Shaping Tomorrow's Nephrology: Insight-Driven Kidney Care
KSN SEOUL, KOREA 2026
The 46th Annual Meeting of the Korean Society of Nephrology
THE KOREAN SOCIETY OF NEPHROLOGY
Jun 11 (Thu) – 14 (Sun), 2026
COEX, Seoul, Korea

Abstract Type : Poster exhibition
Abstract Submission No.: A-0644
Abstract Topic : Basic Research

Effects of microplastics on Human peritoneal mesothelial cells

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Objectives : Peritoneal fibrosis is one of the major hurdles limiting the long-term maintenance of peritoneal dialysis. Microplastics have recently emerged as an important environmental concern. In this study, we investigated the effects of microplastics on human peritoneal mesothelial cells (HPMCs).
Methods : Human peritoneal mesothelial cells were exposed to microplastics (1.0 or 10 μM) for 24 hours. Markers of epithelial-to-mesenchymal transition (EMT), cellular senescence, oxidative stress, and the senescence-associated secretory phenotype (SASP) were evaluated using immunofluorescence staining, western blotting, RT-PCR, and reactive oxygen species (ROS) assays.
Results : Exposure to microplastics did not significantly affect cell viability; however, it induced morphological changes of HPMCs to a spindle-shaped phenotype, suggesting the induction of EMT. Western blot analysis demonstrated increased expression of fibrotic markers, including α-smooth muscle actin and fibronectin, along with increased expression of senescence-related markers such as p53 and decreased expression of epithelial cell markers. Senescence-associated β-galactosidase activity also showed an increasing trend following microplastic exposure. In addition, markers related to oxidative stress and DNA damage, including DSB and DCF-DA fluorescence, were increased in microplastic-treated cells.
Conclusions : Microplastic exposure may induce oxidative stress in human peritoneal mesothelial cells, leading to cellular senescence and epithelial-to-mesenchymal transition, which may ultimately contribute to the development of peritoneal fibrosis.