The Effect of Intravenous Fluid Replacement on Acid-base Parameters and Renal Function: A Randomized Controlled Trial Comparing Normal Saline Solution and Balanced Electrolyte Crystalloid Solution in Sepsis Patients.

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Background: The effectiveness and safety of saline (0.9% sodium chloride) compared with balanced crystalloid fluids as a fluid resuscitation in sepsis remains unclear.

Objective: We aimed to investigate the effect of different types of fluid replacement on acid-base parameters, renal function, and clinical outcomes.

Methods: We conducted an open label randomized controlled trial in the emergency department of Bhumibol Adulyadej Hospital. Septic shock or sepsis patients with severe hyperlactatemia (serum lactate > 4 mmol/L) were randomized to receive normal saline solution (NSS) or Ringer’s lactate solution (RLS). All patients were resuscitated following the survival sepsis campaign guideline. The primary outcomes were changes in acid-base parameters during the first 24 hours. The secondary outcomes were changes in renal function at 48 hours, incidence of acute kidney injury (AKI), and mortality rate.

Results: Between August and December 2017, a total of 34 sepsis patients (22 females, 12 males) were randomly assigned to two treatment groups: 17 to NSS and 17 to RLS. Demographics and baseline clinical characteristics were similar in both groups. Baseline serum bicarbonate in NSS and RLS groups was 21.47 ± 6.57 and 19.94 ± 3.80 mmol/L, respectively (p = 0.412). In the NSS group, serum bicarbonate decreased 1.94 ± 4.66, while in the RLS group, serum bicarbonate increased 1.18 ± 3.76 after 24 hours (p = 0.039). Interestingly, the NSS group was associated with improving renal function compared to the RLS (change in serum creatinine at 48 hours of -0.56 ± 0.80 vs +0.01 ± 0.45 mg/dL, p = 0.016). The incidence and mortality rate of AKI were not statistically different between both groups.

Conclusion: In this study, resuscitation with normal saline in sepsis results in slightly worsening of metabolic acidosis, but associated with improving renal function compared to Ringer’s lactate solution. Nonetheless, the effect on hard outcomes should be further determined in well-designed RCTs with adequate power.

Keywords: Survival sepsis campaign, Fluid resuscitation, Metabolic acidosis, Acute kidney injury