

ORIGINAL ARTICLE

Serum Phosphate Level in Patients with Severe Acute Malnutrition at Nutrition Stabilization Centre, Children Hospital, and Institute of Child Health Multan

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ABSTRACT

Objective: To evaluate the serum phosphate level of children with severe acute malnutrition and effect of therapeutic feeds (F75 and F100) on serum phosphate levels.

Study Design: Prospective Observational Study.

Place and Duration of Study : The study was conducted at Stabilization center of Children's Hospital and Institute of Child Health Multan from 1st March 2018 to 30th March 2019.

Materials and Methods: The total 270 children with severe acute malnutrition, who were under 5 years of age and admitted to the stabilization center for complicated SAM during study duration were included in the study. Initial management of the patients were started by following WHO protocols for Severe Acute Malnutrition management and the baseline labs along with serum phosphate levels were sent for evaluation. Patients were admitted at Stabilization Centre for the management plan as per guidelines. Once the patients were stabilized in one week approximately the transition towards rehabilitation phase of severe acute management started. Serum phosphate levels were assessed at admission, at stabilization (day 7 of admission) and at the time of discharge. Data was analyzed using SPSS version 21.

Results: The mean age of our patients was 22 ± 2 months. The male to female ratio were 1:2. Hypophosphatemia was documented in 180 (66%) patients with mean 0.96 ± 0.40 mmol/ltr $< (1.45 - 1.78$ mmol/ltr) serum phosphate levels at the time of admission. During transition phase the phosphate levels were 1.1 ± 0.45 mmol/l and after rehabilitation phase 1.45 ± 0.45 mmol/l on average of 15 days of management. After using F75 and F100 therapeutic feeds in stabilization, transition, and rehabilitation phase 178 (98.9%) children were treated and had normal serum phosphate level at the time of discharge.

Conclusion: Hypophosphatemia is commonly present in SAM children. Introduction of therapeutic feeds F75 and F-100 during stabilization phase and rehabilitation phase significantly improves phosphate levels in SAM children with low phosphate levels.

Key Words: Hypophosphatemia, Nutrition Rehabilitation, Phosphorous, Severe Acute Malnutrition, Serum phosphate levels, Therapeutic Feeds.

Introduction

Early childhood less than five years of age is an important period for child survival, growth, and development. Adequate nutritional intake currently is necessary for normal growth and development of

children. According to National Nutrition Survey of Pakistan (NNS) 2018, percentage of underweight children was 28.9% (almost one in three children), stunting was seen in 40.2% (almost 4 in 10 children) and wasting in 17.7%.^{1,2} Therapeutic feeds as per WHO guidelines for management of SAM are F75; which provides 75 kcal/100ml and F-100 which provides; 100 kcal/100 ml. F-75 is starter feed and F-100 is the growth catch-up formula.³ Malnourished children during initial stabilization phase are particularly at risk of developing re-feeding syndrome and electrolyte imbalances as hypokalemia, hypomagnesemia, hypophosphate that increases the risk of mortality.⁴ During refeeding the body converts from catabolism to anabolism and a shift occurs from fat to carbohydrate metabolism which elicits insulin release and increased cellular

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uptake of electrolytes, including phosphate (i.e., natural occurring form of mineral phosphorous). If the diet contains insufficient amounts of phosphorous this may exacerbate phosphorous depletion. Serum electrolytes are not routinely monitored; therefore, adequate phosphorous content in the diet is essential to prevent depletion. To prevent refeeding syndrome, the WHO's guidelines on in patient management of SAM includes a stabilization phase with a low energy formula i.e., F-75 as well as gradual transition from stabilization phase (F-75) to rehabilitation phase (F-100). F75 & F100 Therapeutic Feed by WHO Provided about 35mg/kg/dl of phosphorus on 130ml/kg/day feed from F75 to 156mg/kg/day of phosphorus during rehabilitation phase from 200ml/kg/day Of F100.⁵ In previous studies frequency of phosphate levels in children with SAM varies from 72.9% - 93% with limited local data.^{6,7} Studies on hypophosphatemia in SAM children are usually focused on stabilization phase and at first day of admission. Hence it was planned to document phosphorous levels in SAM children and to evaluate improvement in phosphate levels after using therapeutic feeds i.e., F75 and F-100. Hence this study was aimed to evaluate the base line serum phosphate levels in children with SAM and monitoring levels during transition and after rehabilitation phase for improvement after using WHO therapeutic feeding formulas.

Materials and Methods

A prospective observational study was conducted at Stabilization center of Children's Hospital and Institute of Child Health Multan Pakistan from 1st March 2018 to 30th March 2019.

Simple random sampling technique was used and 270 the children whose parents/guardians gave consent and were less than five years and admitted to the Stabilization center with a diagnosis of uncomplicated SAM i.e., weight/height or length < -3SD or Mid Upper Arm Circumference (MUAC) < 11.5cm were included in the study⁸. After taking ethical board IRB letter (CHM-19-13, 03.01.2019) & informed written consent 290 patients fulfilling the inclusion criteria were enrolled during the study duration with SAM admitted to Stabilization Centre. After explaining the risks and benefits of this research, written informed consent was taken from

the children's parents/guardians. The children whose guardian refused consent or had chronic illness or secondary malnutrition were excluded from the study.

A questionnaire was designed by the lead researcher and filled by the nursing staff of stabilization center. All children were managed according to WHO guidelines.⁸ During initial stabilization phase F75 i.e 75 kcal/100 ml, 0.9 gm protein /100 ml was used to stabilize the patients orally or through Nasogastric tubes 130 ml/kg/ day depending on the condition of patient. A child feeding 130 ml/kg/day F75 during stabilization phase gets 31mg/kg/day phosphorous. Stabilization phase lasts for upto 7 days usually. During rehabilitation phase a child gets 210ml/kg/day feed of F-100 which contains 152mg phosphorous/kg/day.

After initial registration and admission baseline labs were sent to the clinical laboratory of CH & ICH. Patients were daily monitored for vital signs, weight, height, and edema. Serum phosphate levels were measured at the time of admission, during the transition phase from stabilization to rehabilitation approx. at 7th day of admission according to WHO protocols of SAM management and during rehabilitation prior to discharge. Data was analyzed using SPSS version 21, mean and averages of frequency was calculated and significant value <5 was considered significant.

Operational Definition:

Serum phosphate level (1.45 – 1.78mmol/dl) were normal and < 1.45 mmol/dl were hypophosphatemia⁹.

Results

The total 270 children with Severe Acute Malnutrition up to 5 years of age were included in the study. The mean age of the children included in the research was 22 ± 2 months. The male to female ratio was 1:2 (Table I). Hypophosphatemia was documented in 180 (66%) patients with mean serum phosphate levels at the time of admission was 0.96 ± 0.40 < (1.45-1.78mmol/Ltr) (Table II). After using F75 and F100 therapeutic feeds during transition phase of the management of SAM patients the mean serum phosphate levels were improved to 1.1 ± 0.45 and after rehabilitation phase on an average of 15 days of management serum phosphate levels raised to 1.45 ± 0.45 mmol/lit. Out of 270 children suffering from

SAM, who were treated with F75 and F100 therapeutic feeds in transition and rehabilitation phase 178 (98.9%) children improved with a normal serum phosphate levels. only two patients still had hypophosphatemia and were further investigated and diagnosed to be suffering from Fanconi syndrome (Table II).

Table I: Baseline Characteristics, Anthropometry, and Complications of SAM Children (n=270)

Characteristics	(n= 270) mean \pm SD
Age (mo.)	22.2 \pm 2
Males (%)	175 (65.22)
Females	95 (35.78)
Weight (kg)	7.5 \pm 1.46
Height / Length (cm)	78.52 \pm 10.21
Edema (%)	38 (20)
Mid Upper Arm Circumference (MAUC)	10.49 \pm 0.92
Length/Height for age (Z score)	1.94 \pm 1.35
Weight for length/ height (Z score)	3.06 \pm 1.01

Table II: Serum Phosphate Levels of SAM Children (n=270)

Blood profile	Stabilizati on Phase (Day 1)	Transition Phase (Day 7)	Rehabilitati on Phase (Day 15)
Hypophosphatemia	188 (66%)	96 (35.5%)	2 (0.7%)
Serum Phosphate levels (1.45-1.78m mol/L)	0.98 \pm 0.40	1.1 \pm 0.45	1.45 \pm 0.45

Discussion

This study shows that hypophosphatemia is very common in children with SAM as supported by similar result in other study.^{6,10-12} Use of therapeutic feeds (F75 and F100) as per WHO guidelines significantly improves serum phosphate levels; mean 0.96 \pm 0.4 to 1.45 \pm 0.45 mmol/ltr after an average of 15 day stay.

In our study frequency of hypophosphatemia among SAM children was 66% during stabilization phase, 35.5 % during transition phase and only 0.7 % during rehabilitation phase. This prevalence is significantly lower than reported by the previous studies.^{6,10} Data suggest that prevalence of hypophosphate in critically ill children at ICU was 71.6% which prolonged the hospital stay but was not directly linked to increased mortality.¹³ However, in the present study we did not include the critically ill children in need of emergency care or on ventilators.

Study by Menezes et.al., also reported significant association between malnutrition and hypophosphatemia.¹⁰ At the time of discharge phosphate levels in our study was 0.7% while in another study it was found to be 17% or more.⁵ Higher prevalence in the study by Kimutai et al could be explained by difference in study population as they enrolled only children with edematous malnutrition. Prevalence of edema was 20% in our study which was higher than the study done by Kimutai et al which reported 12.3%.¹⁴

Early detection and monitoring of serum phosphate levels are mandatory in SAM children to prevent re-feeding syndrome.¹⁵⁻¹⁷ Out of total about 66% children had hypophosphatemia in the present study. It also shows that malnourished children (SAM) must be treated as per WHO guidelines and phosphorous supplementation in stabilization and rehabilitation phase is mandatory using therapeutic feed for better treatment outcome and to reduce Re-feeding syndrome.^{18,19} The therapeutic feeds prepared by WHO recipes for Sam children proves to be effective for correcting the phosphate levels of SAM children. Similar results were documented by Menezes et al.^{10,16,20}

The study was conducted in a public sector territory care hospital, the findings represent a wide range of population and can therefore be generalized for all SAM children with medical complications during stabilization, transition, and rehabilitation phases. There are a few limitations of the study. Post-discharge phosphate levels were not assessed in these children. A multicenter study with large sample size needs to be conducted in future to evaluate the association of hypophosphatemia among SAM children with other factors.

Conclusion

Hypophosphatemia is commonly present in SAM children. Introduction of therapeutic feeds F75 and F-100 during stabilization phase and rehabilitation phase significantly improved phosphate levels in SAM children with poor phosphate levels.

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CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

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DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.

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