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Effectiveness of Nutritional Rehabilitation Center in the Management of Children with Edematous Severe Acute Malnutrition (E-SAM) In India

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ABSTRACT: Research question: What are the outcome children with edematous severe acute malnutrition in nutritional rehabilitation centre (NRC)?**.** Setting- NRC of a tertiary care center**.** Study design- Retrospective observational study. Participants- Children with edematous severe acute malnutrition aged between 6 to 60 months. Methodology – Outcome indicators of NRC studied were complete cure, achieved target weight, discharge without target weight, defaulter, relapse, death, non responder. Complete cure and target weight was defined as weight for height > -1 Standard Deviation and as 15 % weight gain after disappearance of edema respectively**.** Results: Seventeen percent (n=190) of the NRC admissions were having E-SAM. Mean length of hospital stay was 16 days which was significantly more in grade 1 edema group. Average weight gain of children who got discharged from the facility was 9 g/kg/day. Twelve percent children achieved complete cure, while 42 % children gained target weight. Total discharges from the facility were 62%. Twenty six percent children were defaulters and death rate was 1.6 %

Key words: Child, edema, malnutrition, rehabilitation, outcome

I. INTRODUCTION

United Nations Children Fund (UNICEF) reported that about half of the deaths among children under five children are due to malnutrition [1]. Globally prevalence of wasting is 6.9 % while in South Asia region its burden is as high as 14.3 % which includes India and Pakistan [2]. According to National Family Health Survey-4 (NFHS-4), in India 7.5 % under five children are severely wasted and 35.8 % children are underweight. Under National Health Mission, 1151 Nutritional rehabilitation centre (NRC) has been started in various places by the Government of India for the management of severe acute malnutrition (SAM) to decrease the under five mortality [3]. SAM includes both severely wasted and edematous malnutrition. Around one-fifth of the total SAM is edematous SAM as found by Elizabeth KE (2012) and Meena MB et al (2018) in their study [4, 5]. Edematous malnutrition is more severe form of malnutrition with mortality 3-4 times higher than severe wasted children. So, we aimed was to find out the treatment outcome of children with edematous malnutrition treated in the NRC.

II. METHODS

We conducted a retrospective study from September 2018 to April 2019. All children between the age of 1- 60 months with edematous severe acute malnourished (E-SAM) admitted in the Nutritional Rehabilitation Centre (NRC) of a tertiary care center of eastern Uttar Pradesh from January 2011 to July 2018 were enrolled in the study. The data was collected from the SAM register which was filled daily during the admission of the child. E-SAM was defined as any severe acute malnourished child having bilateral pitting edema without any other cause of edema. Severe acute malnutrition in children was defined as weight for height/ length (W/H) <-3 standard deviation (SD), and/or mid upper-arm circumference (MUAC) <115mm, and/or bilateral edema. Edema was graded as (i) grade 1- edema only on feet, (ii) grade 2- edema on feet and legs, (iii) grade 3 – generalized edema. The patients were managed according to World Health Organization Guidelines on the management of severe acute malnutrition in facility (2013) and operational guidelines for the management of SAM in facility given by ministry of health and family welfare (2011) [6,7]. The children with E-SAM were started on F-75 milk starter diet at the rate of 100 ml/kg/day as compared to SAM children who were given 130ml/kg/day. Vitamin A was given once the edema subsided (except when features of Vitamin A deficiency

were present) unlike in SAM children who were given Vitamin A on Day one. After complete disappearance of edema, the target weight (15 % weight gain) was calculated and patient was shifted to transition phase followed by rehabilitation phase. Children were started on empirical antibiotic therapy and baseline investigations were sent to find out any underlying infections and other relevant investigations according to sign and symptoms. The outcomes which were studied were (a) complete cured – children who achieved W/H >-1 SD, (b) Achieved target weight- achieved 15 % weight gain after losing edema. Patient were given hospital care till they attained target weight, (c) discharged without target weight- children who gained >8g/kg/day weight for 3 consecutive days, had lost edema completely and cured for all medical conditions were discharged before achieving 15 % on personal request. Their attendants were trained for diet and home care. (d) medical transfer- the children who deteriorated during stay in NRC were immediately transferred back to the casualty department of the hospital, (e) defaulter- the children who left treatment against medical advice, in whom medical conditions were not treated (f) non-responders- children who were unable to achieve target weight even after 28 days of NRC stay (g) relapse- children who after achieving target weight again developed W/H <-3 SD within 2 months of discharge from the hospital (h) death- children who died in medical transfers or in NRC. Average weight gain was calculated by: {Discharge weight in grams - minimum weight in gms}/{minimum weight in kg x number of days between date of minimum weight and discharge day}. These children were followed up in outdoor patient department of NRC every 2 weekly for four times.

a. Data analysis- Percentages and mean was calculated for determining the outcome. The three grades of edema were compared using chi square test and ANOVA test.
b. Research ethics was followed during collecting the data and confidentiality of reports was maintained. The ethical clearance was taken from institutional ethical committee.

III. RESULTS

A total of 190 (17 %) out of 1118 children with E –SAM were admitted in the duration of study. The mean age of the children was 19.02± 11.90 months with male to female ratio of 0.9:1. Mean weight, height/ length and MUAC on admission were 6.64±1.65, 70.70±7.45 and 108.69±20.72 respectively. Severe {height for age (H/A) <-3 SD}, moderate (H/A between -2 to -3 SD) and mild (H/A between -1 to -2 SD) stunting was present in 150 (78%), 18 (9 %) and 20 (10%) children respectively. Forty (20.80 %) and 52 (27 %) children had W/H <-3 and <-4 SD respectively while 96 (50 %) children had W/H between -3 to -2 SD. Mild, moderate and severe edema was present in 79 (41.40%), 46 (24%) and 65 (33.90%) children respectively ***(figure I).***

The mean day on which edema started subsiding was 2.92±2.12 days and mean day on which children started gaining weight after complete disappearance of edema was 8.42±4.03. One hundred fifty eight (86%) children lost edema before day four of admission. One hundred two (72.74 %) children out of 143 children lost edema before day 10 of admission.

The mean duration of hospital stay was 16.23±9.09 days. Outcome indicators are shown in ***Table I.*** Twenty three (12.1%) out of 119 children who were discharged, were completely cured, while 14 (11.7 %) children were still having W/H <-3SD. Average weight gain of children who got exit from NRC was 9.43±5.90 g/kg/day. The mean number of follow ups 1.29 ±1.55 while 88 (45.8%) children did not come for any follow up A comparative analysis of the 3 grades of edema is given in ***Table II.*** The W/H on follow is given in the ***Figure 2***.

IV. DISCUSSION

Seventeen percent (n=190) of the NRC admissions were having E-SAM, out of which severe edema was present in 33.9% children. Most of the children were below 2 years of age and females were more than males. Forty seven percent (n=92) children also had severe wasting i.e marasmic kwashiorkaor and 50 % children had moderate wasting. Severe stunting was found in 78% (n=150) of the children. Most of the children started losing edema on day 3 and edema was lost significantly earlier in mild edema group. Most of the children started regaining weight on day 8 and it was significantly earlier in mild edema group. There was at least one follow up after the discharge from the facility while 45 % did not come for any follow up. Mean length of hospital stay was 16 days which was significantly more in grade 1 edema group. Average weight gain of children who got discharged from the facility was 9 g/kg/day. One hundred nineteen (62 %) children discharged from the facility. Twenty three (12.1 %) children achieved W/H > -1SD (complete cure) after discharge from the facility and 82 (43 %) children achieved target weight but never had complete cure over 2 months of follow up. Death rate was 1.6% and about one fourth children defaulted from the facility.

Limitation of our study is its retrospective nature so that we were not able to identify exact day on which edema was completely disappeared. Strength of the study was that data was acquired from NRC in which proper WHO guidelines were followed for the management of E-SAM.

Study done by Elizabeth KE (2012) and Meena MB et al (2018) showed that one fifth of the SAM children are E- SAM similar to our study [4, 5]. Study done by Suman RL, Sharma BL and Meena P et al in

2016 showed that mean age of children with E-SAM was 16.54 ±11.05 months similar to our study in which mean age of children was 19.02+/- 11.90 months [8]. Studies show that concurrent edema and wasting in children treated in NRC range from 32.3% to 60 % of children similar to our study where 47.8 % children having marasmic Kwashiokor [5, 8]. More than three fourth of our children had severe stunting along with SAM similar to the study done by Saaka M and Galla SZ (2016) who also found a strong correlation between wasting and stunting in children below 5 years of age [9]. Most (86%) of the children started losing edema on day 3 and 72% of them lost edema completely before day 10 in our study. So, primary failure rate (failure to start to lose edema on day 4 and failure to lose complete edema by day 10) was low according to the Operational guideline on facility based management of children with severe acute malnutrition given by Ministry of Health and Family welfare, Government of India [7]. Study done by Suman RL et al (2016) also showed the mean day on which edema started decreasing was day 3 and mean day on which edema disappeared completely was day 10. They also showed that both these factors were achieved earlier in mild edema group similar to our study [7].

Study by Singh K et al in 12 NRC's of Uttar Pradesh showed 53 % children discharged after gaining target weight while in our study only 43 % E-SAM children gained target weight [10]. Overall cure rate (including those who achieved target weight) by the study of same centre was 68.8 % while that in E SAM in this study it is only 55% [11]. Relapse rate and non-responder rate of E-SAM is also similar to SAM children [11]. Eighty eight (46 %) patients did not come for any follow up in our study. Similar results were also found in a systemic analysis done by Sullivan NPO and James P (2018) [12]. They found that that distance from NRC, travelling and food expenses and loss of daily wage were some factors for decreased follow up. In our study we found that out of those who came for follow up only 23 (12.1 %) children achieved complete cure i.e. W/H > -1SD while 7 (14 %) children still remained below <- 3SD. Study done in Bangladesh by Ashraf H, Alam NH and Chisti MJ et al in 2012 showed 28 % children remained below -3 SD after 3 months of follow up while 53 % children were having >-2 SD on follow up similar to our study [13]. Death rate (1.6%) of children with E SAM in our study was similar to study by Singh K et al in which it was 1.2 % [10]. But Study done by Kumar D et al showed increased mortality in children with E- SAM [14].

V. CONCLUSION

E-SAM can be managed effectively in NRC, but cure rate of children with E-SAM is lower than children with non edematous SAM. Other treatment outcomes of children with E-SAM are similar to children with SAM. Severe stunting is an important associated finding with E- SAM which adds on to the risk of mortality. We recommend association of these NRC's with community rehabilitation schemes to track the defaulters as well as follow up of discharged patients for complete cute.

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Declaration of conflict of interest- none

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Table I: Outcome indicators of E-SAM

Outcome indicator	Number of children		Percentage	
Complete cure	23	Total -119	12.1	62.63
Achieved target weight	82		43.1	
Discharged without target weight and did not achieve target weight on follow up	14		7.3	
Medical transfer	9		4.7	
Defaulter	51		26.8	
Non responders	4		2.1	
Relapse	1		0.5	
Death	6		1.6	

Table II: Comparison of grades of edema in children with E-SAM.

S. No	Outcome	Grade 1	Grade 2	Grade 3	P
A1	Complete cure	8	7	8	0.002#
2	Achieved target weight	45	16	21	
3	Discharged without target weight	7	3	18	
4	Medical transfer	2	3	4	
5	Defaulter	14	10	27	
6	Non responders	1	3	0	
7	Relapse	0	0	1	
8	Death	1	3	2	
65B	Length of stay (days±SD)	18±9.5	14.82±9.75	14.67±7.62	0.05*
C	Mean day to start losing edema	2.8±2.09	3.1±2.07	3.9±2.20	0.005*
D	Mean day to start gaining weight	7.42±4.01	8.67±3.47	9.7±4.2	0.003*

#= chi square test, * = ANOVA test

Figure I: proportions of grades of edema in children with E- SAM

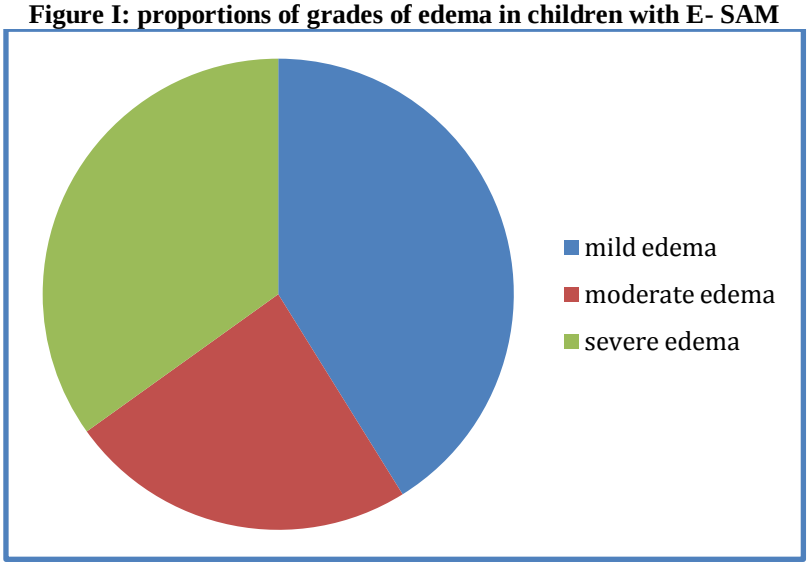
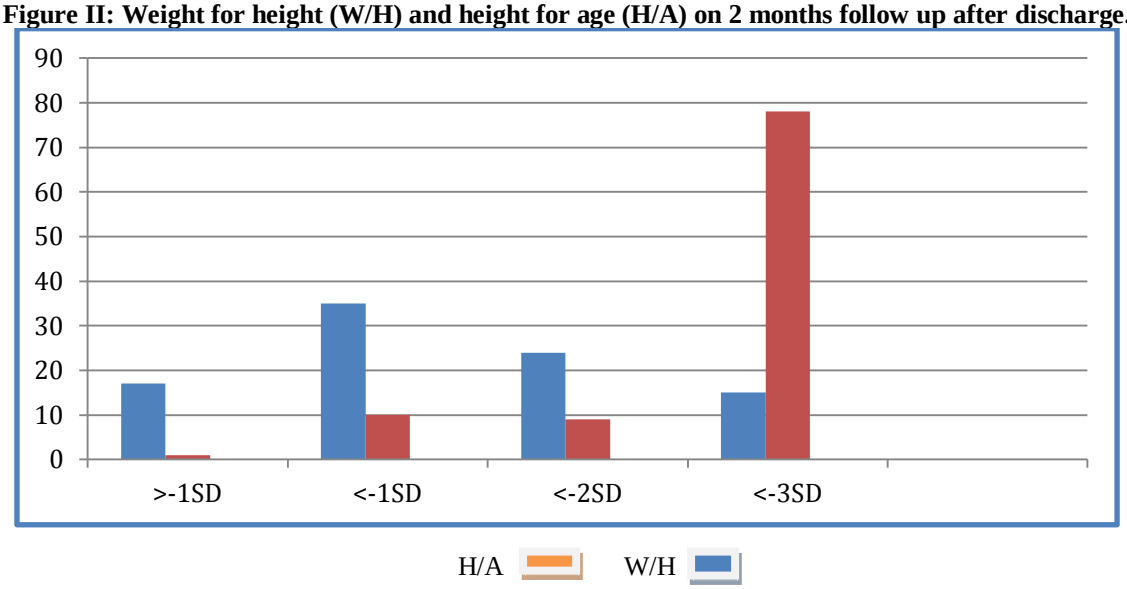


Figure II: Weight for height (W/H) and height for age (H/A) on 2 months follow up after discharge.



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