

**Assessing Co-Morbidities in Severe Acute Malnutrition with Unexpected Dyselectrolytemia in Diarrhea: An Observational Study**Ajit Kumar Singh<sup>1</sup>, Sachin Kumar<sup>2</sup>, Nagendra Prasad Gupta<sup>3</sup><sup>1</sup>Senior Resident, Department of Paediatrics, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India<sup>2</sup>Senior Resident, Department of Paediatrics, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India<sup>3</sup>Professor, Department of Paediatrics, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India

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Corresponding Author: Dr. Sachin Kumar

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**Abstract****Aim:** The aim of the study was to evaluate the spectrum of co-morbidities in severe acute malnutrition with unexpected dyselectrolytemia in diarrhea.**Methods:** The observational study was carried in the Department of Pediatrics, for 15 months. Total 100 Children upto 5 years aged admitted in Nutritional Rehabilitation Centre of Department of Paediatrics were included in this study. Various co morbid conditions in study population were identified. All the laboratory examination was done with standard method.**Results:** Majority of children with SAM were having co-morbidity in the form of Anaemia (91%), Diarrhoea (62%) followed by pneumonia (32%), Rickets (33%), Tuberculosis (15%), Otitis media (11%), UTI (11%), Celiac (4%), Hypothyroidism (3%), & HIV (1%). 60 (60%) SAM children presented with diarrhea out of which Hyponatremia was in 54 cases (54%) & Hypernatremia in 2 cases (2%). No statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM. It was found that 25% SAM children were having hypokalemia. Hypokalemia was found in 45 diarrheal cases & 30 non-diarrheal cases. A statistically significant difference was found with hypokalemia in SAM between Diarrheal & Non diarrheal cases.**Conclusion:** Burden of co-morbid conditions is very high in SAM children. In order to break disease – under nutrition cycle, not only nutritional management but early detection of co-morbid conditions is a must. Co-morbidities identification and treatment in SAM children is key step in reducing morbidity and mortality associated with SAM.**Keywords:** Co-morbidities, Dyselectrolytemia, Potassium, Severe Acute Malnutrition, Sodium.

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**Introduction**

As per National Family Health Survey (NFHS)-4, the prevalence of severe acute malnutrition (SAM) has increased from 6.45 to 7.5% in children under 5 years of age in India. [1] Malnutrition is believed to contribute 61% of diarrheal deaths and 53% of pneumonia deaths in India. [2] Electrolyte imbalance is one of the prognostic factors in severe malnutrition. [3] In malnourished children, excess body sodium and chloride exists (although plasma sodium and chloride may be low) and deficiency of potassium and magnesium exists which require supplementation over weeks. [3,4] Children with SAM are categorized into “complicated and uncomplicated cases” based on clinical criteria. SAM children with complications require inpatient

management and those without complications can be treated on a community basis.

World Health Organization (WHO) states this as a strong recommendation with low-quality evidence. [5] As per the WHO, serum electrolytes are measured and supplemented (potassium and magnesium) only in SAM children with complications. SAM children without complications are managed in community with Ready to Use Therapeutic Food (RUTF) which is enriched with minerals and micronutrients. [6] Malnutrition refers to deficiencies, excesses, or imbalances in a person’s intake of energy and/or nutrients. Thus, malnutrition connotes both under-nutrition and over-nutrition. [7] Malnutrition is a condition caused by defective nutrition in which

either deficiency or excess of energy, protein, or micronutrients cause any measurable adverse effects on tissues/body form (body shape, size, composition), function, and clinical outcome. [8] Protein-energy malnutrition (PEM) is a form of malnutrition that is defined as a range of pathological conditions arising from a coincident lack of dietary protein and/or energy (calories) in varying proportions, which may present as kwashiorkor or marasmus.

Severe acute malnutrition is both a medical and social disorder, and the medical problems of the child result in part from the social problems at home. Malnutrition is the result of chronic nutritional and emotional deprivation when, due to ignorance, poverty, or family problems, caregivers are unable to provide a child with adequate nutrition and care. Nearly two-thirds of undernourished children worldwide live in two regions: Sub-Saharan Africa and Southern Asia. [9] Therefore, with proper management of children with SAM, Millennium Development Goals 1 (to eradicate extreme poverty and hunger) and 4 (to reduce child mortality) can be effectively achieved. [10] In a developing country like India, proper management of children with SAM can have a significant impact on child mortality. Malnutrition in children is widely prevalent in India and is an important predictor of child mortality. In India, the infant mortality rate has been reduced from 57/1000 live births to 41/1000 live births, and the under-five mortality rate from 75/1000 live births

to 50/1000 live births as per National Family Health Survey-4 (NFHS-4, 2015-2016). Among nutritional parameters studies, under-weight and stunting have been reduced from 42.5% to 35.8% and 48% to 38.4%, respectively; however, wasting and severe wasting increased from 19.8% to 21% and 6.4% to 7.5%, respectively. [11]

The aim of the study was to evaluate the spectrum of co-morbidities in severe acute malnutrition with unexpected dyselectrolytemia in diarrhea.

### Materials and Methods

The observational study was carried in the Department of Pediatrics, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India for 15 months. Total 100 Children upto 5 years aged admitted in Nutritional Rehabilitation Centre of Department of Paediatrics were included in this study. Various co morbid conditions in study population were identified. All the laboratory examination was done with standard method.

### Data Analysis

Statistical analysis was done, using the statistical package for social science (SPSS 25.0) for Windows Software. Continuous variables were expressed as means, standard deviation (SD), confidence intervals (95%CI), frequency and range. Chi-square was applied and P value of < 0.05 was considered significant.

### Results

**Table 1: Comorbid conditions in SAM**

Co-morbidity	No. of cases	% Percentage cases
Diarrhea	62	62
Tuberculosis	15	15
Pneumonia	32	32
Otitis media	11	11
UTI	11	11
Rickets	33	33
Anaemia	91	91
Celiac disease	4	4
Hypothyroidism	3	3
HIV	1	1

It was found that Majority of children with SAM were having co-morbidity in the form of Anaemia (91%), Diarrhoea (62%) followed by pneumonia (32%), Rickets (33%), Tuberculosis (15%), Otitis media (11%), UTI (11%), Celiac (4%), Hypothyroidism (3%), & HIV (1%).

**Table 2: Dysnatremia in SAM children in diarrheal & non diarrheal groups**

Serum Sodium	No diarrhea (%)	Diarrhea (%)	Total (% of the total cases)
Hyponatremia	18	36	54
Normonatremia	21	23	44
Hypernatremia	1	1	2
Total cases	40	60	100

It was found that 60 (60%) SAM children presented with diarrhea out of which of Hyponatremia was in 54 cases (54%) & Hypernatremia in 2 cases (2%). No statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM.

**Table 3: Hypokalemia in SAM children**

Serum Potassium	No diarrhea	Diarrhea	Total
Normokalemia	30	45	75
Hypokalemia	10	15	25
Total	40	60	100

It was found that 25% SAM children were having hypokalemia. Hypokalemia was found in 45 diarrheal cases & 30 non- diarrheal cases. A statistically significant difference was found with hypokalemia in SAM between Diarrheal & Non diarrheal cases.

### Discussion

Malnutrition is a major global problem. [12] which interacts with diarrhea in a vicious cycle leading to high morbidity and mortality in children and it is as well as a complicating factor for other illness in developing countries. Malnourished children have long lasting, severe and recurrent diarrhea. The prevalence of diarrhea is 5-7 times more in malnourished as compared to normal children. [13] In malnutrition various abnormalities occur in body electrolytes which become more pronounced with diarrheal incidence since electrolytes conduct an electrical current, helps to balance pH and facilitate the passage of fluid between and within cells through process of osmosis imparting in regulation of the function of neuromuscular, endocrine and excretory systems. [14,15] Severe Acute malnutrition is a major challenge to achieve the millennium development goals. [16] A recent assessment showed that efforts to prevent child deaths need to be stepped up in order to meet that target. [17] One of the most daunting task in the field of nutrition and child health is how to reduce morbidity and mortality associated with severe acute malnutrition. [18,19]

Majority of children with SAM were having co-morbidity in the form of Anaemia (91%), Diarrhoea (62%) followed by pneumonia (32%), Rickets (33%), Tuberculosis (15%), Otitis media (11%), UTI (11%), Celiac (4%), Hypothyroidism (3%), & HIV (1%). Severe acute malnutrition is predominantly seen in the period of infancy and childhood i.e., from six months up to five years of age. Severe malnutrition is not only an important cause of mortality and morbidity but also leads to permanent impairment of physical and possibly mental growth in those who survive. In a study by Chiabi et al [20] on the clinical spectrum of SAM among children in Cameroon, the median age was nine months and a nearly equal gender-wise distribution was observed with 50.8% male and 49.2% female. Further, a similar sex distribution has been observed in some other studies. [21,22]

60 (60%) SAM children presented with diarrhea out of which of Hyponatremia was in 54 cases (54%) & Hypernatremia in 2 cases (2%). No

statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM. The nearly similar distribution of hyponatremia and hypernatremia was found in the study by Tariq et al. Hyponatremia was seen in 43.4% in the study by Dakshayani et al. [23] In the study by Meshram et al [24], hyponatremic children with SAM presented with dysnatremia in the form of hyponatremia in 56% and hypernatremia in 1.4%. Hyponatremia was seen in 14% and hypernatremia in 19% of the children with SAM in the study by Lakshmi et al. [25] Differences in the incidence of hyponatremia and hypernatremia cannot be clearly explained, although they may have been influenced by the morbidity for which the patient was admitted, including diarrhea, vomiting, etc.

It was found that 25% SAM children were having hypokalemia. Hypokalemia was found in 45 diarrheal cases & 30 non- diarrheal cases. A statistically significant difference was found with hypokalemia in SAM between Diarrheal & Non diarrheal cases. In our study hypokalemia was found associated with diarrhea and hyponatremia was found not associated which is comparable to other studies. [26-28]

### Conclusion

Burden of co-morbid conditions is very high in SAM children. In order to break disease – under nutrition cycle, not only nutritional management but early detection of co- morbid conditions is a must. Co-morbidities identification and treatment in SAM children is key step in reducing morbidity and mortality associated with SAM.

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