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Low serum bicarbonate levels at admission predict the development of hospital acquired acute kidney injury: A retrospective cohort study

Sung yoon LIM, Anna LEE, Ho jun CHIN, Ki young NA, Dong-wan CHAE,
*Sejoong KIM

Department of Internal Medicine, Seoul National University Bundang Hospital,
Seongnam, Korea, Korea, South

Objectives : Acute kidney injury (AKI) is a common complication and is strongly related to increase in mortality. Low serum bicarbonate levels are associated with adverse renal outcomes and mortality in patients with chronic kidney injury; however, it is unknown whether lower than normal serum bicarbonate levels may predict the development of AKI in hospitalized patients. The purpose of our study was to determine whether serum bicarbonate levels at admission could be a predictor for the development of AKI and mortality in hospitalized patients.

Methods : We retrospectively enrolled 17706 adult patients who were admitted to Seoul National University Bundang Hospital from January 2013 to December 2013. The patients were divided into 3 groups based on serum bicarbonate levels on the first measurement of their admission, which represented group 1 (below normal levels) <23 mEq/L; group 2 (normal levels) 23 to 27 mEq/L; and group 3 (elevated levels) >27 mEq/L. AKI was defined as an increase in the serum creatinine level by ≥ 0.3 mg/dL or ≥ 1.5 times of the baseline value during the hospital stay.

Results : During a median 6.0 days of hospital stay, the incidence rates of AKI and in-hospital mortality were 5.1% and 0.9%, respectively. The incidence of AKI was higher in group 1 (8.1%) than in group 2 (4.1%) and group 3 (3.6%) ($P < 0.001$). Low serum bicarbonate levels at admission were significantly associated with AKI even after the adjustment for age, sex, hypertension, diabetes mellitus, and estimated glomerular filtration rate (adjusted odds ratio [OR] 2.181, $P < 0.001$). In addition, low serum bicarbonate levels also independently predicted in-hospital mortality (adjusted hazard ratio [HR] 1.864, $P < 0.001$). Pre-existing low bicarbonate levels and subsequent development of AKI increased in-hospital mortality by 15 times, compared to the patients with normal bicarbonate levels and no AKI.

Conclusions : Low serum bicarbonate levels may be associated with the development of AKI and high mortality in hospitalized patients. Clinical trials are needed to clarify the protective role of bicarbonate replacement therapy in preventing further AKI development.

Keywords : acute kidney injury, serum bicarbonate, mortality