STUDY TO EVALUATE THE SPECTRUM OF DIFFERENT CO-MORBIDITIES IN CHILDREN SUFFERING FROM SEVERE ACUTE MALNUTRITION WITH UNEXPECTED DYSELECTROLYTEMIA IN DIARRHEA

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Abstract

Aim: to evaluate the spectrum of co-morbidities in severe acute malnutrition with unexpected dyselectrolytemia in diarrhea.

Material and methods: The study was an observational study which was carried in the Department of pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga Bihar, India for 2 years. after taking the approval of the protocol review committee and institutional ethics committee. Total 200 Children below 5 year age were included in this study. Various co morbid conditions in study population were identified. All the laboratory examination was done with standard method.

Results: Total 200 cases were included in study of which 96% were associated co-morbid conditions in SAM. Majority of children with SAM were having co-morbidity in the form of Anaemia (88%), Diarrhoea (60%) followed by pneumonia (32%), Rickets (31%), Tuberculosis (14%), Otitis media (12%), UTI (11%), Celiac (4%), Hypothyroidism (2%), & HIV (1%). Mean age (SD) of the diarrheal cases was 25(6) months (95% C.I. 24.1- 25.8) of which 70 were male (58.33%). Mean age (SD) of non-diarrheal cases was 19(6). (95% C.I. 16.6 – 19.4) of which 45 were male(75%). 120 (60%) SAM children presented with diarrhea of which 117 had dysnatremia in the form of Hyponatremia in 117 cases (58.5%) & Hypernatremia in 3 cases (1.5%) No statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM (P value of 0.07). It was found that 20% SAM children were having hypokalemia. Hypokalemia was found in 15% of diarrheal cases & 5% in non- diarrheal cases. A statistically significant difference was found with hypokalemia in SAM (P value of 0.019) between Diarrheal & Non diarrheal cases. **Conclusion:** Dyselectrolytemia is high in complicated SAM and mainly sodium disturbances in form of hyponatremia are common in different co-morbid conditions.

Keywords: Co-morbidities, Dyselectrolytemia, Potassium, Severe acute malnutrition, Sodium

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 In our country, as RUTF is not available, children are advised home-based energy dense food along with micronutrient supplements. Hence, their diet may still be deficient in minerals. Diarrhea and pneumonia accounts for approximately half the under-five deaths in India and malnutrition is believed to contribute to 61% of diarrheal deaths and 53% pneumonia deaths. Malnutrition increases the risk and worsens the severity of infections.⁷ SAM children are more prone to severe infections that culminates into different co-morbid conditions and consequentially leads to electrolyte derangement due to reductive adaptation Na⁺, K⁺, ATPase systems of the body begin to ‘shut down’.⁸ Therefore, an even greater electrolyte derangement may occur when these co-morbid conditions are superimposed on SAM. Hence this study aims to find out the incidence of dyselectrolytemia (Na⁺ and K⁺) in malnourished children

with different clinical conditions. This would help to avoid life threatening situation by early recognition and proper therapy for electrolyte changes in SAM children.

Material and methods

The observational study which was carried in the Department of Pediatrics, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga Bihar, India for 2 years, after taking the approval of the protocol review committee and institutional ethics committee.

Methodology

Total 200 Children below 5 year 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 were done with standard method.

Statistical Analysis

The data was analyzed using SPSS 19 (SPSS Inc. Chicago, IL, USA) Windows software program. Descriptive frequencies were expressed using mean and standard deviation.

Results

Total 200 cases were included in study of which 96% were associated co-morbid conditions in SAM. Table 1 showed that majority of children with SAM were having co-morbidity in the form of Anaemia (88%), Diarrhoea (60%) followed by pneumonia (32%), Rickets (31%), Tuberculosis (14%), Otitis media (12%), UTI (11%), Celiac (4%), Hypothyroidism (2%), & HIV (1%).

Table 1: Comorbid conditions in SAM

Co-morbidity	No. of cases	% Percentage cases
Diarrhea	120	60
Tuberculosis	28	14
Pneumonia	64	32
Otitis media	24	12
UTI	22	11
Rickets	62	31
Anaemia *	176	88
Celiac disease	8	4
Hypothyroidism	4	2
HIV	2	1

Mean age (SD) of the diarrheal cases was 25(6) months (95% C.I. 24.1- 25.8) of which 70 were male (58.33%). Mean age (SD) of non-diarrheal cases was 19(6)month (95% C.I. 16.6 – 19.4) of which 45 were male(75%) .

Table 2 shows that 120 (60%) SAM children presented with diarrhea of which 117 had dysnatremia in the form of Hyponatremia in 117 cases (58.5%) & Hypernatremia in 3 cases (1.5%) No statistically significant difference was

found with hyponatremia in diarrheal or non-diarrheal cases of SAM(P value of 0.07)

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

Serum Sodium	No diarrhea (%)	Diarrhea (%)	Total (% of the total cases)
Hyponatremia	42 (35.89%)	75 (64.10)	117 (58.5%)
Normonatremia	34 (44.15%)	43 (55.85%)	77 (38.5%)
Hypernatremia	2 (66.67%)	1 (33.33%)	3 (1.5%)
Total cases	80	120	200

Serum Potassium levels of 200 SAM children were analysed. It was found that 20% SAM children were having hypokalemia. Hypokalemia was found in 15% of diarrheal cases & 5% in non- diarrheal cases. Table 3 shows that Potassium levels of children with diarrheal & non diarrheal children with SAM. A statistically significant difference was found with hypokalemia in SAM (P value of 0.019) between Diarrheal & Non diarrheal cases.

Table 3: Hypokalemia in SAM children

Serum Potassium	No diarrhea	Diarrhea	Total
Normokalemia	70	90	160
Hypokalemia	10	30	40
Total	80	120	200

Discussion

Majority of children with SAM were admitted with co morbidity in the form of Anaemia 98%, Diarrhea 60%, Pneumonia 32%, Tuberculosis 14%, UTI 11% and Otitis media 12% in the present study. In present study anaemia was found in 88% which is higher than 51% from Columbia as reported by Bernal C et al 2008.⁹ It was further observed that children with SAM was having 54% moderate anaemia followed by 33% severe anaemia in present study which is contrary to the study from Delhi as reported by Thakur et al.¹⁰ This can be contributed to nutritional deficiency as majority of the patients had dietary deficiency.

60% of children with SAM in present study was admitted with diarrhea as a co morbid state which is in accordance with 60% from Bangladesh as reported by Khanum et al.¹¹ but lower than 67% from Zambia as reported by Irena et al.¹² 68% from Columbia as reported by Bernal C. et al.⁹ 70% from Kenya as reported by Nzioki et al.¹³ which may be due to geographical factor while higher than 54% from Madhya Pradesh as reported by Kumar et al.¹⁴ 49% from Kenya as reported by Talbert et al.¹⁵ and 11% from Bangladesh as reported by Hossain et al.¹⁶ It may be because of low socioeconomic status, bottle feeding & unhygienic feeding can be contributed to this high prevalence of diarrhea in present study. In our study

hypokalemia was found associated with diarrhea and hyponatremia was found not associated which is comparable to other studies.¹⁷⁻¹⁹ This dyselectrolytemia may present with significant neurological outcomes.^{17,20,21} Further studies are needed establish the exact understanding of electrolyte changes in SAM. 32% of children with SAM in present study were admitted as pneumonia based on the clinical findings & Chest X Ray which is higher than 10% in Ethiopia as reported by Berti *et al.*²² which may be because of late admission in NRC. However it is lower than 33% and 58% from Bangladesh as reported by Hossain *et al.*¹⁶ and Kahnum *et al.*¹¹ respectively

14% of Children with SAM were diagnosed as a Pulmonary tuberculosis in a present study which is higher than 2%, 5.6%, 6.6%, 9% and 9.3% from Karnataka, Madhya Pradesh, Ethiopia, Bangladesh and Uttar Pradesh as reported by Bhat *et al.*²³ Gangaraj²⁴ Berti *et al.*²² Hossain M *et al.*¹⁶ & Kumar *et al.*²⁵ respectively. The high prevalence tuberculosis in present study may be because of children with SAM are belonging to low socio economic class. The high prevalence can be contributed to the more cases having history of contact positive. So screening of all SAM children with Tuberculosis is a must to find the actual disease burden in SAM.

11% of children with SAM were diagnosed UTI in present study which is lower than 11%, 17%, 30%, 31% from Nigeria, Delhi, Turkey and Mexico as reported by Rabasa *et al.*²⁸ Bagga *et al.*²⁹, Caksen *et al.*²⁷, Berkowitz *et al.*²⁶ respectively.

3% of children with SAM were diagnosed with Celiac disease in the present study based on clinical features suggestive of celiac disease, which is lower than 13% from Delhi as reported by Kumar *et al.*²⁵

31% SAM children in our study had ricketic features, and this is comparable with the previous reports.³⁰ This can be contributed to dietary deficiency and Vitamin D supplementation in early period of life. 2% of children with SAM were diagnosed with hypothyroidism in the present study based on clinical features suggestive of hypothyroidism. Exact prevalence of hypothyroidism was not found because selected cases were investigated.

1% of children with SAM were diagnosed HIV positive in the present study which is lower than found in previous studies.^{25,31} This may be because of low prevalence of HIV in present study. However high prevalence of HIV infection in children with SAM in African country may be associated with nutritional deficiencies secondary to decreased nutrient intake, impaired nutrient absorption, increased nutrient losses and increased nutrient demand. This is due to direct effect of HIV and the myriad of opportunistic infections precipitated by HIV induced immunodeficiency.

Conclusion

This study concluded that dyselectrolytemia is high in complicated SAM and mainly sodium disturbances in form of hyponatremia are common in different co-morbid conditions. Hence, we recommend that due care is to be given for management of dyselectrolytemia in complicated SAM children.

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