Title: Lactated Ringers versus Normal Saline in Diabetic Ketoacidosis Fluid Resuscitation

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Practice Site: Cone Health Hospital System

Purpose/Background: The American Diabetes Association (ADA) Guidelines for Hyperglycemic Crisis in Adult Patients recommend 0.9% sodium chloride at 15-20 mL/kg/hour or 1-1.5 L in the first hour. Normal saline (NS) contains higher chloride concentration (154 mmol/L) compared to human plasma (94-111 mmol/L), therefore administering large volumes could potentially delay resolution of metabolic acidosis. Whereas lactated ringers (LR) contains a chloride concentration (109 mmol/L) more comparable to human plasma and may result in fewer electrolyte abnormalities and shorter time to diabetic ketoacidosis (DKA) resolution. The primary purpose of this study was to compare LR versus NS on time to resolution of DKA.

Methods: This multi-center, IRB approved, prospective study evaluated LR versus NS in adult patients with DKA presenting to four hospitals within Cone Health. At Cone Health, the DKA Hyperglycemic Crisis order sets were updated to include lactated ringers as the preferred fluid for resuscitation. Adult patients identified by ICD-10 codes and confirmed laboratory findings for DKA were included in analysis, Patients with end-stage renal disease (ESRD) or who died prior to admission were excluded. The primary outcome of time to resolution of DKA was defined as the time from insulin infusion order until discontinuation of the infusion. Main secondary outcomes included time to anion gap closure, intensive care unit (ICU) length of stay, incidence of hyperchloremia and hypokalemia.

Results: Overall, 1,507 patients were included in the analysis of which 129 patients received LR, and 1,379 patients received NS. There were distinct differences between groups at baseline, including baseline weight. The resolution of DKA was not statistically different between groups, 35.8 hours in the LR group versus 34.6 in the NS group (p=0.46, 95% CI -0.10-0.22). The time to anion gap closure was prolonged in the LR groups by six hours (p<0.001). Patient who received LR were at lower risk of developing hyperchloremia (IRR 0.58, 95% CI 0.33-1.01, p=0.05). The ICU length of stay, inpatient mortality, and incidence of hypokalemia did not differ between groups.

Conclusions: Time to DKA resolution was not statistically different between patients who received NS or LR. However, time to anion gap closure was prolonged in the LR group. As predicted, the incidence of hyperchloremia favored the LR group.

Final analysis

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Content

1. Title limited to 2 lines of text – short, specific titles preferred. (150 characters)
2. Authors’ names limited to 1 line of text – do not use degrees or titles. (75 characters)
3. Practice Site
4. The remaining sections must be **300 words or less** and should include:
   1. Presentation Objective
   2. Self-Assessment Question
   3. Purpose/Background
   4. Methods
   5. Results (preliminary results are acceptable)\*
   6. Conclusions (reached to date)\*
5. \*If results/conclusions not available, insert “In Progress”.
6. List e-mail of resident (or best contact) for follow-up by interested participants.

ASHP ABTRACT

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Methods: This multi-center, IRB approved, prospective study evaluated lactated ringers versus normal saline in adult patients with DKA presenting to four hospitals within Cone Health. At Cone Health, the DKA Hyperglycemic Crisis order sets were updated to include lactated ringers as the preferred fluid for resuscitation. Adult patients identified by ICD-10 codes for DKA with confirmed laboratory findings for DKA (blood glucose > 250 mmol/L, serum bicarbonate < 18 mEq/L, and anion gap >10) were included in analysis, including pregnant women. Patients with end-stage renal disease (ESRD) or who died prior to admission were excluded. Data collected included age, race, gender, pregnancy status if applicable, baseline laboratory values, and type of fluid administered for resuscitation. The primary outcome of time to resolution of DKA was defined as the time from insulin infusion order until discontinuation of the infusion. Main secondary outcomes included in-hospital mortality, acute kidney injury, length of stay, and incidence of hyperchloremic metabolic acidosis.