Biochemical profile of children with severe acute malnutrition

Ashok E, Dr. S Ramesh and Dr. R Surya Prakash

DOI: https://doi.org/10.33545/26643685.2020.v3.i2c.110

Abstract
Background: Malnutrition in children is widely prevalent in developing countries including India. More than 33% of the deaths in 0-5 years are associated with malnutrition. Children with severe acute malnutrition (SAM) are in danger of death from hypoglycemia, hypothermia, fluid overload, electrolyte imbalances. Hence, biochemical profile in these children is important for management.

Objectives: The aim of this study is to describe the biochemical profile of children with severe acute malnutrition.

Methods: This hospital based observational study was conducted on children with Severe Acute Malnutrition. Children were tested for biochemical parameters like complete blood counts with peripheral smear, C-Reactive protein, Blood glucose, renal function tests, serum electrolytes, calcium.

Results: Among the study participants, 35 (46.7%) were anemic. CRP was Positive in 37, (49.3%) of the study population, Peripheral Smear showing Microcytic picture was present in 33, (44.0%) of the study population. Hypocalcaemia was present in 15, (20.0%), Hypokalemia in 21, (28.0%) and Hyponatremia in 3, (4.0%). Elevated Urea was present in 34, (44.0%) and Elevated Creatinine in 30, (40.0%). Random Blood Sugar showed Hypoglycemia among 19, (25.3%).

Conclusion: The observations in this study confirm a significant association between severe acute malnutrition and abnormalities in biochemical parameters. Many of these children had abnormal biochemical parameters like anemia, hypocalcemia, hypokalemia, hyponatremia, hypoglycaemia.

Keywords: Severe acute malnutrition, hypoglycemia, hypocalcemia, hyponatremia, hypokalemia

Introduction
Malnutrition is a general term and it most often refers to undernutrition resulting from inadequate consumption, poor absorption or excessive loss of nutrients. Malnutrition in children is widely prevalent in developing countries including India. More than 33% of deaths in 0-5 years are associated with malnutrition. Severe acute malnutrition (SAM) is defined by very low weight for height/length (z score below −3SD of the median WHO child growth standards), or a mid-upper arm circumference <115 mm, or by the presence of nutritional edema.

Lack of exclusive breastfeeding, late introduction of complementary feeds, feeding diluted feeds containing less amount of nutrients, repeated enteric and repeated respiratory tract infections, ignorance, and poverty are some of the factors responsible for SAM. Children with SAM are in danger of death from hypoglycemia, hypothermia, fluid overload, electrolyte mismanagement, and undetected infections. They cannot be treated like other children. Their feeds, fluids, and micronutrients must be carefully controlled to avoid complications during management. Hence, biochemical parameters in these children are important for management. They guide us to prevent mishappenings in the management of SAM children. Our study tried to find out variations in the biochemical parameters in these children.

Methodology
This hospital based observational study was conducted after obtaining approval from the Institutional Ethics Committee. Study was conducted on children aged 6 to 60 months fulfilling the WHO criteria for Severe Acute Malnutrition, admitted in the Department of Paediatrics, Rajah Muthiah Medical College Hospital during 2019-2020. Children were tested for biochemical parameters like complete blood picture with peripheral smear, Blood glucose, renal function tests, serum electrolytes, calcium and C-reactive protein.
Results
Among the study participants, 35 children (46.7%) were anemic. C-Reactive Protein was Positive in 37, (49.3%) of the study population, Peripheral Smear showing Microcytic anaemia was present in 33, (44.0%) of the study population, Hypocalcemia was present in 15, (20.0%), Hypokalemia in 20% cases, and hyponatremia in 4% cases. In our study, 44% cases showed elevated blood urea levels and 40% cases showed deranged creatinine levels, this is comparable to the study by Ali et al., in which 31.5% cases showed Ureaemia and 37% cases showed deranged creatinine levels.

Table 1.

| Haemoglobin          | Frequency | Percentage |
|----------------------|-----------|------------|
| Anemia               | 35        | 46.7       |
| Normal               | 40        | 53.3       |
| C-Reactive Protein   |           |            |
| Positive             | 37        | 49.3       |
| Negative             | 38        | 50.7       |
| Peripheral Smear     |           |            |
| Microcytic           | 33        | 44.0       |
| Normocytic           | 42        | 56.0       |
| S.Calcium            |           |            |
| Hypocalcemia         | 15        | 20.0       |
| Normal               | 60        | 80.0       |
| Electrolyte Abnormalities |    |          |
| Hypokalemia          | 21        | 28.0       |
| Hyponatremia         | 3         | 4.0        |
| Normal               | 51        | 68.0       |
| Elevated             | 34        | 44.0       |
| Urea                 |           |            |
| Normal               | 41        | 56.0       |
| Elevated             | 30        | 40.0       |
| Creatinine           |           |            |
| Normal               | 45        | 60.0       |
| Elevated             | 30        | 40.0       |
| Random Blood Glucose |           |            |
| Hypoglycemia         | 19        | 25.3       |
| Normal               | 56        | 74.7       |

Discussion
Nutrition is essential for human development and the focal point of health and well-being. Nutrition during the first five years has an impact not only on growth and morbidity during childhood, but also acts as a determinant of nutritional status in adolescent and adult life.

SAM is a preventable and treatable cause of childhood undernutrition and underweight, but also acts as a determinant of nutritional status in adolescent and adult life.

In our study, the mean age of admitted patients was 2.23 ± 1.426 years. Majority of children (49(65.4%)) were within 24 months of age. Similarly, in the studies by Choudhary [5] & Mamidi [6] majority of patients (96% and 71% respectively) were below 24 months. In the first 2 years of life, rapid growth occurs and requirement of substrates for energy and building of tissues also increases, thus deficiency of energy, proteins and micronutrients often result in malnutrition.

In our study, 25.3% cases had hypoglycemia, and 28% cases had hypokalemia while hypocalcemia was seen in 20% cases, and hyponatremia in 4% cases. Tariq et al., in a similar study found hypoglycemia in 6.8%, hypokalemia in 9.5%, hypocalcemia in 10.12%, which was comparable to the findings of our study [7]. We had more cases of hypoglycemia as cases received to our hospital were very sick and referred late, and more cases of hypokalemia due to early weaning and faulty feeding. RBG less than 54 mg/dl was taken as hypoglycemia as per WHO SAM protocol. Serum sodium less than 135mEq/l was taken as hyponatraemia. Serum potassium less than 3.5 mEq/l was taken as hypokalaemia.

In this study, 44% of the children had microcytic hypochromic blood picture and 56% normocytic blood picture. Thakur et al., in their study, found 27.7% cases with normocytic blood picture and 38.6% with microcytic hypochromic blood picture which is comparable to our study [8]. We had more cases of microcytic hypochromic anaemia which may be due to the fact that patients admitted to our hospital were from very low social economic classes and illiterate and they lack knowledge about feeding practices. A Hb level of less than 11 g/dl was the cut off value for anaemia in children aged 6–60 months.

In our study, 44% cases showed elevated blood urea levels and 40% cases showed deranged creatinine levels, this is comparable to the study by Ali et al., in which 31.5% cases showed Uremia and 37% cases showed deranged creatinine levels [9, 10].

Conclusion
The observations in this study confirm a significant association between severe acute malnutrition and abnormalities in biochemical parameters. Many of these children had anaemia, hypocalcaemia, hypokalemia, hyponatraemia, hypoglycaemia. So monitoring biochemical parameters is important in SAM children for proper correction of micronutrients and management.

Limitations
The study was done in a single hospital with a small sample size. The study did not include micronutrient deficiencies. The study was conducted as a Hospital based study in a tertiary care setting affiliated with the teaching hospital. The results are expected to be better in our study results compared to the real settings.

Funding: No funding sources

Conflict of interest: None

Ethical approval: The study was approved by the Institutional Ethics Committee

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