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Original research article

Co-morbidities in Severe Acute Malnutrition with Diarrheal Dyselectrolytemia

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Abstract

Background: Co-morbidities are the reason behind high morbidity and mortality in SAM children. There is lack of literature regarding co morbidity pattern in SAM children.

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

Material and Methods: The study was a observational study which was carried in the Department of Pediatric, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India for 1 year. Total 120 Children below 6 year age were included in this study. Various co morbid conditions in study population were identified. All the laboratory examination were done with standard method.

Results: Total 120 cases were included in study of which 95% were associated co-morbid conditions in SAM. Majority of children with SAM were having co-morbidity in the form of Anaemia (86.67%), Diarrhoea (64.17%) followed by pneumonia (28.33%), Rickets (25.83%), Tuberculosis (15.83%), Otitis media (13.33%), UTI (10.83%), Celiac (5.83%), Hypothyroidism (1.67%), & HIV (0.83%). 77 (64.17%) SAM children presented with diarrhea of which 76 had dysnatremia in the form of Hyponatremia in 76 cases (63.33%) & Hypernatremia in 2 cases No statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM(P value of 0.09). It was found that 25% SAM children were having hypokalemia. Hypokalemia was found in 15.83% of diarrheal cases & 9.17% in non- diarrheal cases. A statistically significant difference was found with hypokalemia in SAM (P value of 0.029) between Diarrheal & 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, NRC, Severe Acute Malnutrition, Hypothyroidism, Celiac disease, Diarrhea, HIV

Introduction

When it comes to children under the age of five, diarrhoea is still a leading cause of hospitalisation and mortality, as well as having significant economic effects. Diarrhoea is the second most common cause of mortality in children under the age of five in the world. Every year, around 525000 children under the age of five die as a result of diarrhoea. Every year, about 1.7 billion instances of paediatric diarrhoea are reported throughout the world. It is also the most common cause of malnutrition in children under the age of five.[1]

During the period 2000-2016, the yearly toll of fatalities due to diarrhoea in children under the age of five reduced by 60 percent. Many more lives might have been spared if basic treatments had been implemented.[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 gastro intestinal system. Disorders of Na+/K+ homeostasis can occur due to excessive loss, gain or retention of the Na+/K+ or H2 O. A vigorous imbalance of these two ions causes hyponatremia/hypokalemia and hypernatremia/hypokalemia. Hypokalemia and hyponatremia are more common in diarrheal patients than non-diarrheal patients.[8] The study's goal was to assess co-morbidities in severe acute malnutrition with dyselectrolytemia in diarrhoea.

Material and methods

The observational study which was carried in the Department of Pediatric, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India for 1 year, after taking the approval of the protocol review committee and institutional ethics committee. Total 120 Children below 6 year 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 17) 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 120 cases were included in study of which 95% had associated co-morbid conditions in SAM. Table 1 showed that majority of children with SAM were having co-morbidity in the form of Anaemia (86.67%), Diarrhoea (64.17%) followed by pneumonia (28.33%), Rickets (25.83%), Tuberculosis (15.83%), Otitis media (13.33%), UTI (10.83%), Celiac (5.83%), Hypothyroidism (1.67%), & HIV (0.83%).

Table 1: Comorbid conditions in SAM

Co-morbidity	No. of cases	% Percentage

Diarrhea	77	64.17
Tuberculosis	19	15.83
Pneumonia	34	28.33
Otitis media	16	13.33
UTI	13	10.83
Rickets	31	25.83
Anaemia *	104	86.67
Celiac disease	7	5.83
Hypothyroidism	2	1.67
HIV	1	0.83

Mean age (SD) of the diarrheal cases was 35(6) months (95% C.I. 24.9- 27.8) of which 44 were male (57.14%). Mean age (SD) of non-diarrheal cases was 27(6). (95% C.I. 17.2 – 20.4) of which 74.42% were male.

Table 2 shows that 77 (64.17%) SAM children presented with diarrhea of which 76 had dysnatremia in the form of Hyponatremia in 76 cases (63.33%) & Hypernatremia in 2 cases No statistically significant difference was found with hyponatremia in diarrheal or non-diarrheal cases of SAM(P value of 0.09)

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

Serum Sodium	**No diarrhea (%)**	**Diarrhea (%)**	**Total (% of the total cases)**
Hyponatremia	24 (31.58%)	52 (68.42)	76 (63.33%)
Normonatremia	17 (42.50%)	23 (57.50%)	40 (33.33%)
Hypernatremia	2 (50%)	2 (50%)	4 (3.33%)
Total cases	43	77	120

Serum Potassium levels of 120 SAM children were analysed. It was found that 25% SAM children were having hypokalemia. Hypokalemia was found in 15.83% of diarrheal cases & 9.17% 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 0.029) between Diarrheal & Non diarrheal cases.

Table 3: Hypokalemia in SAM children

Serum Potassium	**No diarrhea**	**Diarrhea**	**Total**
Normokalemia	32	58	90
Hypokalemia	11	19	30
Total	43	77	120

Discussion

In this research, 95 percent of 120 patients had SAM co-morbid disorders.

The most common co-morbidities were anaemia (86.67%), diarrhoea (64.17%), pneumonia (28.33%), rickets (25.83%), tuberculosis (15.83%), otitis media (13.33%), UTI (10.83%), Celiac (5.83%), hypothyroidism (1.67%), and HIV (1.67%). The current research revealed 86.67 percent anaemia, compared to 51% in Columbia (Bernal C et al 2008).[9] Contrary to Thakur et alresearch .'s from Delhi, children with SAM had 50% moderate anaemia and 38% severe anaemia.[10]

This may be attributed to nutritional deficit since most patients had it. 64.17% 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 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 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. 28.33% of children with SAM in present study was 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.

15.83% 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.

10.83% 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.
5.83% 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]

25.83% 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. 1.67% 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.
0.83% 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

Co-morbidities are a major contributor to the high rates of morbidity and death in SAM children. There is a paucity of information available on the co-morbidity pattern in SAM children. Identification and treatment of co-morbidities in SAM children is a critical step in lowering the morbidity and mortality associated with the disease.

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