Developing Retinal Cells from Peripheral Blood Mesenchymal Stem Cells: A Potential Strategy for Cell Therapy in Retinitis Pigmentosa Patients

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ABSTRACT

Introduction: Retinitis pigmentosa (RP) is a group of inherited retinal diseases characterized by progressive degeneration of photoreceptor cells, leading to blindness. Cell therapy offers a promising approach to treating the progressive retinal degeneration observed in RP. Peripheral blood mesenchymal stem cells (PBMSCs) have emerged as a potential cell source for such therapies due to their accessibility and ability to differentiate into various cell types. This research aimed to isolate and differentiate PBMSCs into retinal cells as an approach to regenerative medicine and cell therapy in RP patients.

Methods and Materials: After identification of the patient with RP by an ophthalmologist and confirmation of the disease by molecular genetic techniques, including whole-exome sequencing (WES) and Sanger sequencing, PBMSCs were isolated from peripheral blood samples using Ficoll separation liquid and cultured in DMEM/F12 medium with 20% FBS. Passage 2 (P2) cells were analyzed by flow cytometry to characterize PBMSCs by CD73, CD90, CD105, CD34, and CD45 markers. The cells were then differentiated into retinal cells with differentiation factors, including taurine, retinoic acid, hbFGF, hEGF, and L-glutamine. The identity of differentiated cells was confirmed by nestin, vimentin, CRX, and rhodopsin expression using Western blot. ANOVA and t-tests were used to examine the Western blot data provided in at least three trials.

Results: The results of WES showed a homozygous deletion of 21 nucleotides (c.2541–2561 del) in the RPGR gene and was confirmed by Sanger sequencing, a novel pathogenic mutation associated with RP. Spindle-shaped PBMSCs appeared within 2–3 weeks after culture. P2 cells showed CD90, CD73, and CD105, but expression of CD34 and CD45 was undetectable, confirming proper isolation of PBMSCs. After differentiation induction, Western blot analysis showed that nestin, vimentin, CRX, and rhodopsin proteins were highly expressed ($p = 0.05$), which verified the differentiation of PBMSCs into retinal cells.

Conclusion and Discussion: Isolating and differentiating PBMSCs into retinal cells offers a promising approach for cell therapy in patients with RP. By harnessing the regenerative potential of PBMSCs, it may be possible to replace lost or dysfunctional retinal cells and restore visual function in RP patients. However, further research is needed to overcome existing challenges and translate these findings into effective therapies for clinical use.

Keywords: Cell-based therapy, Exome sequencing, Retinitis pigmentosa

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