

Capsule Summary

Balanced Crystalloids in Diabetic Ketoacidosis- A Metanalysis

Normal saline is the most widely used crystalloid solution. There is emerging evidence suggesting that balanced crystalloids which have more physiological levels of sodium and chloride may have certain advantages over normal saline particularly with regards to the development of hyperchloremic metabolic acidosis. Diabetic Ketoacidosis (DKA) is a condition which is characterised by mild to severe metabolic acidosis and a severe fluid deficit. Some studies have suggested that hyperchloremia in patients with DKA may be associated with a longer time to DKA resolution and longer hospital length of stay. (1,2) A recently published meta-analysis summarised the evidence comparing different balanced crystalloid solutions in patients with DKA.

Objective:

The primary objective of this systematic review and meta-analysis of Randomised Clinical Trials was to examine the role of saline versus balanced crystalloid in the resuscitation of patients with Diabetic Ketoacidosis

Study Methodology:

- There were 8 randomised clinical trials which were as part of this meta-analysis
- Data from 482 patients was analysed

Study Results:

The findings were as follows on the different parameters:

Parameters	Findings
Time to resolution of Diabetic Ketoacidosis	Median Duration was 3.5 hours longer in saline group (95% CI: 0.90 longer to 6.12 longer) compared to balanced crystalloid group.
Length of Hospital Stay	Median Duration was 0.89 days longer in saline group (95% CI: 0.34 longer to 1.43 longer) compared to balanced crystalloid group.
Post Resuscitation Chloride	Higher post resuscitation chloride levels in the saline group (Median Duration, 1.62 mmol/L higher; 95% CI, 0.40 lower to 3.64 higher) compared to the balanced crystalloids group
Post Resuscitation Bicarbonate Levels	Lower post resuscitation bicarbonate levels in the saline group (MD, 1.50 mmol/L; 95% CI, 2.33 lower to 0.67 lower; moderate certainty) compared to the balanced crystalloids group

Conclusion:

- Use of saline may be associated with longer time to DKA resolution, higher post-resuscitation plasma chloride levels, lower post-resuscitation plasma bicarbonate levels, and longer hospital stay compared with balanced crystalloids.
- Pending further data, low to moderate certainty data supports using balanced crystalloid over saline for fluid resuscitation in patients with DKA

Information Source:

You can access the full article at <https://www.ncbi.nlm.nih.gov/labs/pmc/articles/PMC8740878/>

References:

1. Goad NT, Bakhru RN, Pirkle JL, et al.: Association of hyperchloremia with unfavorable clinical outcomes in adults with diabetic ketoacidosis. *J Intensive Care Med* 2019; 35:1307–1313
2. Oliver WD, Willis GC, Hines MC, et al.: Comparison of plasma-lyte A and sodium chloride 0.9% for fluid resuscitation of patients with diabetic ketoacidosis. *Hosp Pharm* 2018; 53:326–330

Disclaimer

The information presented in this article is for informational and educational purposes only and does not substitute professional medical advice and consultation with healthcare professionals.

Copyright Reserved @2021 independent Publication from Biourbexer Solutions. Please contact us at Contact@biourbexer.com for any queries.

Opinion



Dr. R. Gopinath, MD DA(UK), FFARCS (I),

Retired HOD, Anesthesia & Critical Care, NIMS, Hyderabad, India. Currently HOD Anesthesia & Critical Care, ESIC, Medical College & Hospital, Sanathnagar, Hyderabad.

Past President and Research Cell, IACTA.

Areas of interest- Cardiac Anesthesia, Pain Relief, and Critical Care

- The use of balanced salt solutions in the management of the critically ill has focused on the ill effects of Normal Saline in various clinical situations. The recent meta-analysis on its use in patients with ketoacidotic state with Diabetes Mellitus focuses on the advantages of its use in early resuscitation vis-a-vis parameters like time to resolution, hospital Length of Stay, post resuscitation Chloride levels and HCO₃ levels. All these are favourable for an acute metabolically deranged state such as ketoacidosis.
- Another recent meta-analysis on the use of balanced salt solutions in the intensive care published in the latest issue of NEJM provides us further evidence. The authors conclude that the estimated effect of using balanced crystalloids versus saline in critically ill adults ranges from a 9% relative reduction to a 1% relative increase in the risk of death, with a high probability that the average effect of using balanced crystalloids is to reduce mortality.¹
- Resuscitation with balanced crystalloids demonstrated lower hospital or 28-/30-day mortality compared with saline in critically ill adults but not specifically those with sepsis. The authors conclude that Balanced crystalloids should be provided preferentially to saline in most critically ill adult patients.
- Large volume infusions of crystalloids (nearly 3000 to 7000 milliliters are typically needed) for volume repletion in DKA, especially those with acetate as a buffer help to improve/ stabilize the HCO₃ buffer levels. Acetate is rapidly metabolized, generating equimolar amounts of bicarbonate. The major metabolic effects of acetate administration are related to the development of alkalosis. Acetate metabolism in normal human subjects appears to be first order kinetics.²
- In addition to acting to redistribute carbon systemically like a ketone body, it acts as a cellular regulatory molecule with diverse functions beyond the formation of acetyl-CoA for energy derivation and lipogenesis and in part, as a metabolic sensor linking nutrient balance and cellular stress responses with gene transcription and the regulation of protein function.³
- Hence it is reasonable to conclude that acute physiological and metabolic derangements requiring fluid resuscitation are best managed with balanced salt solutions.

Reference:

1. Hammond DA, Lam SW, Rech MA, Smith MN, Westrick J, Trivedi AP, Balk RA. Balanced Crystalloids versus Saline in Critically Ill Adults: A Systematic Review and Meta-analysis. *Ann Pharmacother.* 2020 Jan;54(1):5-13. DOI: 10.1177/1060028019866420. Epub 2019 Jul 31. PMID: 31364382.
2. Richards, R. H., Vreman, H. J., Zager, P., Feldman, C., Blaschke, T., & Weiner, M. W. (1982). Acetate Metabolism in Normal Human Subjects. *American Journal of Kidney Diseases*, 2(1), 47–57. doi:10.1016/s0272-6386(82)80043-7 10.1016/S0272-6386(82)80043-7
3. Moffett JR, Puthillathu N, Vengilote R, Jaworski DM, Namboodiri AM. Acetate Revisited: A Key Biomolecule at the Nexus of Metabolism, Epigenetics and Oncogenesis-Part 1: Acetyl-CoA, Acetogenesis, and Acyl-CoA Short-Chain Synthetases. *Front Physiol.* 2020 Nov 12;11:580167. DOI: 10.3389/fphys.2020.580167. PMID: 33281616; PMCID: PMC7689297.

Disclaimer

The information presented in this article is for informational and educational purposes only and does not substitute professional medical advice and consultation with healthcare professionals.