

만성 신질환의 단계에 따른 혈중 대사체의 변화: 당뇨 유무에 따른 비교 연구

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Changes of Serum Metabolites Depending on CKD Stages: Comparison between Diabetes and Non-diabetes

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Background: Deteriorated renal function in chronic kidney disease (CKD) results in disturbance of serum metabolites. In this study, we aimed to evaluate the differences of serum metabolites according to eGFR and/or presence of diabetes with metabolomic analysis. In addition, we aimed to identify the important metabolites which predict eGFR.

Methods: Pre-dialysis CKD Patients (n=291) and healthy controls (n=56) were recruited. First, CKD patients with diabetes were enrolled and classified 3 groups according to eGFR: group 1, ≥ 60 ; group 2, 15-59; group 3, < 15 ml/min/1.73m². Then, age-, sex-matched non-diabetic patients in each group and healthy controls were enrolled. Concentrations of serum metabolites were analyzed using ¹H-NMR spectroscopy and data were presented by principal components analysis (PCA) and partial least squares (PLS) regression analysis.

Results: Serum metabolites directionally distributed depending on CKD stages in PCA score plot. Leucine, acetate and pyruvate were significantly decreased as a decrease of eGFR, whereas phosphocholine, TMAO, urea and creatinine were significantly increased. Creatinine, pyruvate, urea, leucine, TMAO, formate, citrate and glucose showed significantly high variable importance in the projection (VIP) score which reflects the influence of each metabolite on eGFR (VIP score > 1.0). R² of validation for eGFR with all identified metabolites in PLS model was 0.778 (Fig.). Twenty-one metabolites including three metabolites associated with glucose metabolism, such as pyruvate, lactate and sorbitol showed significant difference between diabetic and non-diabetic patients in group 1. However, only 7 metabolites showed significant difference between the two patients groups in group 3, but pyruvate, lactate and sorbitol showed no significant difference in group 3.

Conclusions: Serum metabolites of CKD patients directionally distributed as a decrease of eGFR in metabolomic analysis. We identified several important metabolites which predicted eGFR. The differences of metabolites between diabetes and non-diabetes were attenuated as CKD progressed.

Key Words: 만성신질환, 당뇨, 사구체 여과율, 대사체학
Chronic kidney disease, Diabetes, GFR; metabolomics

