Mesenchymal stromal cells (MSCs)

Subjects: Biochemistry & Molecular Biology

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Mesenchymal stem cells (MSCs) are a heterogeneous population of stromal precursors with high proliferative activity and multilineage differentiation, which keeps them in demand for clinical use. The MSC secretome affects the microenvironment promoting cytoprotection and tissue repair. Adipose tissue is one of the most perspective sources of MSCs since they can be obtained in sufficient amounts from patients using a minimally invasive procedure. With aging, the regenerative capabilities of the tissues that are largely due to the activity of adult stem cells are decreased. Due to their tissue niche role of maintaining homeostasis and auto-/paracrine regulation, MSCs are especially interesting from the point of view of cell senescence. Senescence-associated secretory phenotype (SASP) is the most important cause of disturbance of cell communication, which leads to various consequences in the surrounding tissues during aging.

Keywords: adipose-derived mesenchymal stem cells ; replicative senescence ; senescenceassociated secretory phenotype (SASP)

1. Introduction

Mesenchymal stromal cells (MSCs) are a heterogeneous population of poorly differentiated stromal precursors with high proliferative activity and multilineage differentiation, which keeps them in demand for clinical use [1][2]. These days, the positive effects of MSCs are mainly attributed to their ability to produce a number of biologically active factors, including cytokines, exosomes, and extracellular matrix components [3][4][5][6]. The MSC secretome affects the microenvironment at damage area, promoting cytoprotection and tissue repair. These effects are of particular interest for the treatment of ischemia, where the stimulation of vascularization is crucial for the preservation of alive tissue and, therefore, for the prevention of fibrosis [7].

However, the properties of the cell population can vary significantly depending on the donor, tissue sources, and even individual cell clones. This fact complicates the comparison of the results and necessitates the study of each tissue-specific population separately [8]. Adipose tissue is one of the most perspective sources of MSCs since they can be obtained in sufficient amounts from patients using a minimally invasive procedure. Adipose-derived MSCs (ASCs) are considered a promising tool for various types of cell therapy and tissue engineering[9]. According to several authors, ASCs have some advantages over the bone marrow MSCs, including a greater number of precursors from the similar amount of the sample and an increased capability of proliferation, differentiation, and angiogenesis in vivo [10][11][12]. Application of ASCs resulted to increase in the number of vessels and blood flow restoration in damaged tissues after the limb ischemia [13][14][15] and myocardial infarction [16][17]. Neovascularization after administration of ASCs or conditioned medium (CM) was considered the main mechanisms of hepatic regeneration [18].

2. Conclusion

Due to their tissue niche role of maintaining homeostasis and auto-/paracrine regulation, MSCs are especially interesting from the point of view of cell senescence. With the activation of senescence, MSCs change their morphofunctional state. Irreversible arrest of the cell cycle occurs, the morphology, organelles activity, and gene expression are altered, γH2AX heterochromatin foci appear, and a number of other cell senescence markers are found. Senescent cells are able to maintain their viability and functional activity for a rather long period, continuing to interact with the microenvironment and providing local and systemic effects [19][20][21][22][23].

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