

# KSN 2016 Abstract Submission

## *Glomerular disease*

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### Development of a Functional Glomerulus at the Organ Level on a Chip to Mimic Hypertensive Nephropathy

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**Background:** To develop a microfluidic rapid evaluating of multi-inductors device to reproduce the structure and function of glomeruli. And studying the effect of glomerular hemodynamic on glomerular filtration function under hypertension by microfluidic device.

**Methods:** This device consists of PDMS and polycarbonate membrane. Glomerular endothelial cell (MGEC) and podocyte (MPC-5) were co-cultured on the chip. MGEC cells and MPC-5 cells of each culture unit were incubated under flow rate of 5 $\mu$ l/min, 10 $\mu$ l/min, 15 $\mu$ l/min medium. After 0h, 6h, 12h and 24h, the function of GFB were detected by fluorescence microplate, the expression of F-actin, CD-31, vWF of MGEC cells and F-actin, synaptopodin, nephrin, podocin of MPC-5 cells were detected by immunofluorescent staining. The cell apoptosis was assessed by DAPI staining.

**Results:** Compared with traditional cell-culture, MGEC cells and MPC-5 cells grew well and morphological features showed no significant change cell apoptosis. When MGEC cells and MPC-5 cells were treated with medium under 20 $\mu$ l/min, the function of GFB was promoted and the distribution of F-actin was changed. When MGEC cells and MPC-5 cells were treated with medium under flow rate of 10 $\mu$ l/min and 15 $\mu$ l/min. The function of GFB was impaired and the distribution of F-actin was changed obviously. CD-31 decreased and vWF increased progressively over flow rate increasing and time extend. Nephrin and podocin, markers of MPC-5 cells, decreased progressively over flow rate increasing and time ( $P < 0.05$ ). The cell apoptosis increased under 15 $\mu$ l/min for 24h ( $P < 0.05$ ).

**Conclusion:** This work provides an appearance of the hypertransfusion, high filtration and high transmembrane pressure in glomerular capillary when hypertension leads to renal blood flow decompensation by adjusting the fluid infusion speed on glomerular microfluidic device which confirmed directly that the abnormal hemodynamic factors can degrade GFB function by injuring the skeleton of endothelial cells and podocytes and ligand between cells.

**Keywords:** glomerulus-on-a-chip, hypertensive nephropathy, mechanic force, perfusion