

In vitro Regeneration of Neural Cells Using Human Umbilical Cord Derived Mesenchymal Stem Cells

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Abstract : Background: Day-by-day the increasing prevalence of neurodegenerative diseases have become a global issue to manage them by medical sciences. The adult neural stem cells are rare and require an invasive and painful procedure to obtain it from central nervous system. Mesenchymal stem cell (MSCs) therapies have shown remarkable application in treatment of various cell injuries and cell loss. MSCs can be derived from various sources like adult tissues, human bone marrow, umbilical cord blood and cord tissue. MSCs have similar proliferation and differentiation capability, but the human umbilical cord-derived mesenchymal stem cells (hUCMSCs) are proved to be more beneficial with respect to cell procurement, differentiation to other cells, preservation, and transplantation. Material and method: Human umbilical cord is easily obtainable and non-controversial comparative to bone marrow and other adult tissues. The umbilical cord can be collected after delivery of baby, and its tissue can be cultured using explant culture method. Cell culture medium such as DMEMF12+10% FBS and DMEMF12+Neural growth factors (bFGF, human noggin, B27) with antibiotics (Streptomycin/Gentamycin) were used to culture and differentiate mesenchymal stem cells into neural cells, respectively. The characterisations of MSCs were done with Flow Cytometer for surface markers CD90, CD73 and CD105 and colony forming unit assay. The differentiated various neural cells will be characterised by fluorescence markers for neurons, astrocytes, and oligodendrocytes; quantitative PCR for genes Nestin and NeuroD1 and Western blotting technique for gap43 protein. Result and discussion: The high quality and number of MSCs were isolated from human umbilical cord via explant culture method. The obtained MSCs were differentiated into neural cells like neurons, astrocytes and oligodendrocytes. The differentiated neural cells can be used to treat neural injuries and neural cell loss by delivering cells by non-invasive administration via cerebrospinal fluid (CSF) or blood. Moreover, the MSCs can also be directly delivered to different injured sites where they differentiate into neural cells. Therefore, human umbilical cord is demonstrated to be an inexpensive and easily available source for MSCs. Moreover, the hUCMSCs can be a potential source for neural cell therapies and neural cell regeneration for neural cell injuries and neural cell loss. This new way of research will be helpful to treat and manage neural cell damages and neurodegenerative diseases like Alzheimer and Parkinson. Still the study has a long way to go but it is a promising approach for many neural disorders for which at present no satisfactory management is available.

Keywords : bone marrow, cell therapy, explant culture method, flow cytometer, human umbilical cord, mesenchymal stem cells, neurodegenerative diseases, neuroprotective, regeneration

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