KSN 2021
FULLY VIRTUAL MEETING
September 02 (Thu) - 05 (Sun)

Abstract Submission No. : 2146

Comparison of metabolic profiling according to physiological and fibrotic stress between podocyte and tubular cell

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Objectives: There is no studies that have analyzed the difference in metabolic phenotype of podocyte and proximal tubular cell through LC-MS analysis. In vitro, we compared the difference in physiological metabolite profiling and the difference in metabolic change under fibrotic stress between the two cells, which are major cells representing the glomerulus and tubule, respectively.

Methods: Metabolome analysis was performed through LC-MS with p180kit using primary cultured human tubular cells and podocytes. For fibrotic stress, primary cultured human tubular cells and podocytes were treated with recombinant TGF beta (2ng/ml) for 48 hours, and then the fold change of metabolites was used to compare the metabolic expression pattern with each control group.

Results: Compared the control groups of podocytes with tubular cells, the metabolites of the glycerophospholipids and sphingomyelins in control groups of podocytes were increased up to 2-61 times, and amino acid metabolites such as glutamine and glutamate, ornithine were expressed relatively less than tubular cells. After treatment with recombinant TGF beta, the expression of hexoses was increased and the expression of glutamine, glutamate, and ornithine, alanine, taurine decreased in both cells compared to each control group. Contrary to what was previously known in CKD patients, the expression of tryptophane was increased and the expression of kynurenine decreased after treatment with recombinant TGF beta in tubular cells. In addition, the expression of putrescine and spermine were decreased after treatment with recombinant TGF beta in podocyte.

Conclusions: Differences in physiological metabolic profile may reflect differences according to the structure and function of each cell in the kidney. Increased hexoses expression in both cells under fibrotic stress suggests that both cells may have disrupted the anabolic pathway including the hexoses monophosphate shunt. Decrease of glutamine and glutamate may reflect that fibrotic stress could promote to deplete antioxidative capacity in both cells.