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Innovations in regenerative medicine that improve the results of stem cell treatment: 3D cultivation, *in vivo* modeling of stem cell niche and prenatal stem cells exosomes

Statement of the Problem: Hair loss is currently being addressed by hair follicle transplantation. However, for large areas of alopecia, the patient does not have enough hair for auto-transplantation. Proliferation and differentiation of Stem Cells (SCs) requires a specific microenvironment – “stem cells niche”. For *in vivo* modulation of organ-specific niches during SCs transplantation could be useful Fetal Tissue Extracts (FTEs). Exosomes are small vesicles that are secreted by various cell types, including SCs. Exosomes can be carried to distant sites *via* biological fluids and may therefore induce the phenotypic modifications in recipient cells.

Methodology & Theoretical Orientation: Multiplying SCs of hair follicles in 2D culture and introduce them into the scalp skin to form De novo hair follicles were unsuccessful. We developed a technology for creating new hair follicles from SCs in 3D cultures. Also, we investigated the content of growth factors in FTEs and studied the efficacy of FTEs in patients who did not respond to SCs treatment. Finally, we created rejuvenation program, which includes SCs transplantation and exosomes of SCs administration.

Findings: The SCs were transferred to a 3D culture where the formation of primary hair follicles suitable for transplantation occurred under the influence of a specific combination of growth factors. We showed high efficacy of using FTEs for modeling the SCs niche in treatment of liver cirrhosis and non-healing wound in patients who did not have positive response to previous SCs treatment. Transplantation of prenatal hepatoblasts, hematopoietic SCs and fetal liver extracts administration showed efficacy in 75% of liver cirrhosis cases that was characterized by significant decrease of liver fibroscan density, decrease of portal hypertension and ascites, decrease or normalization of biochemical markers of liver damage. In patients with chronic non-healing wounds administration of FTEs activated the wound epithelialization with complete healing. Patients GAIS results after rejuvenation program: Optimal cosmetic results 78.9%; significant improvement but not complete correction 9.7%; improvement but required additional correction 11.3%. The program significantly reduces the biological age and Frailty index that evidences about the decrease in risk of aging disease appearance.

Conclusion & Significance: 3D cultivation, *in vivo* modeling of SCs niche and prenatal SCs exosomes can significantly improve results of the use of SCs in regenerative medicine.

Biography

Abhijit Bopardikar is the Promoter and Founder Director of ReeLabs Pvt. Ltd, Mumbai and Vadivarhe Speciality Chemicals Ltd. (V.S.C.L.), Vadivarhe, Nasik, since 2009.

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