

Original research article

An Observational Study To Evaluate The Spectrum Of Co-Morbidities In Severe Acute Malnutrition With Unexpected Dyselectrolytemia In Diarrhea**Dr. Dheeraj Kumar¹, Dr. Bankey Behari Singh²****¹ Senior Resident, Department of Pediatrics, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India.****² Associate Professor & HOD, Department of Pediatrics, Anugrah Narayan Magadh Medical College and Hospital, Gaya, Bihar, India****Corresponding Author: Dr. Dheeraj Kumar****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, Anugrah Narayan Magadh Medical College and Hospital Gaya, Bihar, India for 15 months. Total 100 Children below 6 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: out of 100, 94% were associated co-morbid conditions in SAM. Majority of children with SAM were having co-morbidity in the form of Anaemia (85%), Diarrhoea (63%) followed by pneumonia (30%), Rickets (28%), Tuberculosis (15%), Otitis media (14%), UTI (10%), Celiac (5%), Hypothyroidism (3%), & HIV (2%). Mean age (SD) of the diarrheal cases was 37(6) months (95% C.I. 23.7- 26.5) of which 37 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 100, 63 (63%) SAM children presented with diarrhea of which 62 had dysnatremia in the form of Hyponatremia in 62 cases (62%) & Hypernatremia in 2 cases (1%) 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 100 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. 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’. 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 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, Anugrah Narayan Magadh Medical College and Hospital Gaya, Bihar, India. For 15 months. after taking the approval of the protocol review committee and institutional ethics committee.

Methodology

Total 100 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 was done with standard method.

Results

Total 100 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 (85%), Diarrhoea (63%) followed by pneumonia (30%), Rickets (28%), Tuberculosis (15%), Otitis media (14%), UTI (10%), Celiac (5%), Hypothyroidism (3%), & HIV (2%).

Table 1: Comorbid conditions in SAM

Co-morbidity	No. of cases	% Percentage
Diarrhea	63	63
Tuberculosis	15	15
Pneumonia	30	30
Otitis media	14	14
UTI	10	10
Rickets	28	28
Anaemia *	85	85

Celiac disease	5	5
Hypothyroidism	3	3
HIV	2	2

Mean age (SD) of the diarrheal cases was 37(6) months (95% C.I. 23.7- 26.5) of which 37 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.

Table 2 shows that 63 (63%) SAM children presented with diarrhea of which 62 had dysnatremia in the form of Hyponatremia in 62 cases (62%) & Hypernatremia in 2 cases (1%) 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	20 (32.26%)	42 (67.74)	62 (62%)
Normonatremia	16 (44.45%)	20 (55.55%)	36 (36%)
Hypernatremia	1 (50%)	1 (50%)	2 (2%)
Total cases	37	63	100

Serum Potassium levels of 100 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. 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 0.023) between Diarrheal & Non diarrheal cases.

Table 3: Hypokalemia in SAM children

Serum Potassium	No diarrhea	Diarrhea	Total
Normokalemia	28	60	78
Hypokalemia	9	13	22
Total	37	63	100

Discussion

In the present study among 100 cases 94% were associated co-morbid conditions in SAM. Majority of children with SAM were having co-morbidity in the form of Anaemia (85%), Diarrhoea (63%) followed by pneumonia (30%), Rickets (28%), Tuberculosis (15%), Otitis media (14%), UTI (10%), Celiac (5%), Hypothyroidism (3%), & 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.

63% 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 1998¹¹ 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 2009¹³ 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 2005¹⁵ 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. 30% 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 Ethiopia as reported by Berti et. al 2008²² which may be because of late admission in NRC. However it is lower than 33% and 58% from Bangladesh as reported by Hossain et al¹⁶ and Kahnum et al 1998¹¹ respectively.

15% 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 al²⁵ 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 2002,²⁸ Bagga et al 2003,²⁹ Caksen et al 2000,²⁷ Berkowitz et al 1983²⁶ 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.^{25,31} 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

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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