Treatment of Traumatic Brain Injury Using Neural Stem Cells

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Abstract—Neural stem cells have the ability of treating traumatic brain injuries by replacing or supporting dysfunctional cells. They also have the capability to form into the cells, which are necessary for a particular region of the brain that is damaged. The potential of neural stem cells in treating traumatic brain injury is a promising form of treatment.

I. INTRODUCTION

Neural stem cells has become a very promising cell type for the treatment for central nervous system injury. One of the main goals of NSC transplantation is to replace or support missing or not properly functioning neurons in the central nervous system. Following TBI, injuries to the neural tissue is permanent. Given the limited quantity of the endogenous NSCs, neural transplantation using exogenous stem cells to the injured brain is a better potential therapy for post-TBI brain repair. The new cells, which are introduced to the brain, will not only be able to replace the lost neural population. There are several categories of cells that have been tested for post-TBI stem cell therapy including embryonic stem cells, adult-derived NSCs, induced pluripotent stem cells, and mesenchyme stromal cells.

II. METHODS

In clinical trials, NSCs were isolated from human fetal brain and were capable of survival for an extended period, migrating to the contralateral cortex and differentiating into neurons and astrocytes after transplantation into the injured brain following a focal brain injury [2]. Transplanted NSCs from human ES cells can differentiate into mature neurons and release growth factors improving cognitive functional recovery of the injured brain. There are currently three ways of obtaining NSCs: direct isolation from the developing or adult central nervous system; amplification of isolated cells in vitro; and directed differentiation from pluripotent cells consisting of either embryonic stem cells or induced pluripotent stem cells [2]. In Figure 1. We can observe ways in which neural stem cells can be obtained. Pluripotent stem cells such as (A) embryonic stem cells obtained from the blastocyst or (B) induced pluripotent stem cells derived from mature somatic cells. NSCs can also be isolated directly from (C) the developing neural tube, (D) the developing nervous system, or (E) from the adult CNS [2]. In Figure 2, we can observe the potential Mechanisms of Action of Stem and Progenitor Cells in Traumatic Brain Injury. The therapeutic effect of stem and progenitor cells in traumatic brain injury (TBI) [5].

III. RESULTS

Due to the complicity of brain trauma, post-TBI neural repair and regeneration are still a far-reaching goal. There are many challenges that scientists face for a successful stem cell therapy. For endogenous repair through adult neurogenesis, strategies guiding migration of new neurons to the site of injury and promoting long-term survival are necessary [4]. For stem cell transplantation, as the intrinsic properties of grafted cells and the local host environment determine the fate of transplanted cells, an optimal cell source and a controlled host environment are necessary for successfully neural transplantation [4]. In general, neural stem cell transplantation is complex therapy that has the potential to work properly. It is definitely necessary for more clinical trials to be conducted of neural stem cells in the treatment of traumatic brain injury.

IV. DISCUSSION

Overall, neural stem cells have the potential to save thousands of lives for people who not only suffer from TBI
but other neurodegenerative diseases. Some challenges that scientists face are the retrieval of these cells, which is difficult especially for people with TBI. TBI causes brain matter to be damaged to a point of no return. Doctors are usually more concerned with preventing secondary injury to the brain rather than treating the original injury. Despite all the concerns NSC is a promising treatment of TBI due to its ability to generate into any type of cell in the brain, which is necessary.

REFERENCES