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Original Research Article

Systemic Diseases Associated with Severe Acute Malnutrition (SAM): A Prospective Observational Study

Ameta Gaurav[1], Aswani Nishant[2], Maru Lipika[3]

[1]Associate Professor, Department of' Pediatrics, American Institute of Medical Sciences, Udaipur, Rajasthan,

[2]Assistant Professor, Department of' Pediatrics, American Institute of Medical Sciences, Udaipur, Rajasthan,

[3]Assistant Professor, Department of' Pediatrics, American Institute of Medical Sciences, Udaipur, Rajasthan,

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Corresponding author: Ameta Gaurav

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Abstract

Introduction: Severe acute malnutrition (SAM) is a cause of almost 50 childhood deaths in children below 5 years in developing world. In India, as National Family Health Survey (NFHS), prevalence of SAM has increased from 7.5% in NFHS-4 (2015-16) to 7.6% in NFHS-5 (2019-21). The aim of study was to determine systemic diseases associated with SAM among 6 months to 5 years children admitted at the department of Paediatrics, GBH General Hospital, American International Institute of Medical Sciences, Bedvas, Udaipur.

Methods: We did a prospective observational study of 208 SAM children over 24 month's duration. Systemic diseases were determined by history, physical examination and uniform investigation protocol. Therapeutic nutritional rehabilitation was provided for 14 days along with management of associated systemic diseases. Cases were followed up weekly for 2 months by monitoring anthropometric parameters of SAM.

Results: Systemic diseases were detected in 57.69 % of cases. Celiac disease (16.82%), Tuberculosis (12.01%), Bronchial asthma (8.18%), severe nutritional anemia (6.78%), congenital haemolytic anemia (4.80%), congenital heart disease (3.84%), chronic kidney disease (2.88%) and recurrent UTI (1.92%), HIV (0.48%) were there. 42.30% cases were not associated with any systemic disease. Among nutritional factors associated were 28.84% of cases and SGA was also associated (13.46%) with SAM. 76.91% subjects started gaining weight during 15 days hospital stay. Weight gain was observed in 91% subjects at follow-up. Weight was attained by 9% subjects. 64.42% children were from rural background and 35.58% from urban background. Timing of initiation of complementary feeding was incorrect in 44%.

Conclusion: Systemic diseases such as celiac disease, tuberculosis, severe bronchial asthma, severe anemia, congenital heart disease, recurrent UTI, chronic kidney disease and HIV were associated with SAM. Our findings also confirm the association of SAM with noncompliance of exclusive breast feeding and delayed complementary feeding.

Keywords: SAM, Severe Acute Malnutrition, Childhood Morbidity, NFHS, WHO.

Abbreviations: SAM-Severe Acute Malnutrition, NHFS- National Family Health Survey WAZ-Weight for age Z score, WHZ-weight for height Z score, SGA – small for gestational age, MCRS-multicentre growth reference study.

Introduction

Severe acute malnutrition (SAM) is prevalent in 1–2% of children below 5 years in developing countries.[1] SAM affects up to 20 million children below 5 years children worldwide[2]. Mortality is 9 times more in SAM children than normal children and is an important major mortality factor below 5 years of children[3]. In India, SAM continues to be a significant public health issue. As per National Family Health Survey-5 (NFHS-5), nearly 7.6 % of children aged below 5 years suffer from SAM. According to NFHS -5 underweight, stunting and wasting are 32.1%, 35.5% and 19.3% respectively in India.[1] SAM increases mortality and morbidity[4]. SAM also compromises physical and mental development of child so children with SAM need to intervene immediately with work up for aetiology and nutritional management [4-9].

Earlier studies regarding aetiology of SAM have shown a decline in case fatality rates[5,6]. But, the response to treatment decreases and default cases increases on follow-ups if they do not respond to nutritional management, may be due to some underlying systemic disease[5-7]. There is also no uniform guideline to work up for associated systemic diseases with SAM.[2] Furthermore, to reduce the prevalence and long-term effects of SAM, there is a need for recognising pattern of associated systemic diseases with SAM and form a work up investigation guideline to identify them.

Aims and Objectives

This prospective observational study was aimed 1] To determine associated systemic factors responsible for SAM children between 6 months to 5 years old children admitted at pediatric ward, GBH General Hospital, Bedwas, Udaipur . 2] To determine the socio-demographic, clinical and nutritional factor profile of severe acute malnutrition (SAM).

Methods

It was a prospective interventional study on children between 6 months to 5 years children with severe malnutrition, admitted to paediatric ward, GBH General Hospital, American International Institute of Medical Sciences, Bedvas, Udaipur a tertiary care hospital, during the study period July 2021 to March 2023 following approval from Institutional Ethical Committee. All Children admitted to Pediatric ward were screened for any one of following WHO criteria's for SAM-weight for length/height ≤3 SD; bilateral pedal edema; mid-upper arm circumference (MUAC) Less than 11.5 cm^2. Children having history of Preterm less than 37week, perinatal insult, NICU admissions, any neurodegenerative/neurometabolic disorder or congenital malformation (other than Cong heart disease) were excluded from the study. Informed written consent was taken from the parents prior to enrolment. All datas comprising complaints, birth weight, breast feeding, complementary feeding, perinatal history,nutritional history, social and demographic details, socioeconomic status (Modified Kuppuswamy Scale), symptoms, general physical examination and systemic examination was performed by resident doctor and were filled up in a designed Performa. The anthropometric measurements (weight, height, weight for height, MUAC) were taken as per classified as per WHO child growth standards[2]. The weight was measured with an electronic weighing scale, length by an Infantometer, height by stadiometer (for age above two years or height above 85 cm), and MUAC by a non-elastic tape. A detailed general and systemic examination was done. Complete blood count, peripheral blood film,

blood sugar, electrolytes, urine routine, serum creatinine, Anti TTG IgA antibody, TSH, blood and urine cultures, 2D echo, USG abdomen, HB electrophoresis (if HB less than 6), tuberculosis work (MT, GA for CBNAAT, ESR, chest X ray) and HIV screening were done. All seropositive for TTG IgA antibody titre were subjected to Upper GI endoscopy and D2 biopsy after consent. All participants received nutritional rehabilitation according to the WHO guidelines[8].

Participants also received management for the associated systemic disease. Children were discharged after attaining following criteria's:- the child was active and alert; the child had no signs of edema, no fever, free from infection, completed all age appropriate immunizations and sensitised care giver.[8] The data were entered into a Microsoft excel sheet 2021 and results were calculated by percentages. The data were analysed using SPSS 23 software.

Results

In this study 208 SAM children (WHZ score <-3 SD) fulfilling inclusion criteria were enrolled. Out of 208 cases, 120 cases were detected with some systemic diseases. Systemic diseases found were - Celiac disease 35 cases (16.82%), Tuberculosis 25 cases (12.01%), Bronchial asthma 17 cases (8.18%), severe nutrional anemia 14 cases (6.78%), severe congenital haemolytic anemia 10 cases (4.80%), congenital heart disease 8 cases (3.84%), chronic renal failure 6 cases (2.88%,), recurrent UTI 4 cases (1.92 %) and HIV one case (0.48%) . 42.30 % cases were not associated with any systemic disorders.

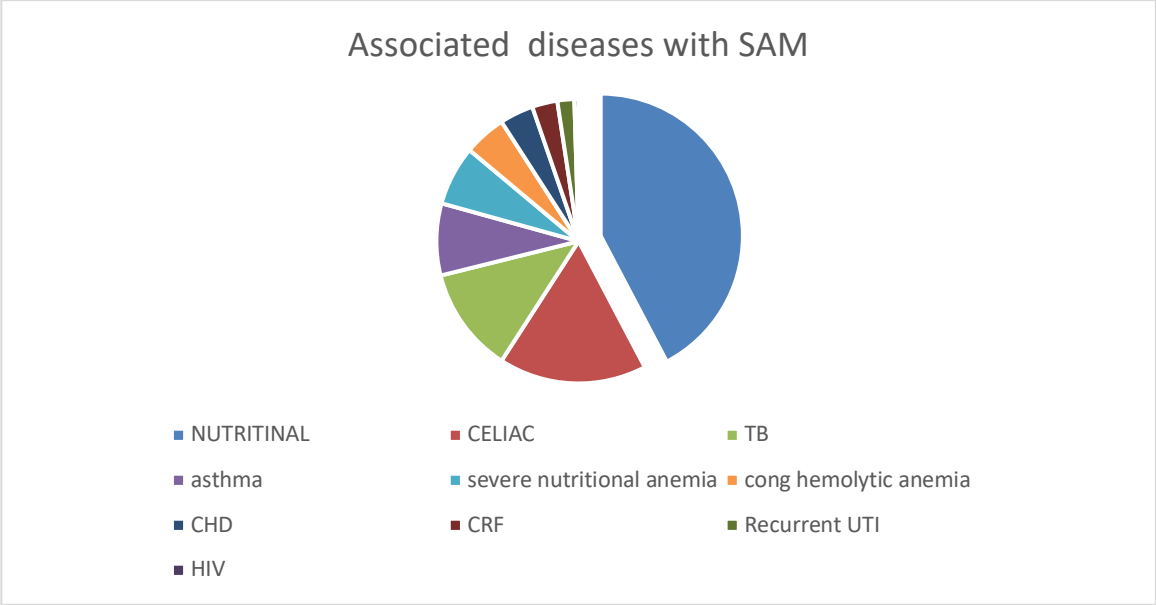

Figure 1: Associated disease with SAM

Table 1: Age and Sex pattern of subjects

Age (in month)	Male	Female	Total
6-12	26	32	58(27.8%)
12-24	28	38	66 (31.7%)
24-36	18	20	38(18.2)
36-48	10	14	24(11.5%)
48-60	10	12	22(10.57%)

Table 1, showing SAM is more common in female (N=116, 55.76%) patients in all age groups from 6 months to 5 years. SAM is most common in the age group of 12 to 24 months (N= 66, 31.81%).

Table 2: Family and feeding pattern of subjects

Characteristics	Number	Percent
Family type		
Joint	63	30.28
Nuclear	145	69.71
Birth order of index case in family		
1	45	21.63
2	57	27.40
≥3	106	50.96
Spacing between two children less than 24 months	149	71.63
Immunization status		
Unimmunized	79	37.98
Partially immunized	90	43.28
Completely immunized	39	18.75
Feeding pattern		
Exclusive breastfeeding till 6 months of age	101	48.55
Bottle feeding		
Formula feed	39	18.75
Animal milk feeding	78	37.56

Among the subjects (N=145, 69.71%) children had nuclear families. SAM was common in children with birth order >3 (N=106, 50.69%) and low literacy status in mothers (N=114, 54.28%). Exclusive breastfeeding till 6 months of age seen in N=101, 48.55 %. Bottle feeding was seen in N=117, 56.25%. (Table 2).

Table 3: Socioeconomically class of Subjects (Modified Kuppuswamy Scale)

Socioeconomic Class	Number	Percent
Upper	2	0.96 %
Upper middle	8	3.80%
Lower middle	28	13.6%
Upper lower	62	29.80%
Lower	108	51.92%

Table 3 shows SAM is more common in lower socio economic class (N=108, 51.92%), of Modified Kuppaswamy Scale. SAM is more common in children living in rural areas (N=143, 68.75%) than urban areas (N=65, 31.253%).

No systemic cause was found in 88 cases (42.3%). We tried to find out some nutritional factors.Nutritional factors associated were found in 28.84 % of cases and there was history of SGA (IUGR) was also associated (13.46%). Timing of complementary feeding was incorrect in 32.69%. Most of Children (76.91%) started gaining weight during hospital stay for 15 days and there was weight gain on follow-up also in these children. Weight gain was not achieved in 11 % children.

Discussion

Severe Acute Malnutrition (SAM) in children is one of the major health problem prevailing 7.6 % of children below 5 years in India. SAM induces significant morphological changes in the brains SAM children.[9-11] Many studies have shown that SAM has long term cognitive and other adverse neurological .problems[9-11] Most of previous studies have emphasised over nutritional factors and excluded systemic diseases for inclusion of participants of the studies. Only very few studies have taken to find etiology or screening of associated systemic diseases.[5-7]

In our study, there was 52% cases of SAM have non nutritional association, which is much higher than other study.[14] In our study, 28 SGA babies, varied from a Bangladesh study which showed high prevalence (84%) of LBW in SAM [12], although we excluded preterm babies, may be the cause of difference(low proportion). It is very important and convenient to do work up for associated systemic diseases along with nutritional rehabilitation of SAM as secondary cases are more in number than nutritional.

We found Celiac disease screening was seropositive among percent of SAM Children which was quite similar to study by Beniwal at (15.38 %) at Bikaner, Rajasthan while prevalence of biopsy confirmed Celiac disease was 14.42% at Bikaner.[5] Results were also similar to the study who found Celiac disease was diagnosed in 13.1% of SAM children in a pilot study done by Kumar P *et al*.[6] Celiac screening rates were higher (27.28%) than our study in study done by Pradeep meena *et al*. at Udaipur which is similar geographical region.[7]

Tuberculosis was reported in 12% of children in the index study and similar trend was found by Devi *et al*, sherin *et al* where 7% and 9 % of children had TB.[14,1] Our findings were also similar to Kumar P *et al* who found tuberculosis (9.3%)and HIV (4%)were diagnosed in SAM children[6]. These findings suggest, Tuberculosis is a commonly associated with SAM and Tubercular work up should be integral part of investigational work up for SAM child.

The mean age of EBF was 4.6 months with a standard variance of 1.7. only 34% of SAM children had Exclusive Breast Feeding till six months for age , rest all were not compliant for exclusive breast feeding till age of age. Results are similar to Various studies have shown the rate of EBF for the first six months as 32%, 49%, 24% in SAM children[14-16] The absence of exclusive breast feeding, consumption of top milk in the initial six months renders them susceptible to SAM.

In this study, only 44% children (n = 91) had Complementary feeding (CF) started after eight months. The mean age of starting complementary feeding is 7.2 months with a standard variance of 2.5. Almost similar results were seen in many studies in India.[13-16] Delayed introduction of CF is a risk factor for SAM. This could be due to the lack of knowledge of mother about age appropriate dietary requirements of the child and low socioeconomic –educational status of mother.

In the present study, 37% of the children were not immunized and 43% of children were partially immunized as per National Immunization Schedule (NIS). Similar results were seen in others studies [15-17] In our study 75 % subjects were from lower class of Kuppuswammy scale. Higher (47%) proportion of SAM children had birth order more than two in our study ,which is similar with findings in previous studies.[13-17]

Limitations

It was a small sample size. We did not follow them after 2 months. A long follow-up improvement after treating associated systemic disease in malnourished children could have better attributed these systemic diseases to SAM. It was is a single centric study involving

a limited geographic region, would render this study to generalize to the entire nation.

Conclusion

It was a hospital-based study to focus on work up for associated systemic diseases, various socioeconomic and nutritional factors in SAM children. Most of SAM children were associated with were Celiac disease, severe congenital haemolytic anemia, severe nutritional anemia, Tuberculosis, Bronchial asthma, congenital heart disease, recurrent UTI, chronic kidney disease HIV. Most of these are from Lower class of Kuppuswamy scale, birth order more than two and incomplete vaccination. Poor Compliance of EBF , inadequate Complementary feeding were among nutritional factors associated. There is a need to form a universe guideline to work up associated systemic diseases with SAM. Also emphasis should be given on timely initiation and adequacy of complementary feeding to prevent SAM in children.

Ethical approval: The study was approved by the Institutional Ethics Committee

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