

STEM CELL THERAPY ITS CHALLENGES, SUCCESSES, FAILURES AND POTENTIAL APPLICATIONS : ON-GOING TRANSLATIONAL RESEARCH

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Critical cells in human organs of injured genetically diseased or aged populations degenerate due to various reasons, mainly injury, genetic mutations and chronic inflammation. The stem cell-niche in most human organs has a limited ability for cell regeneration. In an adult human body, about a billion cells die every day. In some organs and blood pools, injured or lost cells and tissue sheets (e.g. skin graft) could be replaced and in blood loss, it could be replenished by transfusion. For cellular components of blood, we have developed superb tools, specifically tagging them with gamma-emitting radionuclides, for measuring the cellular half-lives, their survival times, turn-over rates and size of blood pools in healthy volunteers and patients. It is possible now to increase the platelet circulating time in blood of splenomegaly patients by splenectomy, thus decreasing the episodes of bleeding complications resulting in fewer visits to blood bank for platelet transfusions. However, these measurements of cell-survival parameters of blood cells are not possible for other cell types, particularly in some retinal- and neuro-degenerative diseases, where only one specific cell type, e.g. neurons, may be lost. This specific cell could be derived from the embryonic or induced pluripotent stem cells (ESC or iPSC) by differentiation and could be delivered to the affected organs provided the cell-loss is not diffuse over a large area and the cells are not migratory. iPSCs now could be derived easily from skin fibroblasts or blood lymphocytes by transfecting with only four genes. In spite of significant and pioneering developments of cell access from ESCs and iPSCs in the last decade, their optimized differentiation methods and their large scale production, cell therapy faces a tremendous challenge in near future due to poor cell-integration in host organs. At present, attention has been diverted to drug discovery. Successes, failures and potential applications of cell therapy in certain diseases are discussed in this article to draw attention of the energetic young minds, scientists and clinicians to solve this challenging puzzle and give hope to the stroke, heart-attack, diabetic and demented patients for a longer and a better quality of life.
