Effect of Two Clinical Guidelines on Calcium and Phosphate Dosing on the Risk of Hypophosphatemia in Newborn VLBW Infants Receiving Parenteral Nutrition

Brandon Trandai, Walid Hussain, Timothy Sentongo, Nasiha Rahim, Macy Mears, Caitlin Jordan, Mary Yanez

THE UNIVERSITY OF CHICAGO UChicago Medicine | Center for Healthcare Delivery Science and Innovation

AT THE FOREFRONT OF KIDS MEDICINE UChicago Medicine Comer Children's

Problem

- Newborn preterm infants on parenteral nutrition (PN) are at risk for developing hypophosphatemia from inadequate intake and/or refeeding syndrome
- Hypophosphatemia is associated with prolonged mechanical ventilation, impaired bone growth and mineralization, and increased mortality in preterm infants
- A high prevalence of hypophosphatemia was seen in our preterm infants on PN while using the calcium (Ca) and phosphorous (PO4) dosing ratios recommended by the American Society for Parental and Enteral Nutrition (ASPEN) 2014 clinical guidelines
    - The ASPEN 2014 clinical guidelines recommend a Ca:PO4 ratio of 1.3:1 (mmol:mmol)
- However, the European Society of Pediatric Gastroenterology (ESPGHAN) published an alternative dosing of Ca:PO4 ratio of 0.8:1 to 1:1 (mmol:mmol) in 2018
    - Given these newer ratio guidelines, there were questions as to whether implementing this Ca:PO4 ratio would help decrease the rate of hypophosphatemia in our patient population

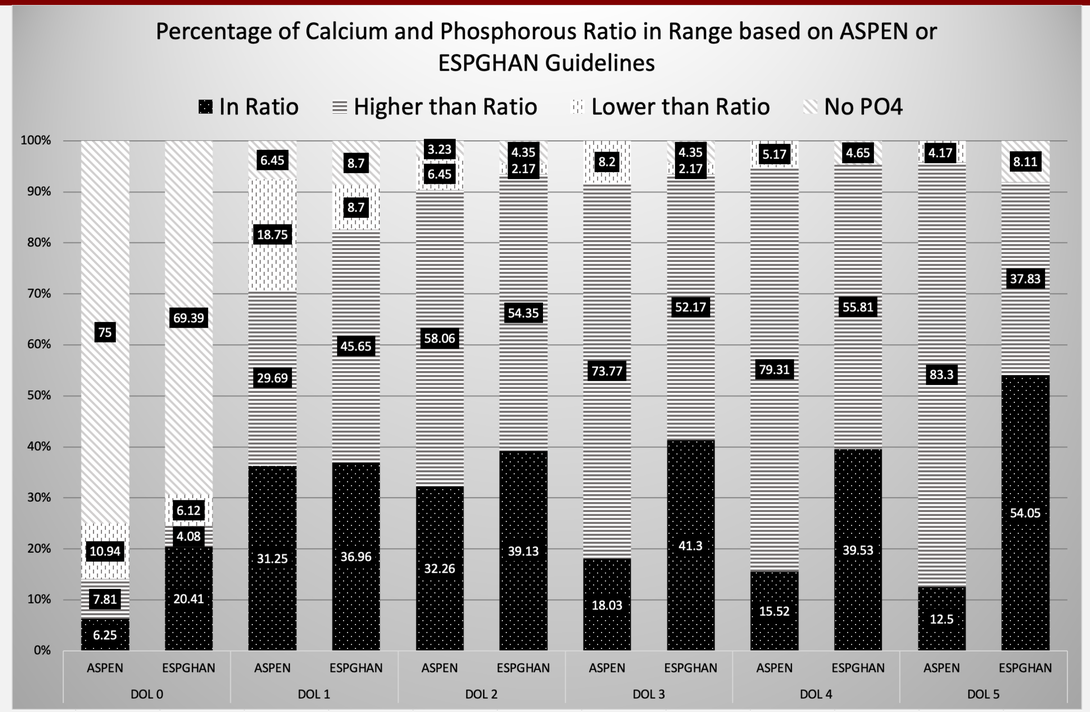
Goal

- The purpose of this quality improvement (QI) project was to compare the effects of dosing Ca:PO4 according to ASPEN guidelines versus ESPGHAN guidelines on rates of hypophosphatemia during PN therapy for very low birth weight infants (<1500g)
- STEEP Principle: Improved safety in this population of very low birth weight infants (VLBW) by reducing the rate of hypophosphatemia and its associated complications
- SMART Goal: If following the ESPGHAN guidelines for Ca:PO4 ratio shows a significant decrease in hypophosphatemia in our VLBW infants during the first 5 days of life, then this ratio will become the new standard ratio in the NICU

Intervention Design

- All VLBW infants had serum electrolytes measured at baseline and regularly monitored as PN components were adjusted during the first five days of life
- The goal range for normal serum PO4 in VLBW infants was 5.0 to 7.3 mg/dL
- Eligibility included birthweight 1500 g, central venous access availability, and PN initiation at birth
- Dosing following ASPEN guidelines was from 7/2023 to 1/2024
- Dosing following ESPGHAN guidelines was from 7/2024 to 1/2025
- The outcomes primarily looked at the frequency of normal serum PO4 vs. hypophosphatemia or hyperphosphatemia necessitating deviation from the guideline-based in-ratio dosing of Ca:PO4
- Key players during this study included the nutritionist team writing the daily PN
- This QI was done in the Neonatal ICU at Hyde Park at Comer Children's Hospital

Results



- The rates of hypophosphatemia were similar at baseline (day '0') and on days '1' and '2' of PN therapy
- From days '3' to '5', there were lower rates of hypophosphatemia in the ESPGHAN group compared to ASPEN group: 52%, 56% and 38% vs. 74%, 79% and 83% respectively
- The likelihood of maintaining normal serum PO4 using in-ratio dosing of Ca:PO4 from days 3 to 5 in the ESPGHAN group compared to the ASPEN group: 41.3% vs 18%, p = 0.01 (day 3), 39% vs 15%, p = 0.007 (day 4), and 54% vs 12%, p = 000 (day 5)

Lessons Learned and Next Steps

- ESPGHAN dosing of Ca:PO4 compared to ASPEN dosing resulted in less infants who were hypophosphatemic with clinical significance occurred on DOL 3 and onwards
- Urgent need to update guidelines for PN for VLBW neonates to optimize dosing of Ca to PO4
- Continue with ESPGHAN2018-CG guidelines in the NICU to ensure the safety and health of this vulnerable population from hypophosphatemia.
- Future aim is to find the optimal Ca:PO4 ratio for VLBW during the first few days of life