THE KOREAN SOCIETY OF NEPHROLOGY

APCN & KSN 2024
June 13(Thu) - 16(Sun), 2024 Coex, Seoul, Korea

Promoting Sustainable Kidney Health:
The Asia-Pacific and Beyond

APSN

Abstract Submission No.: A-0376

Exploring the Association Between Peripheral Blood Monocytes and Prevalence of Diabetic Kidney Disease in diabetes mellitus: Analysis of the NHANES 2005-2016

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Objectives : To investigate the association between peripheral blood monocyte levels and the prevalence as well as the severity of Diabetic Kidney Disease (DKD) in patients with diabetes mellitus, using data from the NHANES 2005-2016 database.

Methods : This cross-sectional study used data from the NHANES 2005-2016 database, including 6,062 diabetic patients aged 20-80 with complete demographic and clinical data. DKD was identified according to the 'KDIGO 2021 Guidelines', with monocyte levels assessed using the Beckman Coulter method. Albuminuria and eGFR (CKD-EPI) defined DKD severity. Statistical analyses incorporated sampling weights and used logistic regression to assess the association between monocyte levels and DKD, adjusting for other confounding factors.

Results : We analyzed demographics and clinical characteristics across three monocyte level groups. Individuals in the highest monocyte level group tended to be older, predominantly male, and current smokers, and had higher BMI, leukocyte count, triglycerides, and UACR, but lower total cholesterol, LDL, HDL, and eGFR levels (all $P < 0.05$). Elevated monocyte levels were linked to increased CKD risk, evidenced by eGFR and UACR, and associated with dyslipidemia. In multivariate logistic regression analysis, after adjusting for age, gender, smoking, duration of diabetes, BMI, SBP, glucose lowering agents, HbA1c, and dyslipidemia, we found a positive association between peripheral monocyte levels and the prevalence of CKD (OR=1.93, P value=0.022). In addition, there was a negative association between monocyte levels and eGFR (β=-7.68, P value < 0.01). However, no significant association was found between monocyte levels and log-transformed UACR (β=0.12, P value=0.156).

Conclusions : In conclusion, our study emphasizes an association between elevated monocyte levels and increased prevalence and severity of DKD, suggesting a potential role of monocytes in DKD's pathophysiology. However, the limitations of our study including the inability to establish causality due to its cross-sectional design and the potential biases inherent in self-reported data.

Table1.jpg

characteristics	Monocytes (× 10^9 /L)			
	Quantiles1 (≤0.49)	Quantiles2 (>0.49, ≤0.65)	Quantiles3 (>0.65)	P value
N	2,181	2,084	1,797	
Age (year)	55.8 (0.38)	57.8 (0.37)	58.5 (0.42)	<0.001
Gender *				<0.001
Female	53.2 (0.02)	46.7 (0.02)	41.7 (0.02)	
Male	46.8 (0.02)	53.3 (0.02)	58.3 (0.02)	
Race *				<0.001
Mexican American	12.3 (0.01)	11.4 (0.01)	7.2 (0.01)	
Non-Hispanic Black	20.4 (0.01)	15.5 (0.01)	10.7 (0.01)	
Non-Hispanic White	49.5 (0.02)	58.4 (0.02)	69.2 (0.02)	
Other Hispanic	6.5 (0.01)	6.5 (0.01)	5.1 (0.01)	
Other Race - Including Multi-Racial	11.3 (0.01)	8.2 (0.01)	7.9 (0.01)	
Education Level *				0.830
Beyond High school	50.3 (0.02)	51.5 (0.02)	50.5 (0.02)	
Within High school	49.7 (0.02)	48.5 (0.02)	49.5 (0.02)	
Current smoking *	14.8 (0.01)	16.2 (0.01)	20.7 (0.01)	<0.001
BMI (kg/m^2)	32.7 (0.27)	33.5 (0.25)	34.3 (0.32)	<0.001
SBP (mmHg)	128.9 (0.56)	130.4 (0.60)	129.5 (0.70)	0.215
DBP (mmHg)	70.6 (0.46)	70.4 (0.43)	70.3 (0.51)	0.717
Leukocytes (× 10^9 /L) *	6.3 [5.40, 7.60]	7.6 [6.50, 8.60]	9.1 [7.80, 10.60]	<0.001
Alb (g/l)	41.3 (0.11)	41.4 (0.11)	41.3 (0.14)	0.696
TG (mg/dL) *	153.0 [103.00, 230.00]	170.0 [115.00, 256.00]	171.0 [118.00, 255.00]	<0.001
LDL cholesterol (mg/dL)	107.9 (1.76)	103.0 (1.46)	101.6 (2.23)	0.047
HDL cholesterol (mg/dL)	48.3 (0.45)	46.3 (0.38)	45.1 (0.49)	<0.001
Total cholesterol (mg/dL) *	187.0 [156.00, 221.00]	182.0 [155.00, 215.00]	178.0 [152.00, 215.00]	0.002
HbA1c (%) *	7.1 [6.50, 8.40]	7.0 [6.50, 8.10]	6.9 [6.50, 8.00]	0.089
eGFR (mL/min per 1.73 m^2)	89.3 (0.71)	86.1 (0.67)	83.6 (0.75)	<0.001
UACR (mg/g) *	11.0 [5.92, 29.88]	11.7 [6.34, 34.27]	12.9 [6.89, 39.99]	0.016
Duration of diabetes (year) *				
<5	30.5 (0.02)	32.9 (0.01)	28.7 (0.02)	0.081
≥5&<10	26.0 (0.02)	20.1 (0.01)	23.9 (0.02)	
≥10	43.5 (0.02)	47.0 (0.02)	47.4 (0.02)	
Glucose lowering agents *				
None	23.4 (0.01)	22.2 (0.01)	22.9 (0.01)	0.801
Oral agents	53.9 (0.02)	54.2 (0.02)	52.1 (0.02)	
Insulin (and oral)	22.8 (0.02)	23.6 (0.01)	25.0 (0.02)	
CKD *	31.1 (0.01)	35.2 (0.02)	39.7 (0.02)	<0.001
Dyslipidemia *	75.1 (0.01)	77.1 (0.01)	80.0 (0.01)	0.035

Table1.jpg

	CKD		eGFR		UACR	
	OR	*P* value	β	*P* value	β	*P* value
Model 1	2.09	0.003	-8.41	<0.001	0.14	0.100
Model 2	1.93	0.022	-7.90	<0.001	0.12	0.155
Model 3	1.93	0.022	-7.68	<0.001	0.12	0.156

Model 1 was adjusted for age, gender, current smoking, *and duration of diabetes.*

Model 2 was adjusted for age, gender, current smoking, *duration of diabetes, BMI, systolic blood pressure, and Glucose lowering agent.*

Model 3 was adjusted for age, gender, current smoking, *duration of diabetes, BMI, systolic blood pressure, glucose-lowering agents, HbA1c, and dyslipidemia.*

CKD chronic kidney disease, eGFR estimated glomerular infiltration rate, UACR urine albumin to creatinine ratio.