

A Short Term (Six-months) Follow-Up of Growth Parameters and Co-Morbid Conditions in Severe Acute Malnutrition (SAM) Children Discharged from Nutrition Rehabilitation Centre (NRC) at Tertiary Level Care Hospital, Indore

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Abstract

Objective: Globally in 2018, the 49.48 million children under five were wasted 17 million were severely wasted. In India 21% are wasted, in Madhya Pradesh 25.8% are wasted and 9.2% are severely wasted. This study evaluates follow up of post discharge SAM children and assess them for growth outcomes and associated co-morbidities, risk factors leading to poor growth outcomes.

Study Design: A prospective observational study.

Setting: the study was conducted in Nutrition Rehabilitation Center of Chacha Nehru Balchikitsalaya and Maharaja Yashwant Rao hospital a tertiary care hospital over a period of 1 year.

Participants/Patients: 246 post discharged SAM children of age 1-59 months were enrolled and followed up for 6 months.

Intervention: Variables recorded were weight monitoring and response criteria. Follow up was done for next 8 visits to assess growth outcomes during follow up.

Results: Out of 246 SAM children, 51.8 % were females with 84% being <2 years. 37.6% had weight for height/length <-3 SD, 4.4% follow MUAC, 2.2% had Oedema, 53.1% follow Z score and MUAC both criteria at presentation. Successful follow-up seen in 91.9%, mean weight gain seen was 6621g at discharge to 8029g at 6-months, MUAC increase from mean value at discharge 108 mm to 111 mm at 6-months, 35.8%, 49.2% were below <-3 SD and <-2 SD at discharge to 3.1%, 7.1% at 6 months respectively, all found to be statistically significant. Most common morbidity associated was diarrhoea and pneumonia. 42.2% of children required inpatient management.

Conclusion: Along with Nutritional Rehabilitation Centre, a Community based programme of severe acute malnutrition is need of an hour.

Keywords: Community based programme, Nutrition Rehabilitation Centre, Severe Acute Malnutrition.

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Introduction

Severe acute malnutrition is a major global public health problem among children in developing countries including India.

Globally in 2018, 49.48 million children under five were wasted of which nearly 17 million were severely wasted. 4.7 million children under 6 months were moderate wasted and 3.8 million were severely wasted. In 2018 more than half of all wasted children belongs to South Asia followed by Sub Saharan Africa. [1]

As per NFHS 4 (National Family Health Survey-4, 2015-2016), In India 38.4% children under five are stunted, 35.5% are underweight, 21.0% are wasted and 7.5% are severely wasted. More than 15 % children under 6 months are severely wasted. In Madhya Pradesh 42% children under five are stunted, 42.8% are underweight, 25.8% are wasted and 9.2% are severely wasted.[2]

A child is considered to as SAM who fulfil WHO criteria of Severe Acute Malnutrition.

Current WHO management of severe acute malnutrition protocols are focused and include: High programme coverage; early identification and management of affected children, child who are clinically stable with good appetite (appetite test pass) is labelled as uncomplicated SAM to be managed as outpatients (community based management of acute malnutrition) using Ready-to-Use Therapeutic Food (RUTF); and inpatient care for the much smaller number of children who failed appetite test and with additional medical complications (complicated SAM).[3]

The community based management of acute malnutrition (CMAM) model has been used widely outside India, around 60 countries managed SAM children with CMAM Programme as their first-line strategy.[4] Although inpatient care through Nutritional Rehabilitation Centres and Malnutrition Treatment Centres of still being principal strategy.[5,6,7] It is crucial to adopt CMAM programme in India to overcome high burden of SAM in India and to provide widespread, effective coverage and treatment of all children with SAM.[8] The fact that follow up after acute and Nutritional rehabilitation phase is crucial is well known and treatment will be successful through community and facility participation. Not much is known about what happens post recovery and whether recovery is sustained at home, or in community over longer period. It would be less attractive as a public health intervention if recovery is not sustained and/or if it is associated with higher relapses or death. There are very less number of publications about studies conducted on short term and long term outcome in post discharged Severe Acute Malnutrition children. Hence in this study a short term follow up of post discharged Severe Acute Malnutrition children to access them for growth outcomes and associated co-morbidities along with risk factors leading to poor growth outcomes.

Materials and Methods

This prospective observational study was conducted in the Department of Pediatrics, MGM Medical College Indore and associated Maharaja Yashwant Rao Hospital (M.Y.H.) and Chacha Nehru Bal Chikitsalaya (CNBC).

The study was conducted for a period of 1 year from January 2018 to July 2019.

246 Post discharged SAM (1 month to 59 months) without systemic complication from Nutrition Rehabilitation Centre who was ready for follow up visits were included in our study. A voluntary written informed consent was obtained from parents of the children for allowing participation of their children in the study. The children were followed up 8 visits i.e. at 15, 30, 45, 60 days and then 3, 4, 5 and 6 months a total of 6 months duration. At every follow up visit, anthropometry and illness were recorded and feeding counselling and appetite test were done. In initially four follow up visit therapeutic special food were given as per protocol for optimum growth. Paired 't' test was applied using online statistical software for comparing weight, length, MUAC, weight for height/length, different types of illness. A p value of < 0.05 was considered as statistically significant. Before initiating the study in the institution, clearance from Institutional Ethics Committee was obtained.

Result

Out of 246 children enrolled in the study, 8.1% (20) of children were lost to follow up, among 226, 51.8% (117) were female and 48.2% (109) male. Malnutrition were commonly noticed in 13-24 months was 50%, followed by 2-12 months 34%. As per WHO admission criteria 6% (85) follow weight for height/length (Z score), 4.4% (10) follow MUAC, 2.2% (5) Oedema, 53.1% (120) follow Z score and MUAC both criteria, 5 (2.7%) follow all three admission criteria at presentation. (Table I)

Mortality was 0.0%, statically significant mean weight gain at discharge was 6621.199 gram to 8029.133 gram at 8th follow up (P < 0.005). Increase in MUAC from mean value at discharge 108.500 mm to 111.473 mm at 8th follow up, statistically significant

(P < 0.05). There was significant length/height gain in whole 6 months of follow up, with mean length was at discharge 70.469 cm to 70.553 cm post follow up. (P value < 0.05). (Table II)

Statistically significant (P value < 0.05) improvement in weight for length/height (Z score) status with time interval were noticed, at the time of discharge 88 (35.8%) were below < -3 SD and 112 (49.2%) were below < -2 SD to 7 (3.1%) below < -3 SD and 16 (7.1%) below < -2 SD at 8th follow up, 3.1% children still follow WHO admission criteria at the end of 8th follow up (Table III). 204 episode of illness were experienced during follow up visit, out of six type of illness, the most common was diarrhoea 31.86% (65) followed by Pneumonia 21.2% (43), fever 14.7% (30), cough and cold 11.3% (23), vomiting 9.3% (19), any other 11.8% (24), out of any other group only one patient was diagnosed as pulmonary tuberculosis. 57.8% were managed as outpatient and 42.2% required hospitalization for the management of illness. The difference among the six types of illness present among patients was found to be statistically significant (P < 0.05). The mean weight gain in follow up for Cough & Cold (1.783) is the highest and it shows the lowest score for Pneumonia (1.023). In pair wise comparison of the illness present result found that mean weight gain in follow up does not differ significantly except Cough & Cold & Pneumonia (P > 0.05) (table IV).

The mean weight loss during follow up for Pneumonia (6.622) is the highest and it shows the lowest score for Fever (1.380), in pair wise comparison among the illness result found that the mean weight loss during follow ups does not differ significantly with the illness present (P value > 0.05). (Table V) The mean of average weight gain (gram/kilogram body weight/day) during follow up were 1.313 with illness and 1.586 without illness.

Table 1: Baseline characteristic

Characteristic	Frequency	percentage
1. AGE(Months)		
• 1 to 12	77	34
• 13 to 24	113	50
• 25 to 36	22	10
• 37 to 48	10	4
• 49 to 59	4	2
2. SEX		
• Male	109	48.2
• Female	117	51.8
3. WHO admission Criteria		
• Weight-for-Height (Z score)	85	37.6
• MUAC	10	4.4
• Oedema	5	2.2
• Z score and MUAC both	120	53.1
• All three	6	2.7

Table 2: Pre-Post Comparison of Average Weight, MUAC, Length between different Time Intervals

Time Interval	N	Mean Weight	Std. Deviation	T Test	P Value	Mean MUAC	Std.	T TEST	P VALUE	Mean Length	Std.	T TEST	P-VALUE
At Disch (NRC)	226	6621.199	1360.099			108.500	16.923	6.032	0.000	70.469	7.042	3.552	0.000
At 1st Followu	226	6820.580	1416.261	12.590	0.000	108.867	16.905			70.522	7.028		
At 1st Followu	226	6820.580	1416.261			108.867	16.905	5.408	0.000	70.522	7.028	1.740	0.083
At 2nd Followu	226	7006.367	1461.945	18.270	0.000	109.212	16.900			70.535	7.027		

At 7th Followu	At 7th Followu	At 6th Followu	At 6th Followu	At 5th Followu	At 5th Followu	At 4th Followu	At 4th Followu	At 3rd Followu	At 3rd Followu	At 2nd Followu
226	226	226	226	226	226	226	226	226	226	226
7818.735	7818.735	7630.071	7630.071	7419.257	7419.257	7232.031	7232.031	7138.628	7138.628	7006.367
1626.974	1626.974	1577.247	1577.247	1601.687	1601.687	1504.678	1504.678	1488.855	1488.855	1461.945
24.436	21.862	9.005	9.005	7.661	7.661	18.503	18.503	13.262	13.262	
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
110.929	110.929	110.558	110.558	110.186	110.186	109.624	109.624	109.535	109.535	109.212
17.027	17.027	17.013	17.013	16.971	16.971	16.918	16.918	16.889	16.889	16.900
15.579	11.537			10.751	10.751	12.448	12.448	3.515	3.515	6.453
0.000	0.000			0.000	0.000	0.000	0.000	0.000	0.000	0.000
70.549	70.549	70.553	70.553	70.55 ^a	70.55 ^a	70.55 ^a	70.55 ^a	70.549	70.549	70.535
7.048	7.048	7.036	7.036	7.036	7.036	7.036	7.036	7.039	7.039	7.027
1.000	1.000			1.000	1.000	1.000	1.000	1.000	1.000	1.740
0.318	0.318			0.318	0.318	0.318	0.318	0.318	0.318	0.083

At 8th Followu	At Discharg	At 8th Followu											
226	226	226	8029.133	1654.240	32.326	0.000	111.473	17.023	22.084	0.000	70.553	7.049	
8029.133	6621.199	8029.133					111.473	17.023	22.084	0.000	70.553	7.049	
1654.240	1360.099	1654.240					108.500	16.923	22.084	0.000	70.469	7.042	4.304
													0.000

Table 3: Association between W/H Z score (SD) Value and Follow-up counts at different Time Interval

W/H Z score (SD)	Time Interval-Followups			Total	Result
		At Dischahrge (NRC)	At 8th Follow UP		
-2.	Count	1	0	1	Non Significant
	%	0.4%	.0%	.2%	
-3.	Count	5	0	5	Significant
	%	2.2%	0.0%	1.1%	
-4.	Count	2	0	2	Non Significant
	%	0.9%	.0%	0.4%	
< -1	Count	26	36	62	Non Significant
	%	11.5%	15.9%	13.7%	
< -2	Count	107	16	123	Significant
	%	47.3%	7.1%	27.2%	
< -3	Count	57	5	62	Significant
	%	25.2%	2.2%	13.7%	
< -4	Count	22	2	24	Significant
	%	9.7%	0.9%	5.3%	
< +1	Count	0	56	56	Significant
	%	0.0%	24.8%	12.4%	
< +2	Count	0	14	14	Significant
	%	0.0%	6.2%	3.1%	
< Median	Count	6	96	102	Significant
	%	2.7%	42.5%	22.6%	
Median	Count	0	1	1	Non Significant
	%	.0%	0.4%	0.2%	
Total	Count	226	226	452	
	%	100.0%	100.0%	100.0%	

Table 4: Comparison of Average Weight Gain in Follow-Ups Between Different Illness Present

ILLNESS	N	Average Wt. Gain in follow Up (g/kg body wt/day)	Std. Deviation	F Test	P Value
Vomiting	19	1.158	0.375	3.271	0.000
Cough & Cold	23	1.783	0.671		
Diarrhoea	65	1.338	0.923		
Pneumonia	43	1.023	0.672		
Fever	30	1.367	0.669		
Any other	24	1.333	0.761		
Total	204	1.309	0.774		

Post Hoc

Pair Wise Comparison		Mean Difference	Std. Error	Sig.	Result
Vomiting	Cough & Cold	-0.625	0.233	0.085	Non Sig
	Diarrhoea	-0.181	0.196	0.941	Non Sig
	Pneumonia	0.135	0.207	0.987	Non Sig
	Fever	-0.209	0.221	0.934	Non Sig
	Any other	-0.175	0.231	0.974	Non Sig
Cough & Cold	Diarrhoea	0.444	0.183	0.151	Non Sig
	Pneumonia	.759*	0.195	0.002	Significant
	Fever	0.416	0.209	0.350	Non Sig
	Any other	0.449	0.220	0.321	Non Sig
Diarrhoea	Pneumonia	0.315	0.148	0.276	Non Sig
	Fever	-0.028	0.166	1.000	Non Sig
	Any other	0.005	0.180	1.000	Non Sig
Pneumonia	Fever	-0.343	0.179	0.395	Non Sig
	Any other	-0.310	0.192	0.589	Non Sig
Fever	Any other	0.033	0.206	1.000	Non Sig

Table 5: Comparison of Average Weight Loss during Follow-Ups Between Different Illness Present

ILLNESS	N	Average Loss of Weight During follow ups (g/kg body wt/day)	Std. Deviation	F Test	P Value
Vomiting	19	2.731	3.959	1.871	0.101
Cough & Cold	23	3.610	15.793		
Diarrhoea	65	2.390	3.752		
Pneumonia	43	6.622	13.169		
Fever	30	1.380	2.837		
Any other	24	2.131	2.912		
Total	204	3.272	8.614		

Table 6: Post Hoc

Pair Wise Comparison		Mean Difference	Std. Error	Sig.	Result
Vomiting	Cough & Cold	-0.880	2.642	0.999	Non Sig
	Diarrhoea	0.340	2.223	1.000	Non Sig
	Pneumonia	-3.891	2.348	0.562	Non Sig
	Fever	1.351	2.499	0.994	Non Sig
	Any other	0.600	2.617	1.000	Non Sig
Cough & Cold	Diarrhoea	1.220	2.068	0.992	Non Sig
	Pneumonia	-3.011	2.202	0.746	Non Sig
	Fever	2.230	2.362	0.934	Non Sig
	Any other	1.480	2.487	0.991	Non Sig
Diarrhoea	Pneumonia	-4.231	1.675	0.122	Non Sig
	Fever	1.010	1.881	0.995	Non Sig
	Any other	0.259	2.036	1.000	Non Sig
Pneumonia	Fever	5.242	2.027	0.106	Non Sig
	Any other	4.491	2.172	0.308	Non Sig
Fever	Any other	-0.751	2.334	1.000	Non Sig

Discussion

In our study; out of 246 children enrolled, 8.1% (20) of children were lost to follow up. Aprameya HS *et al.* found 30% loss-to-follow up, distance from Nutritional rehabilitation unit (NRU), travelling and food expenses, and loss of daily wages were the factor responsible for reduced compliance with follow-up visits. Lost to follow up were reported 0.0%, 12%, 23%, 24%, 25%, 45% in Khare RD *et al.*, Kerac M *et al.*, Khanum S *et al.*, Burza S *et al.*, Bahwere P *et al.*, Somasse YE *et al.* respectively.[10-15,22]

Malnutrition was more commonly noticed in the age group of 13-24 months was 50 %, followed by 2-12 months 34%. It is recognized that infants who are beyond 6 months of age continued on Breast Feeding tend not to remain healthy and not to grow well, the monotony of the diet in fact may contribute to anorexia, often noted in the second six months of life.[25]

Similar result were found in Chaturvedi *et al.*, Burza S *et al.*, Aprameya HS *et al.*, Singh *et al.*, found that majority of admission were less 2 years old.[6,10,15,24]

51.8% (117) were female and 48.2% (109) male, similar result were found in Chaturvedi *et al.*, Burza S *et al.*, Taneja *et al.*[7,10,15,23]

Out of 226, 37.6% (85) follow weight for height/length (Z score), 4.4% (10) follow MUAC, 2.2% (5) Oedema, 53.1%(120) follow Z score and MUAC both criteria, 5 (2.7%) follow all three admission criteria at presentation. Similarly Singh *et al.* found that 70.7% had both the criteria 8.1% had oedema [16]Aprameya HS *et al.* found the same result except None had edema at presentation.[10] Kumar *et al.* reported 27% oedematous malnutrition.[17]

Mortality in our study was 0.0%, however we were not able to trace lost to follow up cases because of we were unable to make contact with them. Similar result were found in chaturvedi *et al.* and Burza S *et al.* of 0%, 1% mortality respectively. Highest mortality were reported by Kerac M *et al.* that was 10%, in other study Khanum S *et al.*, Bahwere P *et al.*, Aprameya HS *et al.*, Somasse YE *et al.* reported 2%, 3.87%, 4%, 9% mortality respectively.[10-15,20]

Mean weight gain at discharge 6621.199 g to 8029.133 g at 8th follow up was noticed which were statically significant (p value < 0.05). Similar result found by Aprameya *et al.* also [6]. No significant gain in length/height at each follow up visit, but significant length/height gain in whole 6 months of follow up mean length/height was 70.469 cm at discharge from NRC to 70.553 cm at 8th follow up (P value < 0.05). We were not considered weight for age (WAZ) because it is not considered in WHO guidelines, whereas most of the study consider it in anthropometric analysis.

There is statistically significant ($P < 0.05$) gain in MUAC from mean value at discharge 108.500 mm to 111.473 mm at 8th follow up. Similar result found by Taneja *et al.*, Saxena DM *et al.* found that the mean MUAC increase during admission and discharge but decrease in follow up. Sometimes mean MUAC during follow up was decreased due to again negligence of parents for providing sufficient nutrition to children [7,21]. There was gradually improvement in weight for length/height status with time interval at each follow up visit, at the time of discharge 88 (35.8%) children were below < -3 SD and 112 (49.2%) were below < -2 SD and at the time of 8th follow up 7 (3.1%) children were below < -3 SD and 16 (7.1%) were below < -2 SD, which were statistically significant (P value < 0.05), after 8th follow up 3.1% follow WHO admission criteria of SAM. Similar results were reported in the study by Khanum *et al.* and Kerac *et al.* [11,14].

204 episode of illness were experienced during follow up visit out of six type of illness the most common was diarrhoea 31.86% (65) followed by Pneumonia 21.2% (43), Fever 14.7% (30), Cough and cold 11.3% (23), vomiting 9.3% (19), any other 11.8% (24) out of any other group only one patient was diagnosed as pulmonary tuberculosis. 57.8% were managed as outpatient and 42.2% required hospitalization for the management of illness. Similar results

were reported in the study by Khanum and Ashworth [14]. Multiple co-morbidities found in our study, this was supported by Kumar R *et al.*, Bahwere *et al.*, Chaturvedi *et al.* [17,20,24]

The difference among the six types of illness present among patients was found to be statistically significant ($P < 0.05$). The mean weight gain in follow up was highest for Cough & Cold (1.783) and lowest score for Pneumonia (1.023). In pair wise comparison of the illness mean weight gain in follow up does not differ significantly except Cough & Cold & Pneumonia ($P > 0.05$).

The mean weight loss during follow up for Pneumonia (6.622) is the highest followed by cough/cold then diarrhoea and lowest score for Fever (1.380). In pair wise comparison among the illness mean weight loss does not differ significantly (P value > 0.05).

Diarrhoea was the most common associated morbidity and leads to poor weight gain and weight loss in our study. Khanum *et al.* found that Children who experienced more diarrhoea had lower than average weight gain ($P = 0.08$). It is therefore likely that the high prevalence of diarrhoea morbidity constrained growth. Many studies have shown an adverse effect of diarrhoea on growth. [14,22,23] The mean of average weight gain (gram/kilogram body weight/day) during follow up were 1.313 with illness and 1.586 without illness. The children's average weight gain after discharge was below the recommended national and international standards. [18,19], and lower than that achieved by other programs in India [17] and Community Based Management of Acute Malnutrition (CMAM) programs elsewhere [9] Similar result were reported by Chaturvedi *et al.* [24] Our result show, children gained post discharge weight below the national standards of care, poor length/height gained, suffered multiple morbidities, defaulted on follow-up visits. These are important

findings and it strengthen the need for finding appropriate solutions to provide effective care for SAM children in the program. At present in our state around 315 NRC 3 SMTU are functioning for SAM management only few parts of state started with community based programme the results yet to come as shown in different part of country where CMAM programme has been found to be beneficial in post discharge SAM management.

Conclusion

We conclude that our result show, children gained poor post discharge weight, height/length, suffered multiple morbidities, defaulted on follow-up visits and high prevalence of malnutrition in our state. Based on the study findings and strengthens the need for finding appropriate solutions to provide effective care for SAM children in the program. We therefore recommend the implementation of community-based management programme of severe acute malnutrition is need of an hour.

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