Prognostic value of serum bicarbonate in patients hospitalized for acute heart failure

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Background: Acute heart failure (AHF) requiring hospitalization is associated with significant morbidity and mortality. Acid-base disorders are very common in patients with AHF due to pulmonary oedema and low tissue perfusion. However, its long-term prognostic significance remains to be clarified. We aimed to determine the relationships between serum bicarbonate (HCO3) levels, which reflect acid-base homeostasis, with long-term outcomes.

Methods: This cohort study included all patients admitted for AHF from June 2021 to August 2022 in a single center. We excluded patients who did not have available gasometric values at admission. All patients had received a primary diagnosis of acute decompensated heart failure, including signs and symptoms of fluid overload and a concentration of N-terminal pro-B-type natriuretic peptide (NT-ProBNP) of 300 pg/mL at least. Clinical and demographic characteristics of all patients were collected during hospitalization. Normal range of HCO3 were defined as 22 to 26 mmol/L. The primary objective was a composite outcome of cardiovascular death and AHF readmission.

Results: Total of 153 patients were enrolled. Median age was 75.4 ± 10.8 years and 66 (43%) patients were female. 62 (38%) patients had diabetes and 67 (41%) had chronic kidney disease. The median [IQR] of NT-ProBNP at admission was 4525 (IQR 25-75: 2010-7148), 58 (38%) patients had left ventricular ejection fraction (LVEF) ≤ 40%, 90 (56%) patients had atrial fibrillation and 49 (32%) patients had coronary artery disease. Regarding acid-base disorders, 38 (24.8%) patients had high serum HCO3 level, and 53 (34.6%) patients had low serum HCO3 level. During a median follow-up period of 10 months, there were 24 deaths (15%), and 60 patients were readmitted for heart failure. High serum HCO3 level (≥26 mmol/L) was significantly associated with higher incidence of the composite outcome (24/38, 63.2% vs 48/115, 41.7%; OR 2.39, 95% CI: 1.12-5.09, p = 0.017) compared with normal and low HCO3 level. In contrast, low serum HCO3 level had lower incidence of the composite outcome (19/53, 36% vs 53/100, 53%; OR 0.5, 95% CI: 0.25-0.98, p = 0.032) compared with normal and high serum HCO3 level. Moreover, we did not find differences between groups stratified by acidaemia (OR 0.82, 95% CI: 0.32-2.08, p = 0.43), alkalaemia (OR 2.8, 95% CI: 0.69-11.26, p = 0.12) and hyperlactatemia (OR 0.72, 95% CI: 0.34-1.52, p = 0.45).

Conclusions: High serum HCO3 level, but not low serum HCO3 level, on admission was associated with composite outcome cardiovascular death or AHF readmission in patients with acute heart failure. HCO3 level seems to be a useful tool to identify acid-base disorders for stratifying the risk of adverse outcomes in patients with acute heart failure.