P-204

투석 전 단계의 당뇨병성 만성신부전 환자에서 혈당 조절 지표로서 당화 알부민

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Glycated Albumin as an Indicator of Glycemic Control in Pre-dialysis Diabetic Chronic Kidney Disease Patients

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Objectives: Good glycemic control is important to prevent progression of diabetic nephropathy and reduce cardiovascular complications. Recently, several studies suggested that hemoglobin A1c (HbA1c), a widely used glycemic control marker, has serious limitations by falsely underestimating glycemic control in diabetic patients on hemodialysis. In contrast, glycated albumin (GA), which is not influenced by RBC survival time, is thought to more accurately reflect glycemic control in ESRD patients. Study aim was to validate this finding in pre-dialysis diabetic chronic kidney disease (CKD) patients.

Methods: Clinically stable pre-dialysis type 2 diabetic patients were enrolled between March 2009 and August 2012. A total of 770 patients were enrolled and stratified into 6 groups using newly revised KDIGO CKD staging that subdivided stage 3 into 3a and 3b stages. Parameters of glycemic control were investigated along with other biochemical and clinical parameters. The GA was measured using the LUCICA GA-L kit (Asahi Kasei).

Results: The numbers of patients according to CKD stages 1 to 5 were 215, 350, 94, 49, 50 and 12, respectively. Various demographic and clinical parameters, including serum glucose, HbA1C and GA, among CKD groups were comparable. However, as CKD stage increased the patients showed tendency to be older and have lower hemoglobin and serum albumin levels. HbA1c and GA showed positive correlation at all CKD stages, however, the slope of regression line between GA and HbA1c was significantly steeper (control group vs. other CKD stages: $p<0.05$) with decrease in renal function. Furthermore, GA/HbA1c ratio and glucose/HbA1c ratio also increased ($r=0.24$, $p<0.001$ and $r=0.17$, $p<0.001$, respectively) with progression of renal failure. In contrast, glucose/GA ratio remained constant throughout the all CKD stages ($r=0.06$, $p=0.12$). In multivariate analysis, weekly erythropoietin (EPO) dose ($p=0.001$) was associated with glucose/HbA1c ratio. The cut off value in ROC curve of weekly EPO dose affecting glucose/HbA1c ratio was 3500 U/week (0.70, 95% CI 0.51-0.88). The degree of proteinuria ($p<0.001$) was associated with glucose/GA ratio.

Conclusion: Our results indicate that HbA1c may underestimate glycemic control state even in pre-dialysis diabetic CKD patients, especially those who are on EPO treatment. GA might be an useful indicator of glycemic control in diabetic pre-dialysis patients without heavy proteinuria.

Key Words: 당뇨병성 신증, 당화 혈색소, 당화 알부민
Diabetic nephropathy, Glycated hemoglobin, Glycated albumin