The Effect of Fluid Resuscitation with Normal Saline Solution (NSS) Versus Ringer’s Acetate (RA) on Renal Function and Host Defense in Severe Sepsis/Septic Shock Patients: A Randomized Controlled Trial

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Background: Recent large observational studies in severe sepsis showed that NSS might worsen acute kidney injury (AKI) determined by serum creatinine. In animal model with sepsis, NSS could impair monocyte/neutrophil functions and main host defense mechanism during sepsis, leading to renal dysfunction.

Objective: This prospective randomized controlled, concealed allocation trial was conducted to examine the effect of NSS versus RA on renal function assessed by urine neutrophil gelatinase associated lipocalin (uNGAL) level, a novel more precise biomarker of AKI, and host defense mechanism assessed by monocyte/neutrophil functions in severe/septic shock patients presenting at the emergency department, King Chulalongkorn Memorial Hospital.

Methods: NSS or RA was utilized for volume expansion during fluid resuscitation phase for 72 hours. The treatment followed recommendations for fluid therapy provided by the Surviving Sepsis Campaign. Blood and urine samples were collected at 72 hours after randomization. Primary outcome was uNGAL level on day 3. Secondary outcomes were monocyte HLA-DR (mHLA) expression, neutrophil chemotaxis activity, and CD11b expression on day 3, as well as AKI incidence on day 7.

Results: Fifty-nine patients were recruited, with 29 and 30 for NSS and RA, respectively. The volume of resuscitation during the first 6 hours were comparable (NSS=1,431 mL, RA=1,186 mL, \(p=0.20\)). Patients receiving NSS became more acidosis than RA. There was no significant difference in renal function between both groups at baseline. The uNGAL levels (NSS=220.2 ng/mL, RA= 130.4 ng/mL, \(p=0.51\)), mHLA-DR expression, neutrophil chemotaxis, and CD11b expression on day 3 were comparable between the two groups. The incidences of AKI determined by serum creatinine on day 7 were not different (NSS=24.1%, RA=26.7%, \(p=0.82\)).

Conclusion: In severe sepsis/septic shock patients receiving fluid resuscitation, NSS, when compared with balanced solution, does not impair renal function as well as host defense mechanism. NSS can still be used as the main fluid therapy in severe sepsis/septic shock patients.

Keywords: Acute kidney injury, Sepsis, Septic shock, Balanced solution