Glycated Albumin and Hemoglobin A_{1c} in Diabetic Patients with Pre-dialysis Chronic Kidney Disease

Il Young Kim, Min Jung Kim, Soo Bong Lee, Dong Won Lee, Min Ji Shin Byeong Yun Yang, Harin Rhee, Sang Heon Song, Eun Young Seong and Ihm Soo Kwak

Division of Nephrology, Department of Internal Medicine, Pusan National University School of Medicine, Yangsan, South Korea.

Objectives:

●In clinical practice, glycemic control is best assessed by hemoglobin A_{1C} (HbA_{1C}) assay in general diabetic population. However, recent studies have demonstrated that HbA_{1C} underestimates and inaccurately reflects long-term glycemic control in dialysis-dependent patients with DM [1-3].

●While the role of HbA_{1C} and glycated albumin (GA) assay in diabetic patients on dialysis has been investigated[1-3], it is unclear in diabetic patients with pre-dialysis CKD.

●In this study, we evaluated whether GA might be more accurate indicator than HbA_{1C} for glycemic control in diabetic patients with pre-dialysis CKD.

Methods:

●This study included 147 diabetic patients who received HbA_{1C} and GA test simultaneously in Pusan National University Yangsan Hospital from January 2012 to December 2013.

●All patients were categorized into 2 groups according to estimated GFR (eGFR) by Modification of Diet in Renal Disease equation: pre-dialysis CKD group (n = 98, eGFR <60 ml/min/1.73 m^2); non-CKD group (n = 49, eGFR ≥ 60 ml/min/1.73 m^2).

●All blood chemical exams including serum albumin, serum glucose, hemoglobin, creatinine, GA, and HbA_{1C} were measured after an overnight fast of at least 12 hours.

●HbA1c levels were analyzed using routine high-performance liquid chromatography (HPLC, Bio-Rad Lab-oratories Inc., Hercules, CA, USA), and GA level was measured by enzymatic methods using the Lucica GA-L kit (Asahi Kasei Pharma Corp., Tokyo, Japan) with an auto-matic spectrophotometer.

Results:

Table 1. Demographic and clinical characteristics of study population

Variable	Pre-dialysis CKD (n = 98)	Non-CKD (n = 49)	P value
Age (years)	64.9± 11.7	63.4 ± 15.1	0.545
Male (%)	53.1	55.1	0.815
Current smoking (%)	36.7	32.7	0.626
eGFR (ml/min/1.73 m^2)	24.0 ± 16.2	82.7 ± 16.2	<0.001
Height (cm)	161.1 ± 8.1	158.7 ± 7.7	0.095
Weight (kg)	60.9 ± 10.5	59.2 ± 11.4	0.383
BMI (kg/m^2)	23.6 ± 3.7	23.4 ± 3.7	0.943
Hemoglobin (g/dl)	11.6 ± 9.9	12.2 ± 1.6	0.687
Serum glucose (mg/dl)	206.7 ± 122.5	242.6 ± 147.3	0.145
Serum albumin (g/dl)	3.7 ± 0.48	3.8 ± 0.48	0.085
Glycated albumin (%)	20.5 ± 5.7	17.5 ± 3.5	<0.001
Hemoglobin A_{1c} (%)	7.4 ± 1.9	7.6 ± 1.3	0.427
GA/HbA_{1c}	2.78 ± 0.40	2.29 ± 0.28	<0.001

Data are presented as mean ± SD, or (%). BMI, body mass index; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; GA, glycated albumin; HbA_{1c}, Hemoglobin A_{1c}

Figure 1. Relationship between eGFR and GA/HbA_{1c} in pre-dialysis CKD group.

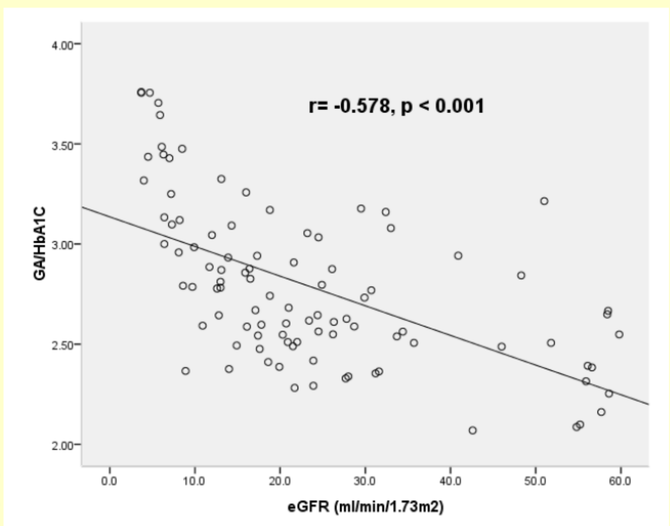

Table 2. Multiple regression analysis for GA/HbA_{1c}

Variables	β[a]	P value
Age (years)	-0.029	0.705
Male	-0.078	0.299
Smoking	0.004	0.953
Pre-dialysis CKD	0.544	<0.001
BMI (kg/m^2)	-0.047	0.507
Hemoglobin (g/dl)	0.071	0.323
Serum albumin (g/dl)	-0.059	0.413
Serum glucose (mg/dl)	0.042	0.562

[a]β means standardized regression coefficients. BMI, body mass index; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; GA, glycated albumin; HbA_{1c}, Hemoglobin A_{1c}

1) Table 1 shows demographics of study population. Mean eGFR were 24.0 16.2 and 82.7 16.2 ml/min/1.73 m^2 in pre-dialysis CKD group and non-CKD group respectively. GA was significantly higher in pre-dialysis CKD group compared with non-CKD group (20.5 5.7 % vs. 17.5 3.5%, P < 0.001). HbA_{1C} tends to be lower in pre-dialysis CKD group compared with non-CKD group. However, there was no significant difference in HbA_{1C} between two groups (7.4 1.9% vs. 7.6 1.3%, P=0.427). GA/HbA_{1c} Ratio was significantly higher in pre-dialysis CKD group compared with non-CKD group (2.78 0.40 vs. 2.29 0.28, P < 0.001)

2) Figure 1 shows correlation between GA/HbA_{1c} and eGFR in pre-dialysis CKD group. In pre-dialysis CKD group, GA/ HbA_{1c} ratio was inversely correlated with eGFR. (r = -0.578, P < 0.001). In contrast, non-CKD group did not show significant correlation between GA/HbA_{1c} and eGFR.

3) To assess which factors are associated with GA/HbA_{1c}, multivariate analysis was created. In multiple regression analysis for GA/HbA_{1c}, the presence of CKD is the only significant predictor of GA/HbA_{1c} (β = 0.544, P < 0.001) (Table 2).

Conclusions:

● GA/HbA_{1c} ratio increases as eGFR declines in diabetic patients with pre-dialysis CKD. This result suggests that the more renal function decreases, the more HbA_{1c} underestimates degree of hyperglycemia in diabetic patients with pre-dialysis CKD.

● The presence of pre-dialysis CKD was independently associated with GA/HbA_{1c} ratio.

● GA might be more reliable indicator for glycemic control than HbA_{1c} in diabetic patients with pre-dialysis CKD.

References:

1) Inaba M, et al.: Glycated albumin is a better glycemic indicator than glycated hemoglobin values in hemodialysis patients with diabetes: Effect of anemia and erythropoietin injection. *J Am Soc Nephrol 18: 896–903, 2007*

2) Peacock TP, et al.: Comparison of glycated albumin and hemoglobin A(1c) levels in diabetic subjects on hemodialysis. *Kidney Int 73: 1062–1068, 2008*

3) Freedman BI, et al.: Comparison of glycated albumin and hemoglobin A1c concentrations in diabetic subjects on peritoneal and hemodialysis. *Perit Dial Int 30: 72–79,* 2010

51ERA-EDTA

314--MP

I) Diabetes. I2) Clinical studies.

II Young Kim

DOI: 10.3252/pso.eu.51era.2014

Poster presented at: 51 ERA-EDTA CONGRESS AMSTERDAM 2014