THE KOREAN SOCIETY OF NEPHROLOGY
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Beyond Challenges, Towards Healthier Kidney

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Characterizing Glomerular Barrier Dysfunction with Patient-Derived Serum in Glomerulus-on-a-Chip Models

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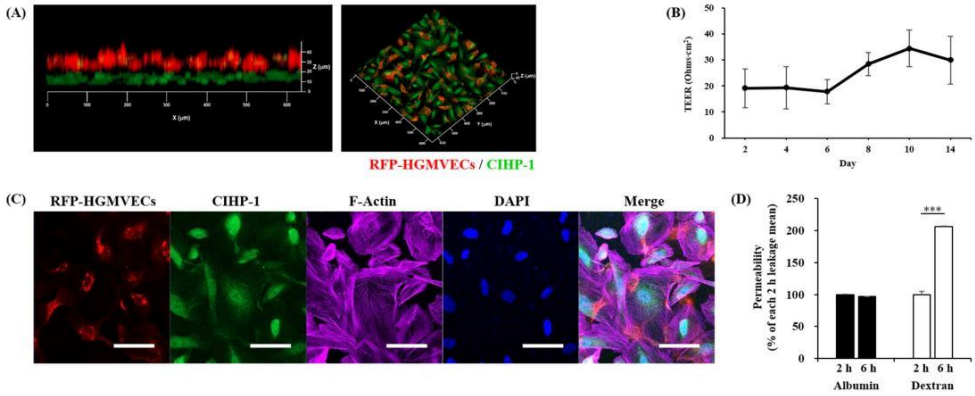
Objectives : Glomerulonephritis (GN) leads to podocyte injury and glomerular filtration dysfunction, resulting in proteinuria and progressive kidney failure. The lack of physiologically relevant in vitro models has hindered research progress. This study aimed to develop a microfluidic glomerulus-on-a-chip model that mimics the human glomerular filtration barrier (GFB) to investigate podocyte responses and permeability changes in GN.
Methods : A microfluidic chip was designed with glomerular endothelial cells and podocytes cultured on opposite sides of a porous membrane to form a functional GFB. Permselectivity was assessed by evaluating albumin and dextran clearance. Serum from patients with various GN subtypes was applied to assess its impact on podocyte viability, WT1 expression, and changes in albumin permeability.
Results : Endothelial cells and podocytes successfully formed intact monolayers, demonstrating selective permeability. In serum-induced GN models, podocyte viability declined, WT1 expression decreased, and albumin permeability increased in IgA nephropathy and membranous nephropathy, but not in minimal change disease or lupus nephritis.
Conclusions : The glomerulus-on-a-chip system effectively replicates GN-associated permeability changes, providing a physiologically relevant platform for studying glomerular pathology and therapeutic responses in vitro.

figure 1..jpg



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