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Metabolic acidosis is inversely associated with pulse wave velocity in chronic kidney disease: Results from the KNOW-CKD Study

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Objectives : Metabolic acidosis, usually manifested by low serum bicarbonate level, is common in chronic kidney disease (CKD) that can have various deleterious consequences such as impaired myocardial function and chronic inflammation. Arterial stiffness is common in CKD patients and may induce poor cardiovascular outcomes in CKD. There might be a close association between metabolic acidosis and arterial stiffness. The present study aimed to investigate the association between serum bicarbonate and arterial stiffness from the baseline cross-sectional data set of a large-scale Korean CKD cohort.

Methods : Between 2011 and 2016, 2,238 CKD patients were enrolled in the KoreaN Cohort Study for Outcome in Patients With Chronic Kidney Disease (KNOW-CKD). We analyzed 1,809 participants from this cohort who had been measured for serum bicarbonate levels. Arterial stiffness was measured by brachial-to-ankle pulse wave velocity (baPWV). We employed a multivariable linear regression model analysis with adjustment, including demographic factors, eGFR, proteinuria, hemoglobin, total cholesterol, albumin, calcium, phosphorous, and iPTH.

Results : Patients were 53.6 ± 12.3 years old and 1,111 patients (61.4%) were male. The mean eGFR was 50.1 ± 30.1 mL/min/1.73m². The serum bicarbonate level was 25.7 ± 3.7 mEq/L. Advanced CKD stages were associated with lower serum bicarbonate level levels ($P < 0.001$, P for linear trend < 0.001). baPWV values varied according to the serum bicarbonate quartile ($1,621 \pm 397$, $1,535 \pm 358$, $1,511 \pm 320$, $1,472 \pm 287$ for the 1st to 4th quartiles of serum bicarbonate, respectively, $P < 0.001$, P for linear trend < 0.001). Univariate analysis showed serum baPWV ($r = -0.178$, $P < 0.001$) had an inverse relationship with serum bicarbonate. A multivariable linear regression model showed that baPWV had a significant inverse association with serum bicarbonate (B coefficient -5.65 ; 95% CI -10.22 , -1.09 ; $P = 0.015$).

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Conclusions : Metabolic acidosis estimated by low serum bicarbonate was associated with high baPWV in pre-dialysis CKD patients in Korea. Further studies are warranted to elucidate the causal relationship between serum bicarbonate and baPWV, and the role of metabolic acidosis in the development of cardiovascular disease in CKD.

Keywords : metabolic acidosis, serum bicarbonate, chronic kidney disease, arterial stiffness, brachial-to-ankle pulse wave velocity