Cerebrospinal Fluid Research

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Oral presentation

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GLP-1 secreting encapsulated human mesenchymal stem cells for neuroprotection

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from 51st Annual Meeting of the Society for Research into Hydrocephalus and Spina Bifida
Heidelberg, Germany. 27–30 June 2007

Published: 20 December 2007

Cerebrospinal Fluid Research 2007, **4**(Suppl 1):S47 doi:10.1186/1743-8454-4-S1-S47

This abstract is available from: http://www.cerebrospinalfluidresearch.com/content/4/S1/S47

Background

Neuroprotective treatment for the prevention of secondary injury to head injury still lacks clinical utility. In our experimental study of controlled cortical impact (CCI) in rats, we investigate, whether transplantation of GLP-1-transfected stem cells encapsulated in alginate may prevent cellular responses after trauma

Materials and methods

CCI was applied to 50 male adult Sprague-Dawley rats. Trauma groups consisted of trauma only, animals treated with GLP-1-transfected human mesenchymal stem cells (GLP-1 hMSC) encapsulated in alginate beads, with non-transfected encapsulated human mesenchymal stem cells (hMSC) and sham-treated with alginate capsules only (ALG). Seven healthy and untreated animals served as age-matched controls. Alginate beads were stereotactically implanted into the right lateral ventricle before CCI.14 days post-injury, GLP-1-concentrations in the CSF were measured and brains were histologically and immunohistochemically assessed using specific antibodies against NeuN, GFAP, MAP2 and GLP-1.

Results

Anti-NeuN immunostaining showed a significant decrease of vital neurons in the dentate gyrus in the trauma animals as well as in the groups treated with non-transfected hMSC and with alginate capsules only. Both, GFAP and MAP2-immunohistochemistry, assessed in the area of contusion, mirrored the Anti-NeuN results showing less pronounced cellular reactive changes in the GLP-1 treated animals. Stem cells in the intraventricular compartment seem vital as well as positive staining of the GLP-1 peptide at the trauma site was observed.

Conclusion

Our immunohistological findings on treatment with GLP-1-transfected human mesenchymal stem cells in rats resulted in less histological sequels after controlled cortical impact trauma. This may break into new concepts for local neuroprotective therapy in traumatic brain injury as well as for other neurodegenerative diseases of the central nervous system, e.g. chronic hydrocephalus.