INSIGHTS IN STEM CELLS: OPEN ACCESS

Immunomodulatory effect of human umbilical cord perivascular cells in the prevention of neurodegeneration

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Abstract

A complex balance between pro-inflammatory and anti-inflammatory responses controls the maintenance of health. Conversely, dysregulation of these inflammatory responses contributes to a wide variety of diseases and disorders. For example, chronic inflammation plays an important role in cardiovascular disease, psychiatric disorders, neurodegenerative disease, sepsis, etc.

An on-going challenge for a wide variety of diseases/disorders is developing immune-targeted treatment strategies. Mesenchymal stem cells (MSC) have potent anti-inflammatory properties, and this immunomodulation is the crucial property underlying the therapeutic benefit of MSC. MSC have been isolated from many tissues. MSC isolated from the perivascular region of the human umbilical cord are known as human umbilical cord perivascular cells (HUCPVC). First trimester (FTM) and term HUCPVC have increased regenerative properties compared to older MSC sources. Research from our lab has shown that HUCPVC secrete factors that support brain cell survival, promote regrowth, and modulate immune responses to rebuild damaged cells in the brain under different physiological conditions. Here, we present the research findings from our group at the Create Fertility Centre, Toronto, to review how:

1. HUCPVC can prevent axon degeneration after traumatic brain injury
2. HUCPVC can distally modulate neuroimmune responses to reduce depressive behaviours in a rodent model of major depressive disorder (MDD) and systemic inflammation (LPS)
3. Potential use of HUCPVC in preventing noise-induced hearing loss

Our recent data suggest that in *in vitro* and *in vivo* models, HUCPVC interact with the axon of sympathetic neurons, reduce axonal degeneration, and improve axon morphology. We found that HUCPVC reduced stress-induced or LPS-induced circulating pro-inflammatory cytokines, monocytes, neuroinflammation, and depressive and anxiety-like behaviours. This resolution of inflammation resulted from the host immune cell-mediated phagocytosis of HUCPVC. Our studies suggest that HUCPVC are promising sources of cells that could be utilized in multiple aspects of neurodegenerative diseases.

Biography

Subhendu Mukherjee completed his Master's degree in Biochemistry from Calcutta University, followed by PhD in Biomedical Engineering from Jadavpur University, India. During this time, he was awarded a 3 year research scholarship for performing research at the University of Connecticut Health Center, USA. After that, he did his postdoctoral fellowship at McMaster University, Canada. After completing his postdoctoral fellowship, he joined Sunnybrook Research Institute, Toronto, Canada as an associate research scientist. At present, he is the Director of the Neuroregeneration Research Programs at the CReATe Fertility Centre, Toronto, Canada.

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