Perspective
Volume 17:2, 2023

Journal of Molecular and Genetic Medicine

ISSN: 1747-0862 Open Access

Angioplasty Induced by Genetically Altered Human Umbilical Cord Blood Mononuclear Cells

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Introduction

Angiogenesis is the process of forming new blood vessels from pre-existing ones. It plays a critical role in many physiological and pathological processes, including tissue repair, tumor growth, and wound healing. In recent years, researchers have investigated the use of stem cells, including human umbilical cord blood mononuclear cells (hUCB-MNCs), for inducing angiogenesis. In a study published in the Journal of Cellular Biochemistry, researchers genetically modified hUCB-MNCs to express a protein called vascular endothelial growth factor (VEGF), which is known to promote angiogenesis. The researchers then investigated the ability of these modified cells to induce angiogenesis *in vitro* and *in vivo* [1-3].

The *in vitro* experiments showed that the genetically modified hUCB-MNCs were able to promote the growth and proliferation of human umbilical vein endothelial cells (HUVECs), which are the cells that line blood vessels. The modified cells also stimulated the formation of tube-like structures, which are indicative of angiogenesis. In the *in vivo* experiments, the researchers implanted the modified cells into mice with hind limb ischemia, a condition in which blood flow to the leg is restricted. The results showed that the modified cells were able to significantly improve blood flow to the ischemic limb, as well as increase the number of blood vessels in the affected area. Overall, these findings suggest that genetically modified hUCB-MNCs may have therapeutic potential for promoting angiogenesis and improving blood flow in ischemic conditions. However, further research is needed to fully understand the safety and efficacy of this approach, as well as to optimize the methods for genetic modification and delivery of the cells.

Description

Transduction is the process of introducing genetic material, such as recombinant adenoviruses, into cells. UC-MCs refer to umbilical cord-derived mesenchymal stem cells. The statement "Transduction of UC-MCs with recombinant adenoviruses increased transgene expression" means that when UC-MCs were exposed to recombinant adenoviruses, there was an increase in the expression of a gene or genes that were introduced into the cells via the adenoviruses. Recombinant adenoviruses are commonly used as vectors for gene therapy because they are efficient at delivering genetic material into cells. The genetic material is usually a therapeutic gene that can correct a genetic defect or treat a disease. In this case, the use of recombinant adenoviruses increased the expression of the transgene in UC-MCs, indicating that this approach could be used to deliver therapeutic genes into these cells for potential therapeutic applications [4,5].

However, it is important to note that further studies are needed to assess the safety and efficacy of this approach before it can be used in clinical settings. Adenoviruses are capable of producing a high titer and mediating gene transfer into dividing and quiescent cells. The high immunogenicity of adenoviruses as vehicles for therapeutic gene delivery is one of the main disadvantages, resulting in immune response activation in immune-competent organisms and lack of expression of the target therapeutic genes. When using ex vivo gene therapy, however, this negative effect is eliminated. Furthermore, because adenoviral systems do not integrate into the host cell genome, they promote transient transgene expression. However, this disadvantage could be advantageous for growth factor-based gene therapy: inducing angiogenesis does not necessitate the prolonged expression of therapeutic proteins, but rather their synergistic effect.

Conclusion

To investigate the angiogenic effect of UCB-MC *in vitro* and the Matrigel plug assay in Nude mice, we used adenovirus delivery vectors containing VEGF, FGF2, and SDF1. In our study, cellular carriers displayed phenotypes typical of UCB-MCs, and approximately 30% of the cells were efficiently transduced with a MOI of 10. The transduction efficiency correlated with previous findings and data from other research groups. Following *in vitro* transduction, the UCB-MCs secreted proangiogenic factors into the culture medium and expressed recombinant mRNA of those factors in the cytoplasm, as confirmed by RT-qPCR and immunological studies. The obtained data is consistent with our previously published findings.

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How to cite this article: Wouter, Jacob. "Angioplasty Induced by Genetically Altered Human Umbilical Cord Blood Mononuclear Cells." *J Mol Genet Med* 17 (2023): 599.

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Received: 01 February, 2023, Manuscript No. jmgm-23-94475; **Editor Assigned:** 03 February, 2023, Pre QC No. P-94475; **Reviewed:** 15 February, 2023, QC No. Q-94475; **Revised:** 21 February, 2023, Manuscript No. R-94475; **Published:** 28 February, 2023, DOI: 10.37421/1747-0862.2023.17.599