factors and the reduction of osmolytes and metabolites related to tissue damage.