

Letter to the Editor

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Dear Editor
We recently read with a special interest the manuscript entitled “Effects of alkalisation and rehydration on plasma potassium concentration in neonatal calves with diarrhea” by Trefz FM., et al., *JVIM* Mar 2015.¹

In the study, 71 diarrheic calves with or without dehydration were allocated to three separate treatment groups. (1) Group CID (constant drip infusion, given 5 or 10 L of 0.9% saline that was spiked with 250 mL of an 8.4% sodium bicarbonate solution and dextrose if necessary) consisted of 22 calves, (2) group hypertonic bicarbonate solution (HBS; given either 500 or 750 mL of hypertonic 8.4% NaHCO₃) consisted of 15 calves and (3) the group HBS+CID (given 250 or 500 mL of an 8.4% sodium bicarbonate solution followed by a CDI consisting of 5 or 10 L of isotonic saline spiked with 250 mL of an 8.4% sodium bicarbonate solution and dextrose if necessary) consisted of 34 calves.

Dr Trefz et al. concluded that “intravenous administration of hypertonic sodium bicarbonate solutions to neonatal calves with diarrhea and strong ion acidosis induces an immediate and sustained plasma potassium-lowering effect that appears to be caused by its efficient and rapid alkalizing ability”. Dr Trefz et al. then concluded that “the combination of rapid alkalisation with hypertonic sodium bicarbonate followed by a continuous infusion of larger volumes of iso- or slightly hypertonic solutions represents the best treatment strategy in dehydrated neonatal calves with diarrhea and clinical signs of hyperkalemia”. Scientifically, the authors have no basis to conclude that administration of sodium bicarbonate solution is the best strategy to treat hyperkalemia in diarrheic calves and that the plasma potassium-lowering effect is caused by its efficient and rapid alkalizing ability as there was no control group in the study. At best, the authors could generate conclusions regarding the most effective method of application of bicarbonate solution (assuming that it is effective to give bicarbonate solution) among the three methods examined to treat hyperkalemia.

Several investigations have shown little or no benefit to alkalization for emergent treatment of hyperkalemia.^{2–5} Kaplan et al. 1997 JL. (The hyperkalemia research group) investigated the efficacy of emergency alkalization in non-nephrectomized dogs with K⁺ induced cardiac conduction abnormalities.⁵ The latter group used a control crossover study giving K⁺ loads (mean ± SD pre-treatment K⁺ level of 9.06 ± 0.82 mmol/L), and comparing various treatments matched with respect to sodium and water content. Alkalization effect was tested by comparing the effects of a NaHCO₃ solution with a solution differing only by substitution of chloride for the HCO₃ moiety (hypertonic NaCl 0.9%). Although direct comparisons between studies cannot be made because at times significant differences in the experimental models, but failure to include a control group that matched Na⁺ and water content of NaHCO₃ solution as per Trefz et al. study is a significant experimental design flaw. It is not possible to determine whether the

potassium-lowering effect of NaHCO₃ resulted from the alkalisation or because of the load of Na⁺.

Another important questionable aspect of the study is that it fails to consider the additive or multiplicative effect of the different treatments into the statistical analysis. The analysis did not account for confounding factors or potential interaction including doses of NaHCO₃, osmolarity and volume of the CDI, and administration of glucose.⁶

Lastly, the conclusion and recommendations with regard to medical management of hyperkalemia diarrheic calves is further weakly supported when only a small subset of their cases was hyperkalemic. The number of hyperkalemic calves, which are the clinically relevant subjects to test their hypothesis here, accounted for less than a third (n = 20) of the total calves in the study. Specifically, there were no hyperkalemic calves in the HBS group and only 5 calves of 22 in the CID group and 15/34 in the HBS+CID group.

In summary, the strong conclusions and recommendations drawn by Trefz F., et al., study regarding the plasma potassium-lowering effect of NaHCO₃⁻ may not be appropriate because of the weaknesses of the experimental design and statistical analysis.

Sincerely,

References

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Diego Gomez-Nieto, MV, MSc, MVSc,
DACVIM

Department of Pathobiology, Ontario Veterinary College, University of Guelph, Guelph, ON, Canada

Luis G. Arroyo, LMV, DVSc, PhD, DACVIM
and Laurent Viel, DVM, MSc, PhD

Department of Clinical Studies, Ontario Veterinary College, University of Guelph, Guelph, ON, Canada

William C. Sears, MS, MSc

Department of Population Medicine, Ontario Veterinary College, University of Guelph, Guelph, ON, Canada