Original research article

Evaluation of the spectrum of co-morbidities in severe acute malnutrition and it's association with unexpected dyselectrolytemia in diarrhea.

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Abstract

Aim: To evaluate the spectrum of co-morbidities in severe acute malnutrition and study its association with unexpected dyselectrolytemia in diarrhea.

Methods: The study was an observational study which was carried in the Department of Pediatric, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India for period of 1 year from April 2019 to March 2020. Total 110 Children below 5 year age with severe acute malnutrition (SAM) 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 these 110 patients, 70 (63.64%) were males and remaining 40(36.36%) were females. Male to female ratio was 1.75:1. Maximum numbers of patients were in the age group of more than 1-3 year which constituted 45(40.90%) cases. Majority of children with SAM were having co-morbidity in the form of Anaemia (85.45%), Diarrhoea (64.55%) followed by Pneumonia (27.27%), Rickets (24.55%), Tuberculosis (14.55%), Otitis media (10.91%), UTI (9.09%), Celiac (4.45%), Hypothyroidism (2.73%), & HIV (1.82%). In SAM children presenting with diarrhea (n=71), Hyponatremia was present in 49 cases (69%) & Hypernatremia in 2 (2.8%) cases. No statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM (P value of 0.07). Serum Potassium levels of 110 SAM children were analysed. It was found that 21.82% SAM children were having hypokalemia. Hypokalemia was found in 13.64% of diarrheal cases & 8.18% in non-diarrheal cases.

Conclusion: Co-morbidities identification and treatment in SAM children is key step in reducing morbidity and mortality associated with SAM.

Keywords: Co-morbidities, Severe Acute Malnutrition, Diarrhea, Hyponatremia, Hypokalemia, Celiac disease, HIV

Introduction

Diarrhoea still continues to be a major cause of hospitalization in children under five years of age and is the second leading cause of death among children in age group of 1 to 59 months. It has severe economic consequences on the family and society. Globally there are nearly 1.7 billion cases of childhood diarrhoea every year. It is also the major cause of Malnutrition in under fives.[1] From 2000 to 2016 the toll of annual number of deaths from diarrhoea in under fives had decreased by 60%. Many more, however could have been saved through simple interventions.[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 readily 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.[6] 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 as due to reductive adaptation, Na+, K+, ATPase systems of the body begin to 'shut down'. Regulation of Na+/K+ depends upon excretion, intake, and absorption through gastro intestinal 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 and its association with unexpected dyselectrolytemia in diarrhea.

Material and methods

The observational study which was carried in the Department of Pediatric, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India over period of 1 year from April 2019 to March 2020, after taking the approval of the protocol review committee and institutional ethics committee.

Methodology

Total 110 Children, below 5 years of age, admitted in Nutritional Rehabilitation Centre (NRC) of Department of Paediatrics, were include in this study. Various co-morbid conditions in study population were identified. All the laboratory investigations were done with standard method.

Data Analysis

Statistical analysis was done, using the statistical package for social science (SPSS 20) 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

Out of these 110 patients, 70 (63.64%) were males and remaining 40(36.36%) were females. Male to female ratio was 1.75:1. Table 1 shows maximum numbers of patients were in the age group of more than 1-3 year which constituted 45(40.90%) cases. This was followed by below 1 year age group which constituted 35(31.82%) cases.

Table 1: Sex and Age distribution of children

Sex	Number of cases	(Percentage
Male	70	63.64
Female	40	36.36
Age		
Below 1 year	35	31.82
1-3 years	45	40.90
3-6 years	30	27.28

Total 110 cases were included in study of which 90% were associated co-morbid conditions. Table 2 showed that majority of children with SAM were having co-morbidity in the form of Anaemia (85.45%), Diarrhoea (64.55%) followed by pneumonia (27.27%), Rickets (24.55%), Tuberculosis (14.55%), Otitis media (10.91%), UTI (9.09%), Celiac (4.45%), Hypothyroidism (2.73%), & HIV (1.82%).

Table 2: Co-morbid conditions in SAM

Co-morbidity	No. of cases	% Percentage
Anaemia	94	85.45
Diarrhea	71	64.55
Pneumonia	30	27.27
Rickets	27	24.55
Tuberculosis	16	14.55
Otitis media	12	10.91
UTI	10	9.09
Celiac disease	6	5.45
Hypothyroidism	3	2.73
HIV	2	1.82

Mean age (SD) of the diarrheal cases was 3.9 months (95% C.I. 23.9- 26.8) of which 40 were male (56.33%). Mean age (SD) of non-diarrheal cases was 3.1. (95% C.I. 18.7 – 21.6) of which 76.92% were male.

Table 3 shows that of total 110 SAM children, 71 (64.55%) SAM children presented with diarrhea, of which Hyponatremia was seen in 49 (69%) cases & Hypernatremia in 2 (2.8%) cases. No statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM (P value of 0.07)

Table 3: Dysnatremia in SAM children in diarrheal & non-diarrheal groups

Serum Sodium	No Diarrhea (%)	Diarrhea (%)	Total (% of the total cases)
Hyponatremia	20 (28.99%)	49 (71.01)	69 (62.72%)

Normonatremia	17 (45.95%)	20 (54.05%)	37 (33.64%)
Hypernatremia	2 (50%)	2 (50%)	4 (3.64%)
Total cases	39	71	110

Serum Potassium levels of 110 SAM children were analysed. It was found that 21.82% SAM children were having hypokalemia. Hypokalemia was found in 13.64% of diarrheal cases & 8.18% in non- diarrheal cases. Table 4 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 0.024) between Diarrheal & Non-diarrheal cases.

Table 4: Hypokalemia in SAM children

Serum Potassium	No Diarrhea (%)	Diarrhea (%)	Total (% of the total cases)
Normokalemia	30 (34.9%)	56 (65.1%)	86 (78.2%)
Hypokalemia	9 (37.5%)	15 (62.5%)	24 (21.8%)
Total cases	39	71	110

Discussion

In the present study among 110 patients, 70 (63.64%) were males and remaining 40(36.36%) were females. Male to female ratio was 1.75:1. Maximum numbers of patients were in the age group of more than 1-3 year which constituted 45(40.90%) cases. This was followed by below 1 year age group which constituted 35(31.82%) cases. Majority of children with SAM were having co-morbidity in the form of Anaemia (85.45%), Diarrhoea (64.55%) followed by pneumonia (27.27%), Rickets (24.55%), Tuberculosis (14.55%), Otitis media (10.91%), UTI (9.09%), Celiac (4.45%), Hypothyroidism (2.73%), & HIV (1.82%). In present study anaemia was found in 85.45% 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 50% moderate anaemia followed by 38% 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 underlying nutritional deficiency as majority of the patients had dietary deficiency.

71(64.55%) of children with SAM in present study were admitted with diarrhea as a   co-morbid state which is in accordance with 60% from Bangladesh as reported by Khanum et. al 1998[11] but lower than 67% from Zambia as reported by Irena et. al 2011,[12] 68% from Columbia as reported by Bernal C. et al 2008,[9] 70% from Kenya as reported by Nzioki et. al 2009[13] , which may be due to geographical factor while higher than 54% from Madhya Pradesh as reported by Kumar et al 2013,[14] 49% from Kenya as reported by Talbert et.al 2005[15] and 11% from Bangladesh as reported by Hossain et.al 2009.[16] It may be because of low socioeconomic status, bottle feeding & unhygienic feeding that can be contributory to this high prevalence of diarrhea in present study. In our study hypokalemia was found significantly to be associated with diarrhea and hyponatremia was found not significantly associated, which is comparable to other studies.[17-19] This dyselectrolytemia may present with significant neurological outcomes.[17,20,21] Further studies are needed to establish the exact understanding of electrolyte changes in SAM. 27.27%% of children with SAM in present study were admitted as a pneumonia, based on the clinical findings & Chest X Ray, which is higher than 10% in Ethopia as reported by Berti et. al 2008[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 1998[11] respectively.

14.55% 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 2013,[24]Berti et al 2008,[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.

9.09% 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 2002,[28]Bagga et al 2003,[29]Caksen et al 2000,[27]Berkowitz et al 1983[26]respectively.
4.45% of children with SAM were diagnosed with Celiac disease in the present study based on clinical and laboratory features suggestive of celiac disease, which is lower than 13% from Delhi as reported by Kumar et al 2012.[25]

24.55% SAM children in our study had ricketic features, and this is comparable with the previous reports.[30] This could be contributed to dietary deficiency and lack of Vitamin D supplementation in early period of life. 2.73% of children with SAM were diagnosed with hypothyroidism in the present study based on clinical and laboratory features suggestive of hypothyroidism. Exact prevalence of hypothyroidism was not found because selected cases were investigated.

1.82% 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 community from which children were included 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
Co-morbidities identification and treatment in SAM children is key step in reducing morbidity and mortality associated with SAM.

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