Phosphorus Depletion in Very Low Birthweight Infants on Long-Term Total Parenteral Nutrition

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Thirty infants with birthweights below 1,500 g who required total parenteral nutrition (TPN) from birth were given one of two regimens differing only in their phosphate content. Fifteen of the infants with low phosphorus intake (LPI group), received phosphorus (P) in a daily dose of 9.3 mg/kg. The remaining 15 infants with high phosphorus intake (HPI group) were given P in a daily dose of 49.3 mg/kg. Both groups received 57 mg/kg/day calcium (Ca) and 100 IU/day vitamin D.

TPN was given exclusively for 4 to 6 weeks, since enteral feeding had become impossible owing to severe gastrointestinal or other surgical problems. Serum and urinary P and Ca, urinary creatinine (UCr), and plasma alkaline phosphatase (AP) were estimated at 2, 4, and 6 weeks of life.

Mean serum Ca values for both groups remained within the normal range during the study period. Serum P levels were normal in the HPI group during the study period (mean value ± SD = 5.6 ± 13 mg/dl). In the LPI group, serum P levels were abnormally low (2.9 ± 0.64 mg/dl) and significantly lower when compared with those of the HPI group (p < 0.01). Urinary P excretion (UP) was significantly higher in infants of the HPI group (UP/UCr = 0.47 ± 0.14 mg/mg) than in those of the LPI group (UP/UCr = 0.12 ± 0.09 mg/mg) (p < 0.001). Throughout the study period the AP values were higher and increased more rapidly with postnatal age in the infants of the LPI group (p < 0.01). There was no correlation in the changes of AP values with serum P and Ca levels.

On completion of the 6-week study-period, all infants in the LPI group (100%) were diagnosed as having biochemical metabolic bone disease (increased plasma AP activity of bone origin isoenzyme), whereas only 44% of infants in the HPI group had evidence of biochemical rickets. In the HPI
group, the only abnormality detected by radiography consisted of osteopenia, which was apparent in 11.1% of infants. In the LPI group, radiographic findings consisted of osteopenia and metaphyseal changes found in 88.8% of infants.

Our findings suggest that VLBW infants require high doses of P when on TPN. The optimal P and Ca administration requires further investigation.