The therapeutic potential of human umbilical cord blood-derived mesenchymal stem cells in Alzheimer's disease

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Abstract

The neuropathological hallmarks of Alzheimer's disease (AD) include the presence of extracellular amyloid-β peptide (Aβ) in the form of amyloid plaques in the brain parenchyma and neuronal loss. The mechanism associated with neuronal death by amyloid plaques is unclear but oxidative stress and glial activation has been implicated. Human umbilical cord blood-derived mesenchymal stem cells (hUCB-MSCs) are being scrutinized as a potential therapeutic tool to prevent various neurodegenerative diseases including AD. However, the therapeutic impact of hUCB-MSCs in AD has not yet been reported. Here we undertook in vitro work to examine the potential impact of hUCB-MSCs treatment on neuronal loss using a paradigm of cultured hippocampal neurons treated with Aβ. We confirmed that hUCB-MSCs co-culture reduced the hippocampal apoptosis induced by Aβ treatment. Moreover, in an acute AD mouse model to directly test the efficacy of hUCB-MSCs treatment on AD-related cognitive and neuropathological outcomes, we demonstrated that markers of glial activation, oxidative stress and apoptosis levels were decreased in AD mouse brain. Interestingly, hUCB-MSCs treated AD mice demonstrated cognitive rescue with restoration of learning/memory function. These data suggest that hUCB-MSCs warrant further investigation as a potential therapeutic agent in AD.