



The Impact of Fluid Resuscitation with Plasma-Lyte A Versus Lactated Ringers on Acid-base Status in Emergency Department Patients with Acidosis

Alexander Longley, PharmD Candidate; Danielle Whybark, PharmD Candidate; Blake Rosenfelder, PharmD; Jessica Worland, PharmD; Amanda Troup, PharmD, BCPS Mercy Hospital, Springfield, MO

Introduction & Purpose

- Lactated Ringers (LR) and Plasma-LyteA (PA) are balanced crystalloid fluids, which are designed to more closely mimic human plasma electrolyte content.
- Studies have shown balanced crystalloid fluids, due to their unique salt content, can prevent worsening and possibly improve acidosis when compared to normal saline.
- Studies that have compared balanced crystalloids to saline have not evaluated the difference in efficacy between balanced crystalloids.
- This study will evaluate the impact PlasmaLyte-A or Lactated Ringers have on acidosis when used for fluid resuscitation.

Objectives

Primary Objective:

- To compare the acid-base status of patients that have received LR to those that received PA.

Secondary Objectives:

- To describe prescribing trends of Lactated Ringers and Plasma-Lyte A for patients with acidosis admitted to the Emergency Department
- To determine cost differences between PA and LR

Study Population

Age		
	Lactated Ringers	Plasma-Lyte A
Mean (range)	52.4 (1-90)	59.7 (23-85)
Sex		
	Lactated Ringers	Plasma-Lyte A
Female	44%	53%
Baseline pH		
	Lactated Ringers	Plasma-Lyte A
Mean (range)	7.24 (7.11-7.34)	7.14 (6.73-7.34)

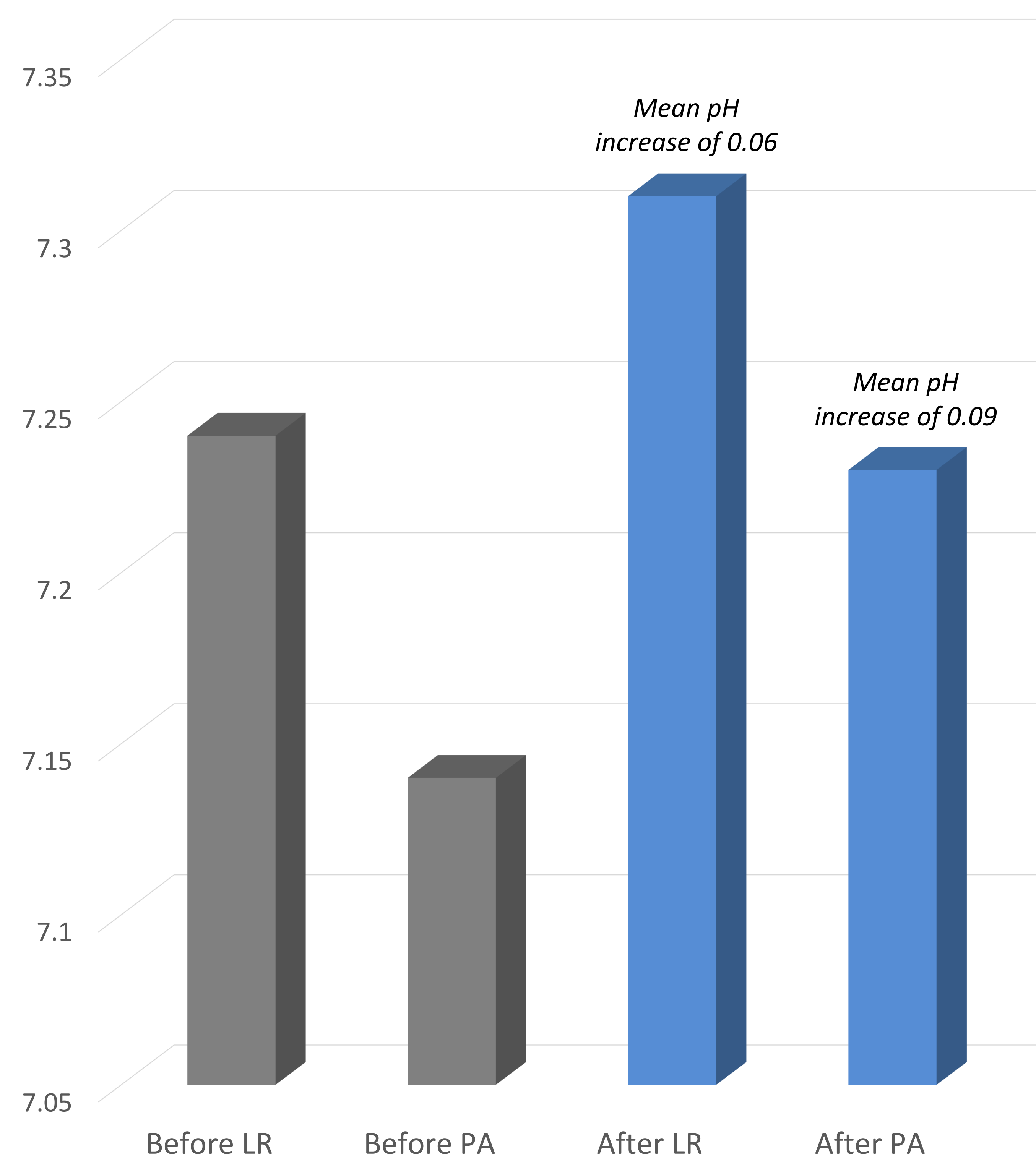
Methods and Materials

- A 6-month report of Plasma-Lyte A and Lactated Ringers use in the emergency department was reviewed from January 1, 2019 to June 30, 2019.
- Patients that received a Lactated Ringers or Plasma-Lyte A bolus and had a serum pH of less than 7.35 were included. Patients were excluded if they did not have laboratory values required to evaluate the effect of these fluids on serum pH or received sodium bicarbonate during the evaluation period.
- The primary endpoint was pH change after bolus administration.
- Statistical analysis was performed using student t-test to determine statistical significance of results.

Results

- The report yielded 1,184 subjects, of that 51 cases met study criteria.
- Plasma-Lyte A yielded a mean pH change of 0.09 (N=17). Lactated Ringers yielded a mean pH change of 0.06 (N=34). The difference between groups was deemed not significant (p=0.22).
- Due to the narrow difference in pH change between groups, a post-hoc power calculation determined 1,130 subjects were needed to meet a 95% power.
- No trends were determined for a preferred fluid in either respiratory acidosis or metabolic acidosis as both fluids appeared to be used indiscriminately.
- A mean volume of 1,200 mL LR and 1,500 mL PA was administered in each group. Based on a cost of \$2.95 per Liter of LR, and \$4.32 per Liter of PA, the average cost per fluid bolus was \$5.90 for LR vs \$8.64 for PA. This resulted in a \$2.76 (46.8%) increase in fluid resuscitation cost in the PA group.

pH of Acidotic Patients Before and After Fluid Bolus with LR or PA



Discussion

- As power was not met and a statistical significance was not demonstrated between Plasma-Lyte A and Lactated Ringers, no data can be used to determine a difference in the effect of these fluids on acidosis without potentially committing a type II error.
- Patients receiving PA had a more severe baseline acidosis and received more fluid. This may be taken into consideration for the difference of pH that is shown between the two groups.
- While \$2.76 is an insignificant amount of money to the individual patient, the added cost across thousands of patients would ultimately be worth consideration.
- Study limitations include:
 - Small sample size
 - Single institution study

Conclusions

This study did not demonstrate a significant difference between Plasma-Lyte A and Lactated Ringers with regards to improving acidosis. A larger multicenter study, as described by the post-hoc power calculation, will be needed to effectively evaluate any difference between these two solutions.

Disclosure Statement

None of the authors have any financial or professional conflicts to disclose.

References

- Hadimioglu N, Saadawy I, Saglam T, Ertug Z, Dinckan A. The Effect of Different Crystalloid Solutions on Acid-Base Balance and Early Kidney Function After Kidney Transplantation. *Anesthesia & Analgesia*. 2008;107(1):264-269. doi:10.1213/ane.0b013e3181732d64.
- Hasman H, Cinar O, Uzun A, Cevik E, Jay L, Comert B. A Randomized Clinical Trial Comparing the Effect of Rapidly Infused Crystalloids on Acid-Base Status in Dehydrated Patients in the Emergency Department. *International Journal of Medical Sciences*. 2012;9(1):59-64. doi:10.7150/ijms.9.59.
- Omron EM, Omron RM. A Physicochemical Model of Crystalloid Infusion on Acid-Base Status. *Journal of Intensive Care Medicine*. 2010;25(5):271-280. doi:10.1177/0885066610371633.
- Traverso LW, Lee WP, Langford MJ. Fluid Resuscitation After an Otherwise Fatal Hemorrhage: I. Crystalloid Solutions. *The Journal of Trauma: Injury, Infection, and Critical Care*. 1986;26(2):168-175. doi:10.1097/00005373-198602000-00014.
- Wang Y, Guo W, Gao D, et al. Effects of Plasma-lyte A, lactated Ringers, and normal saline on acid-base status and intestine injury in the initial treatment of hemorrhagic shock. *The American Journal of Emergency Medicine*. 2017;35(2):317-321. doi:10.1016/j.ajem.2016.10.007.
- Weinberg L, Pearce B, Sullivan R, Siu L, Scurrah N, Tan C, et al. The effects of plasmalyte-148 vs. Hartmann's solution during major liver resection: a multicentre, double-blind, randomized controlled trial. *Minerva Anestesiologica*. 2015 December;81(12):1288-97.



Contact

Alexander Longley, PharmD Candidate
Mercy Hospital, Springfield, MO
Email: Alexander.Longley@Mercy.net