Clinical profile and major co-morbidities among children with severe acute Malnutrition (SAM): Experience from a tertiary care teaching hospital.

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ABSTRACT

Background: Malnutrition is a leading cause of morbidity and mortality in children aged less than 5 years and is responsible for 60% of the 10 million deaths in this age group worldwide.

Aim: To study the clinical profile and major clinical co-morbidities among children with severe acute malnutrition (SAM) admitted in a tertiary care teaching hospital.

Methods: A prospective study was conducted in a tertiary care teaching hospital of Haryana. All children aged (6 months to 5 years) with severe acute malnutrition (as per WHO definition) admitted in pediatrics ward during 1st April 2018 to 31st March 2019 were included in the study. The socio-demographic details, anthropometry, clinical details and outcome were recorded in a pre-designed structured performa. Statistical analysis was done using SPSS software version16.Chi-square analysis was applied where applicable and P value< 0.05 was considered significant.

Results: After screening a total of 131children, 102 children who met the inclusion criteria were enrolled in the study. Out of these, 50 (49.02%) were males and 52 (50.98%) were females. Majority of children (i.e. 59.8%) belonged to 6-12 months age group whereas 32.35% were in 12-24 months age group and 7.84% in 24-59 months age group. Majority (92.16%) belonged to lower socio-economic status. Exclusive breastfeeding for first 6 months was documented in 74.51% of the children while the rest had incomplete/faulty feeding. Delayed initiation of complementary feeds was observed in 80 (78.43%) children and had a significant association with poor future outcome ($p<0.05$). Major clinical co-morbidities were severe anemia (56.86%), diarrhea (27.45%) and acute lower respiratory tract infection (19.6%).Specific nutritional deficiencies were rickets in 8 (7.8%) children, nutritional tremors syndrome (NTS) in 03 and scurvy in 01 child respectively.

Conclusions: In our study, most vulnerable age group for severe malnutrition was 6-12 months infants. Low socioeconomic status of family and delayed complementary feeding were the major risk factors. Most common co-morbidities were anemia, diarrhea and lower respiratory tract infections.

Keywords: Severe acute malnutrition (SAM), complementary feeding, co-morbidities, outcome.

INTRODUCTION

World health organization (WHO) defines malnutrition as cellular imbalance between the supply of nutrients and energy with respect to body's demand to ensure growth, maintenance and specific function. (Onis and Blossner, 1997).[1] In India, around 6.4% of the under 5 children suffer from severe acute malnutrition(SAM)(WHO,2011)[2].Wherea s, it is responsible for 60% of the 10 million deaths occurring annually in < 5 year children worldwide, In India alone, more than 33% of under 5 year deaths were due to malnutrition.(WHO, 2011; Amsalu and Tigabu, 2008).[2,3] Childhood malnutrition not only leads to higher mortality rates, there is also incriminating evidence to suggest that it leads to shorter adult height, poor scholastic performances, decreased economic productivity and birth of more growth restricted babies.(Black et al, 2008).[4] Also, lifestyle diseases like obesity, hypertension and diabetes were more common in adults who suffered from childhood malnutrition. (Martins et al, 2011).[5] National Family Health Survey (NFHS-4) data showed that stunting was present in 38% of children, wasting in 21% of children and underweight in 36% of children less than five years of age. (IIPS, NFHS-4, 2017).[6]

There is a paucity of data regarding clinical presentation and outcome of children with SAM from Haryana. We therefore planned this study to determine the pattern of risk factors and major clinical morbidities affecting children with admitted to a tertiary care teaching hospital of Haryana.

MATERIAL AND METHODS:

A prospective observational study was conducted in the Department of pediatrics, Kalpana Chawla Government Medical College, Karnal over a period of one year from 1st April 2018 to 31st March 2019 after obtaining approval from Institute's ethics committee. All children aged 6 months to 5 years with SAM admitted in pediatrics ward and undergoing treatment during 1st April 2018 to 31st March 2019 were included in the study after obtaining a written informed consent from parents.(WHO child growth standards, 2009).[7]

Inclusion criteria were:

a). Weight for length/height < -3 SD of WHO growth standards and / or

b). Bilateral pitting pedal edema of nutritional origin and/ or

c). Mid- upper arm circumference <115 mm and/or

d). Presence of visible severe wasting.

Exclusion criteria were:

- Children less than 6 months and more than 5 years of age.
- Children with gross congenital malformations,
- cerebral palsy, chronic renal / liver failure, congenital heart disease, inborn error of metabolism.
- Refusal of consent by parents.

All children were admitted and managed in the pediatric ward medically and nutritionally. A total of 131 cases of severe PEM were screened and in final analysis 102 of these fulfilling the inclusion criteria were enrolled in the study. A detailed history regarding socio-demographic factors, feeding history

including details of breast feeding, complementary feeding and present and prior illnesses was noted in a pretested structured performa and later recorded in Microsoft excel sheet. Socio-economic status was classified according to modified Kuppuswami index. (Singh et al, 2017).[8] A complete general and systemic examination was done by pediatrician and complete medical diagnosis with presence/absence of clinical co morbidities and nutritional deficiencies were recorded.

Anthropometric measurements (including weight, height, mid upper arm circumference, weight for age, height for age, and weight for height) were recorded in a pre-designed performa at admission and at discharge. Weight was recorded in grams with an accuracy of ±10 grams using electronic weighing machine, height/length was measured by a stadiometer / infantometer with an accuracy of ±1 cm, mid upper arm circumference (MUAC) was measured midway between olecranon process and acromion process with non-stretchable measuring tape with an accuracy of ±1 mm. Weight for height/ length Z score was assessed using WHO growth charts.

Medical and nutritional management of all children was done 2 phases:

a). Stabilization phase b). Rehabilitation phase

In the stabilization phase (usually for first 3-7 days), the babies were treated with the use of appropriate antibiotics, appropriate intravenous fluids, blood transfusions, symptomatic therapy as per standard guidelines. (Bhatnagar et al, 2007).[9] The patients were given WHO F-75 diet during the stabilization phase usually through the oro-gastric route initially.

After stabilization, when child improved medically and appetite improved, more energy dense feeding with F-100 diet was started. Also, therapeutic diet and home based diets like khichdi, dalia, banana, kheer, chapatti, dal etc. were added. In addition to this, all children were given micronutrients (including Vitamin A, Vitamin B complex, Vitamin C, Vitamin D, vitamin K, folic acid, zinc, calcium, magnesium and potassium and others) in appropriate doses. Children were nursed in a separate malnutrition treatment corner and tender loving care (TLC) and developmentally supportive care was provided. All the feeds were prepared in the dietetics department of our hospital under the direct supervision of dietitian in a safe and hygienic environment. Apart from this, the parents were also educated about preparation of such diets and locally available therapeutic foods before discharge.

All children were assessed daily for weight gain, improvement in appetite, any feeding problem, clinical improvement and loss of edema. Children were discharged on meeting the discharge criteria as per WHO:

1. 15% weight gain from the day of admission.

2.Absence of infections and medical complications.

3. Disappearance of edema

4. Care givers trained to give diet, supplements and take care of the child at home

5. On request, if good weight gain (>10gm/kg/day) for 3 consecutive days.

(WHO Child growth standards, 2009)[7]

After discharge, children were followed up weekly in pediatrics outpatient department for 1 month or until cured. The outcome criteria i.e. cured or not cured were determined after 1 month follow up. **Data analysis:** Data was recorded in Microsoft excel sheet. Data analysis was done with SPSS software version 16. Statistical tests used were chi square test and P value<0.05 was considered statistically significant.

RESULTS:

A total of 102 children out of 131 screened fulfill the inclusion criteria of SAM during the study period. The baseline characteristics and socio-demographic profile of all the children are as shown in **Table 1**.The majority of children were present in the infantile age group of 6 months to 1 year (61, 59.8%).Socially, the majority (94, 92.16%) belonged to lower socio-economic status.

The feeding practices of all children are as shown in **Table 2**. A total of (76, 74.51%) children were exclusively breastfed till 6 months of age while 26 (25.49%) children had faulty/inadequate breastfeeding. Delayed introduction of complementary feeds was observed in 80(78.43%) children. The future outcome was better in children with timely introduction of complementary feeds as compared to those with delayed introduction of complementary feeds. **(67/80, 83.75% vs. 22/22, 100%) (P<0.05)**.

The major clinical co-morbidities among the study children are shown in **Table 3**. Severe anemia (Hb<7 gram %) was found in maximum number of children (58, 56.86%) followed by diarrhea (27.45%) and lower respiratory tract infection (19.6%). Sepsis was seen in 12 (11.76%) of children. Edematous malnutrition was seen in 5 children. Specific nutritional deficiencies like rickets (in 8 patients), nutritional tremors syndrome in 3 and scurvy was seen in 1 child. Among biochemical abnormalities, electrolyte imbalance was present in 23 (22.54%) children while hypoglycemia was present in 2 (1.96%) children.

Out of the total of 102 children, 89 (87.25%) children had a positive outcome (recovered) and were discharged while 13 (12.75%) children had an adverse outcome (death/unrecovered/ left treatment).

DISCUSSION:

This was a prospective observational study which included children aged 6 months to 5 years admitted in pediatric ward with SAM over a period of one year. There was no sex predilection among males and females with regard to prevalence of SAM. It was similar to findings of Das et al (2017), Aguayo et al (2012), Ubesie et al (2012) and Gernaat et al (1998).[10,11,12,13] Majority of the children with SAM belonged to the age group of 6-12 months (50.98%) followed by 12-24 months (29.41%). This suggested a predominant number(80% of study population) was below 2 years of age which was similar to past studies by Jena et al (2018) and Mahgoub et al (2012).[14,15] This could be explained in view of inadequate and delayed complementary feeding which was documented in significant number of children in the study population (80/102,

78.43%). This is consistent with the findings of Jena et al (2018) who had observed delayed complementary feeding in 65% of malnourished children.[14] Continuation of breastfeeding for a long time without adequate addition of complementary feeding is detrimental for a child's health after six months of age as caloric and nutritional requirements are not met by breast milk alone.

Also, inadequate diversification of diet with high calorie foods and unhygienic methods for preparation of complementary feeds could be corroborating factors as suggested by diarrhea in 27.45% of study population. Another important factor was that92% children with SAM belonged to low socioeconomic status and only 1% to upper socio-economic status by Kuppuswami index. (Singh et al, 2017).[8] This is similar to findings by Singh et al (2006), and Kumar et al (2018).[16,17] This is due to inadequate food availability, poor purchasing capacity and illiteracy among lower socio-economic strata. In our study, 68.63% children were completely immunized for age, 29.41% had incomplete immunization while only 1.96% were unimmunized which is in contrast to the results of Das et al (2017), Jena et al (2018) and Sharma et al (2004).[10,14,18] It might be due to better coverage and greater number of diseases covered in revised national immunization schedule as compared to past studies.

Among clinical complications, severe anemia (Hb < 7 gram%) was found to be the most common co-morbidity (56.86%)followed by diarrhea (27.45%) and acute lower respiratory tract infection (LRTI) in 19.6%which was similar to the observations of Das et al (2017), Kumar et al (2018) and Mathur et al (2016).[10,17,19] The prevalence of sepsis in 12 patients (11.76%) and LRTI in 19.6% can be very well explained as malnourished children have poor immune status thus predisposing them to various infections. Edema was seen in only 4.9% of children in our study while Kumar et al (2018) observed a higher prevalence of edema in their studies.[17]

Nutritional tremor syndrome was observed in 2.94% of children in our study which has not been reported by any other study from this part of country. Florid clinical rickets was observed in 8 patients thereby stressing the need of routine vitamin D3 supplementation in children.

Majority of children (89, 87.25%) in our study showed good outcome (recovered) while13 out of 102 (12.75%) children showed an adverse outcome. However, out of these 13 children, only 1 death was reported, rest of the children either left treatment against medical advice or did not turn for follow up. This was comparable to similar studies of the recent past by Das et al (2017) and Kumar et al (2018).[10,17]

Conclusion:

Our study concludes that the most vulnerable group for severe malnutrition is 6-12 month and most belonged to low socioeconomic status. Most common factor associated in them was delayed/improper complementary feeding. This is self- explanatory as weaning starts post 6 months in most children. Most common co- morbidities were anemia and diarrhea.

The study reaffirms that hospital management of children with SAM is very

much possible if managed as per evidence based nutritional and medical guidelines. The importance of patience cannot be overemphasized as these kids require prolonged admission time in hospital settings. Also, health care providers need to educate and sensitize general public about the importance of timely initiation of complementary feeding with age appropriate locally available foods and hygienic food practices so as to prevent malnutrition in children to break malnutrition-disease-malnutrition cycle. This will lead to healthy children and brighter future for our society as a whole.

Conflict of interest : none

Contribution of Authors: Dr. Poonam Mehta nee Marwah- conceptualized and designed the study, interpretation and analysis of data, review of literature, manuscript writing. Parul Singh - Data collection and analysis. Both the authors approved the final manuscript

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Table 1: Baseline data of children with severe acute malnutrition (SAM) enrolled in the study (n=102).

Variables		Outcome			Chi-Square	p-value
		Total	Cured	Not cured		
Age	6 Month-12 Month	61	52(50.98%)	9(8.82%)	1.819	0.403
	12 Month-24 Month	33	30(29.41%)	3(2.94%)		
	24Month-59 Month	8	8(7.84%)	0(0.00%)		
Sex	Male	50	44(43.14%)	6(5.88%)	0.005	0.942
	Female	52	46(45.10%)	6(5.88%)		
Birth Order	First	28	26(25.49%)	2(1.96%)	10.167	0.071
	Second	37	30(29.41%)	7(6.86%)		
	Third	17	17(16.67%)	0(0.00%)		
	Fourth	10	10(9.80%)	0(0.00%)		
	Fifth	8	6(5.88%)	2(1.96%)		
	Sixth	2	1(0.98%)	1(0.98%)		
Low birth weight (<2.5kg)	Yes	8	7(6.86%)	1(0.98%)	0.005	0.946
	No	94	83(81.37%)	11(10.78%)		
Socio-Economic Status	Upper	1	1(0.98%)	0(0.00%)	1.157	0.885
	Upper Middle	1	1(0.98%)	0(0.00%)		
	Lower Middle	5	5(4.90%)	0(0.00%)		
	Upper Middle	1	1(0.98%)	0(0.00%)		
	Lower	94	82(80.39%)	12(11.76%)		
Immunization Status for age	Complete	70	61(59.80%)	9(8.82%)	0.302	0.86
	Incomplete	30	26(25.49%)	4(3.92%)		
	Unimmunized	2	2(1.96%)	0(0.00%)		
Total		102	89(87.25%)	13(12.75%)		

Table-2 Feeding practices in children with severe acute malnutrition (SAM) (n=102)

Variables		Outcome			Chi-Square	p-value
		Total	Cured	Not cured		
Exclusively Breast fed for 6 month	Yes	76	66(64.71%)	10(9.80%)	0.557	0.455
	No	26	24(23.53%)	2(1.96%)		
Delayed Complementary Feeding	Yes	80	67(65.69%)	13 (12.75%)	3.959	.047*
	No	22	22(22.55%)	0		
Total		102	89(87.25%)	13(12.75%)		

Table 3: Major Clinical co-morbidities in Children with Severe Acute Malnutrition (SAM) (n=102)

	COMORBIDITIES	FREQUENCY	%
1.	SEVERE ANEMIA (Hb <7 gm %)	58	56.86
2.	DIARRHEA	28	27.45
3.	LOWER RESPIRATORY TRACT INFECTION	20	19.60
4.	SEPSIS	12	11.76
5.	DEHYDRATION	10	9.80
6.	RICKETS	08	7.84
7.	EDEMA	05	4.90
8.	CONGESTIVE HEART FAILURE	05	4.90
9.	SEIZURES	04	3.92
10.	NUTRITIONAL TREMORS SYNDROME	03	2.94
11.	SUB-ACUTE INTESTINAL OBSTRUCTION	02	1.96
12.	PSYCHO-MOTOR CHANGES	02	1.96
13.	URINARY TRACT INFECTION	02	1.96
14.	ENTERIC FEVER	01	0.98
15.	SCURVY	01	0.98
16.	TUBERCULOSIS	01	0.98
17.	MENINGITIS	01	0.98
18.	SHOCK	01	0.98
19.	MEASLES	01	0.98
20.	HYPOTHERMIA	01	0.98
BIOCHEMICAL FINDINGS			
01	ELECTROLYTE IMBALANCE	23	22.54
02	HYPOGLYCEMIA	02	1.96