Osmotic stress is a physical risk factor for adverse events related to peripheral parenteral nutrition (PN) administration, such as infiltration. We sought to improve prediction of compounded PN osmolality utilizing basic nutrient solutions available to North American neonatal intensive care units" Borenstein et al (2018).

Abstract:

BACKGROUND: Osmotic stress is a physical risk factor for adverse events related to peripheral parenteral nutrition (PN) administration, such as infiltration. We sought to improve prediction of compounded PN osmolality utilizing basic nutrient solutions available to North American neonatal intensive care units. This study tested the hypothesis that calculated osmolarity underestimates osmolality in compounded PN.

METHODS: Osmolarity (mOsm/L) was calculated utilizing commercial software. Osmolality (mOsm/kg) was determined by a freezing-point depression micro-osmometer. The relationship between calculated osmolarity and measured osmolality was modeled from linear or polynomial regression analysis using the least squares method. Regression models were based upon calculated osmolarity and included various combinations of PN components.

RESULTS: Calculated osmolarity significantly underestimated measured osmolality in all PN

samples (n = 363). Based upon the osmolality of PN and the basic nutrient solutions, we determined a polynomial regression that effectively corrects for the osmolal gap (measured osmolality-calculated osmolarity) in the validation set (R2 = 0.99367). The unbiased analysis corrected for the osmolal gap based on individual solute behaviors, as well as the solute-solute interactions in compounded solutions.

CONCLUSIONS: Calculated osmolarity (mOsm/L) significantly underestimates the osmolality (mOsm/kg) in compounded PN. We developed a new algorithm to more accurately predict PN osmolality based upon calculated osmolarity from commercial software and composition of neonatal basic nutrient solutions used in North America. We propose that use of this PN algorithm will facilitate future studies to determine whether a causal association exists between PN osmolality and adverse events, and to establish safe thresholds for PN concentration in neonates.

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Reference:
Borenstein, S., Mack, E., Palmer, K., Cat, T., Gibson, L.C., Sandhu, M., Wang, J. and Simmons, C.F. (2018) A New Model for Non-Lipid Compounded Neonatal Parenteral Nutrition Solution Osmolality. JPEN. 42(6), p.1075-1083.

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