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Editorial

Stem Cell Therapy for Neurodegenerative Diseases

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Stem cell therapy for neurodegenerative diseases

Aging-related neurodegenerative disorders mainly include Alzheimer's disease (AD) and Parkinson's disease (PD). AD is the most common form of dementia, which is one of the major causes of disability and dependency in the elderly. Since the pathologic characteristics of AD are beta-amyloid (Abeta) plaques and neurofibrillary tangles (NFT) [1], depleting Abeta should be a useful therapy for AD. Extracellular Cathepsin B is associated with amyloid plaques, and colocalizes with Abeta in regulated secretory vesicles in chromaffin cells in AD brains. One report demonstrated that Cathepsin B reduces the relative abundance of Abeta through limited proteolysis, suggesting that the activation of Cathepsin B could offer a therapeutic strategy for AD [2]. Furthermore, antioxidants such as glutathione and vitamin E have been shown to be related to a reduced risk of AD resulting from a decrease in ROS levels, and protects against lipid peroxidation in the brain [3]. In contrast, PD is a chronic progressive disease, characterized by bradykinesia with tremors or postural instability. Its pathologic features show that dopaminergic neurons are lost in the mid-brain, associated with the activation of microglia [4]. Treatment of PD includes medications such as those used in dopamine replacement therapy, dopamine agonists, and anticholinergics, as well as exercise and physical therapy. All treatments aim to control symptoms but cannot prevent the development of the disease.

Neuroinflammation has been shown to be associated with the neurodegenerative diseases, and microglia have been reported to play an important role in the immune defense system of the central nervous system. Microglia activation and the release of associated inflammatory factors have been reported to contribute to chronic neurodegenerative disorders [5]. Stem cells mainly include embryonic stem cells (ESCs), inducible pluripotent stem cells (iPSCs) and tissue-derived stem cells such as bone marrow, fat tissue and cord blood. Stem cell-derived neurons have the potential to integrate into the existing neural networks of the host brain. Human ESCs appear to increase acetylcholine levels to improve cognition and memory in the animal model [6]. Human iPSCs can differentiate into neural cells, and one report showed that induced iPSCs generated from familial ADs into neurons may increase Abeta42 secretion, suggesting that these iPSCs provide a potential strategy for the development of

drugs against AD [7]. Bone marrow-derived mesenchymal stem cells (MSCs) were able to home on the injured brain and remove Abeta plaques from the hippocampus and to reduce Abeta deposits through the activation of endogenous microglia in an induced AD mouse model [8]. Human umbilical cord-derived MSCs have been shown to improve memory deficits, and reduce Abeta deposition [9]. Moreover, one report showed that dopaminergic neurons can be induced from human ESCs, iPSCs, and non-human primate iPSCs [10]. Another report showed that bFGF promoted human BMMSCs to trans-differentiate into neural like cells in vitro, and to play a therapeutic role in a PD animal model [11]. Human umbilical cord-derived MSCs with overexpression of HGF can improve damaged neurons in PD animal models [12].

AD and PD are the most common forms of dementia in the elderly, and there has been a rapid increase in the number of patients worldwide. Pharmacological therapies for AD and PD are mainly aimed at relieving symptoms, but stem cell therapy has the potential to not only regenerate new neurons and replace damaged neurons but also to modulate the immune system. Advanced stem cell therapy is a potential clinical approach to the treatment of neurodegenerative diseases.

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