



STEM CELL THERAPY: CANCER TREATMET

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ABSTRACT

As our understanding of stem-cell behavior rapidly increases, more and more reports suggest that use of stem-cell therapy will extend well beyond regenerative medicine in the near future. Due to their inherent tumorigenic migratory properties, stem cells can serve as vehicles for the delivery of effective, targeted treatment to isolated tumors and to metastatic disease. In vitro, stem cells can readily be engineered by inserting specifically tailored transgenes with anti-tumor effects to

create tumor-seeking therapeutic vehicles. More recently, the specific tumor-oriented migration and incorporation of mesenchymal stem cells (MSCs) have been demonstrated in various pre-clinical models, highlighting the potential for MSCs to be used as an ideal carrier for anti-cancer gene delivery. Engineered MSCs are capable of producing specific anti-cancer agents locally and constantly. Astute investigation on engineered MSCs may lead to a new avenue toward an efficient therapy for patients with cancer. In the present review, we will explore about stem cells, anti-cancer effects and the recent developments.

KEYWORDS: tumor-oriented migration and incorporation of mesenchymal stem cells.

INTRODUCTION

Recently stem cell therapies are assumed to be used as safe and effective treatments. Even applications of stem cells are being investigated in clinical trials, including the use of stem cells to regenerate damaged tissues – such as heart, skin, bone, spinal cord, liver, pancreas and cornea or to treat blood or solid-organ cancers. The majority of these trials are using mesenchymal stem cells, which are derived from sources such as fat tissue, bone marrow and connective tissue while few of the trials are using blood stem cells. Cancer, being the leading

cause of mortality and morbidity throughout the world, tried to be cured by conventional therapies including surgery, chemotherapy, and radiotherapy. While with the advancement of the biomedical sciences, various tumor-targeted therapeutic methods have been developed on molecular, cellular, and tissue levels. Despite improved treatment models, the overall outcome of cancer patients has not been remarkably improved. When fatalities occur, the majority of cancer patients die from the recurrence of metastasis or therapy-related life-threatening complications. The field urgently requires further explorations of ideal strategies to proactively focus on targeted tumor tissue and to efficiently attack malignant cells. Along with the discovery of specific anti-cancer genes and the revelation of MSCs' capacity for tumor directed migration and incorporation, a new research field has been inspired with the aim of exploiting efficient therapy for cancer using engineered MSCs.^[1] In the present review, we will explore about stem cells, anti-cancer effects and the recent developments.

Types and Sources

Stem cells can be divided into main three categories: Embryonic, germinal, and somatic. Embryonic stem cells (ESCs) originate from the inner cell mass of the blastocyst. ESCs are omnipotent and have indefinite replicative life span, which is attributable to their telomerase expression.^[2] Germinal stem cells are derived from primary germinal layers of embryo. They differentiate into progenitor cells to produce specific organ cells.^[3] Somatic/adult stem cells are progenitor cells as they are less totipotent i.e. less replicative life span than ESCs. They exist in mature tissues such as hematopoietic, neural, gastrointestinal, and mesenchymal tissues. The most commonly used adult stem cells (ASCs) derived from bone marrow are hematopoietic stem cells (HSCs) and other primitive progenitor cells including mesenchymal stem cells (MSCs) and multipotent adult progenitor cells (MAPCs).^[3,4]

Usability

Ideally, ESCs would be the source of stem cells for therapeutic purposes due to higher totipotency and indefinite life span compared to ASCs with lower totipotency and restricted life span. However, use of ESCs has ethical constraints, and their use for research and therapeutic purposes are restricted^[5] and prohibited in many countries throughout the world. In addition, the stem cells with higher totipotency have been shown to be more tumorigenic in mice.^[6] Thus, for ease of availability and lesser constrained on ethical issue, ASCs are most commonly used for research and therapeutic purposes and is easy accessibility compared to ESCs is also another reason. Literature shows ASCs from bone marrow (HSCs

and MSCs) are the most commonly studied stem cells.^[7-14]

Stem Cells and Cancer

Complex microenvironment of the malignant cells is referred as the tumor^[15] Solid tumors containing malignant cells and supporting cells called as stroma which includes fibroblast, endothelium, pericytes, lymphatics, and a mononuclear infiltrate.^[3,6] These stromal elements respond to signals and factors produced by the tumor cells and provide components necessary for tumor survival, including structural support, vasculature, and extracellular matrices.^[16] Any approach targeted on both malignant cells and tumor stromal elements is capable of leading to the advancement of anti-cancer therapy. By combining with the discovery of specific anti-cancer genes with the identification of powerful tumor-directed migration and incorporation of MSCs, a new field of research has been inspired with the aim of executing an efficient therapy for cancer using engineered mesenchymal stem cells.^[1] Tumor-directed migration and incorporation of MSCs were evidenced in a number of pre-clinical studies *in vitro* using transwell migration assays and *in vivo* using animal tumor models. The homing capacity of MSCs has been demonstrated with almost all tested human cancer cell lines, such as lung cancer, malignant glioma, Kaposi's sarcomas, breast cancer, colon carcinoma, pancreatic cancer, melanoma, and ovarian cancer. It is not an overstatement to describe MSCs as a *double-edged sword* in their interaction with tumors because of its pro-tumorigenic effects. If MSCs are suitably engineered with anti-cancer genes, they could be employed as a single-edged sword against cancers¹. In the tumor microenvironment, engineered MSCs could serve as a constant source of anti-cancer agent production, and locally produced and released anti-cancer agents that act on adjacent tumor cells, thereby inducing tumor growth inhibition or apoptosis.^[17-24]

CONCLUSION

With urgent need to search the effective treatment of cancers, the stem cell therapy may play an important role. It's only hope in present time in cancer biology. This review concluded with force to more and more studies required in field of the stem cell therapy to treat the deadly diseases not only the cancer while other diseases also.

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