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Peritoneal Dialysate-derived Mesenchymal Stem Cells Attenuate Phenotypic Transition in Peritoneal Mesothelial Cells and Reduce Oxidative Stress

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Objectives : Peritoneal fibrosis (PF) is a major complication of long-term peritoneal dialysis (PD), driven by epithelial-to-mesenchymal transition (EMT), oxidative stress, and extracellular matrix accumulation. Current treatments primarily slow disease progression rather than reverse fibrosis, underscoring the need for regenerative approaches. Mesenchymal stem cells (MSCs) have demonstrated anti-fibrotic potential in preclinical studies, but their clinical use is hindered by challenges in cell sourcing. This study explores peritoneal dialysate-derived MSC-like cells (PD-MSCs) as a novel, autologous, and clinically accessible therapeutic option for PF.
Methods : PD-MSCs were isolated from dialysate samples of early-stage PD patients and characterized for MSC markers (positive: CD29, CD44, CD73, CD90, CD105, CD166; negative: CD34, CD79a, HLA-DR) using real-time PCR and flow cytometry. Their differentiation potential into adipocytes, chondrocytes, and osteocytes was assessed. The therapeutic effects of PD-MSCs on TGF-β-induced EMT in human peritoneal mesothelial cells (HPMCs) were evaluated through real-time PCR, Western blotting, and reactive oxygen species (ROS) assays (DCF-DA and MitoSOX). Expression levels of anti-fibrotic proteins, hepatocyte growth factor (HGF) and bone morphogenetic protein-7 (BMP-7), were also analyzed.
Results : PD-MSCs expressed characteristic MSC markers and exhibited trilineage differentiation potential. Treatment with PD-MSCs significantly inhibited TGF-β-induced EMT in HPMCs, restoring epithelial markers while suppressing mesenchymal markers. PD-MSCs also reduced ROS production, as demonstrated by DCF-DA and MitoSOX assays, and restored HGF and BMP-7 expression in TGF-β-exposed HPMCs. Notably, PD-MSCs exhibited comparable or superior efficacy to tonsil-derived MSCs (T-MSCs) in mitigating EMT, reducing oxidative stress, and enhancing anti-fibrotic protein expression.
Conclusions : PD-MSCs represent a promising autologous and clinically accessible cell source for treating peritoneal fibrosis. By attenuating EMT, reducing oxidative stress, and promoting anti-fibrotic factor expression, PD-MSCs can be a novel and safe autologous stem cell therapy for preserving peritoneal membrane integrity in PD patients.