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Original Research Article

An Observational Research to Investigate the Spectrum of Co-Morbidities in Severe Acute Malnutrition Associated with Unexpected Dyselectrolytemia in Diarrhoea

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Abstract

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

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 15 months. Total 50 Children upto 5 years of 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: out of 50, 94% were associated co-morbid conditions in SAM. Majority of children with SAM were having co-morbidity in the form of Anaemia (86%), Diarrhoea (64%) followed by pneumonia (30%), Rickets (28%), Tuberculosis (16%), Otitis media (14%), UTI (10%), Celiac (6%), Hypothyroidism (4%), & HIV (2%). Mean age (SD) of the diarrheal cases was 37(6) months (95% C.I. 23.7- 26.5) of which 29 were male (58.73%). Mean age (SD) of non-diarrheal cases was 28(6). (95% C.I. 16.6 – 19.4) of which 75.67% were male. Among 50, 32 (64%) SAM children presented with diarrhea of which 32 had dysnatremia in the form of Hyponatremia in 31 cases (62%) & Hypernatremia in 1 case (2%) No statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM (P value of 0.08). Serum Potassium levels of 50 SAM children were analysed. It was found that 22% SAM children were having hypokalemia. Hypokalemia was found in 13% of diarrheal cases & 9% in non- diarrheal cases. A statistically significant difference was found with hypokalemia in SAM (P value of 0.023) between Diarrheal & Non diarrheal cases.

Conclusion: we conclude 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.

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

Introduction

Malnutrition is a major global problem.[1] 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[2] 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[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. 3Malnutrition 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'. Regulation of Na^+/K^+ depends upon excretion, intake, absorption occurs through gastrointestinal system. Disorders of Na^+/K^+ homeostasis can occur due to excessive loss, gain or retention of the Na^+/K^+ or H_2O. A vigorous imbalance of these two ions causes hyponatremia/hypokalemia and hypernatremia/hypokalemia. Remarkably, hypokalemia and hyponatremia are seen more frequently in diarrheal population than non-diarrheal.[8] The aim of the study to evaluate the spectrum of co-morbidities in severe acute malnutrition with unexpected dyselectrolytemia in diarrhea.

Material and methods

The observational study which was carried in the Department of Pediatrics, Darbhanga medical college and Hospital, Laheriasarai, Darbhanga, Bihar, India, for 15 months. Total 50 Children upto 5 years aged, admitted in Nutritional Rehabilitation Centre of Department of Paediatrics, were include in this study. Various co morbid conditions in study population were identified. All the laboratory examination were 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

Total 50 cases were included in study of which 94% 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

(86%), Diarrhoea (64%) followed by pneumonia (30%), Rickets (28%), Tuberculosis (16%), Otitis media (14%), UTI (10%), Celiac (6%), Hypothyroidism (4%), & HIV (2%).

Table 1: Co morbid conditions in SAM

Co-morbidity	No. of cases	% Percentage
Diarrhoea	32	64
Tuberculosis	8	16
Pneumonia	15	30
Otitis media	7	14
UTI	5	10
Rickets	14	28
Anaemia *	43	86
Celiac disease	3	6
Hypothyroidism	2	4
HIV	1	2

Table 2 shows that 63 (63%) SAM children presented with diarrhea of which 32 had dysnatremia in the form of Hyponatremia in 31 cases (62%) & Hypernatremia in 1 case (2%) No statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM (P value of 0.08)

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

Serum Sodium	No diarrhea (%)	Diarrhea (%)	Total (% of the total cases)
Hyponatremia	10	21	31 (62%)
Normonatremia	8	10	18 (36%)
Hypernatremia	0	1	1 (2%)
Total cases	18	32	50

Table 3 shows that Potassium levels of children with diarrheal & non diarrheal children with SAM. Serum Potassium levels of 50 SAM children were analysed. It was found that 22% SAM children were having hypokalemia. Hypokalemia was found in 13% of diarrheal cases & 9% in non- diarrheal cases. A statistically significant difference was found with hypokalemia in SAM (P value of 0.023) between Diarrheal & Non diarrheal cases.

Table 3: Hypokalemia in SAM children

Serum Potassium	No diarrhea	Diarrhea	Total
Normokalemia	13	26	39
Hypokalemia	5	6	11
Total	18	32	50

Discussion

In the present study among 50 cases 94% were associated co-morbid conditions in SAM. Majority of children with SAM were having co-morbidity in the form of Anaemia (86%), Diarrhoea (64%) followed by pneumonia (30%), Rickets (28%), Tuberculosis (16%), Otitis media (14%), UTI (10%), Celiac (6%), Hypothyroidism (4%), & HIV (2%) in the present study. In present study anaemia was found in 85% 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 51% moderate anaemia

followed by 35% 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.

64% 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. 30% 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 Ethopia 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.

16% 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],Gangaraj[24], 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.

10% 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.

5% 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 2012.[25]

28% 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. 3% 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.

2% of children with SAM were diagnosed HIV positive in the present study which is lower than found in previous studies[25]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

We conclude 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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