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Hypochloremia or Hyperchloremia: Which one is more associated with the development of contrast-induced nephropathy?

Hyung jung OH[1], Dong-ryeol RYU[2], *Yong eun CHUNG[3]

[1]Ewha Convergence Institute, Ewha Womans University Mokdong Hospital, Korea, South, [2]Internal Medicine, Ewha Womans University, College of Medicine, Korea, South, [3]Radiology, Yonsei University, College of Medicine, Korea, South, [4]Internal Medicine, Yonsei University, College of Medicine, Korea, South

Objectives : Although hyper- and hypochloremia have been considered to be associated with worsening renal outcomes due to metabolic acidosis or alkalosis, there is no study for correlation of hyper- and hypochloremia and the development of contrast-induced nephropathy (CIN), yet.

Methods : Among total 13,088 Korean patients who had less than 2.0 mg/dL of serum creatinine (Cr) and underwent contrast enhanced abdominal CT in Severance Hospital between January 2014 and December 2015, we investigated serum creatinine concentrations before CT examination and after procedure within 72 hours, and calculated the change of serum creatinine levels. Moreover, we divided these patients into three groups based on the baseline serum chloride concentration (Hypochloremia, Normochloremia, and Hyperchloremia) and conducted multivariate logistic regression analyses to reveal the association between each group and the increase in the rate of CIN occurrence. Furthermore, we performed above same statistical analyses with the patients less than 1.2 mg/dL (normal range) and 1.2 to 2.0 mg/dL of serum creatinine levels for sub-analyses, respectively.

Results : Two thousand five hundred twenty five (19.3%) patients were in the hypochloremic group (Cl- < 98 mEq/L), and 241 (1.8%) patients were in the hyperchloremic group (Cl- > 110 mEq/L). The developmental rate of CIN was the highest in hyperchloremic group (14.5%), and was the second highest in hypochloremic group (12.4%) with statistical significance compared to normochloremic group (10.5%), but there was no significant difference in the rate of CIN development between hypochloremic and hyperchloremic groups. Moreover, multivariate logistic regression showed that only hypochloremia [1.179 (1.027-1.353), P = 0.019], but not hyperchloremia [1.348 (0.926-1.963), P = 0.119], was still associated with the rise in the development of CIN even after adjusting for age, sex, BMI, comorbidity disease, serum Cr, total CO2 and contrast volume compared to normochloremia. In addition, the sub-analysis with the patients who had 1.2 to 2.0 mg/dL of serum Cr concentration

at baseline (n=808) showed that hypochloremia and hyperchloremia were still significantly associated with the increase in the rate of CIN occurrence even after adjusting for above same variables [in hypochloremia; 2.057 (1.156–3.661), P = 0.014, and in hyperchloremia; 2.733 (1.009–7.403), P = 0.048], while neither hypochloremia nor hyperchloremia was significantly related to the increase in the developmental rate of CIN among the patients with less than 1.2 mg/dL of serum Cr concentration (n=12,280).

Conclusions : More caution might be needed for the development of CIN in the patients with 1.2 to 2.0 mg/dL of serum Cr levels and hypochloremia and hyperchloremia before contrast CT examination, when they need to use contrast.

Keywords : hypochloremia, hyperchloremia, contrast-induced nephropathy, slightly elevated serum creatinine level