Original Research Article

Etiological factors of severe acute malnutrition and impact of nutrition rehabilitation centre: a prospective observational study from Bhavnagar

Vibhuti D. Gamit*, Jayendra R. Gohil, Adithya Nikhileshwar B., Tanmay P. Vagh

Department of Pediatrics, Government Medical College, Sir T General Hospital, Bhavnagar, Gujarat, India

*Correspondence:
Dr. Vibhuti D. Gamit,
E-mail: gamitvibhuti17@gmail.com

ABSTRACT

Background: Severe acute malnutrition (SAM) causes almost half of childhood deaths in children <5 years in developing countries. In India, as National Family Health Survey (NFHS), prevalence of SAM has increased from 6.4 in NFHS-3 (2005-2006) to 7.5% in NFHS-4 (2015-1016); [5.8 to 9.5% Gujarat]. The aim of study was to determine the etiological factors and outcome of SAM and the benefit of nutrition rehabilitation centre (NRC) among 6 months to 5 years children at the Pediatrics, NRC ward, Sir T. General Hospital.
Methods: A prospective observational study of 151 SAM children over nine months. Etiological factors were determined by history and relevant investigations, exclude other systemic disorders. Therapeutic nutrition was provided for 14 days. Cases were followed up two weekly for 2 months by monitoring weight after NRC admission.
Results: Association was found between Small for gestational age (64.9%), joint family (59.6%) and low birth spacing (59.6%) as etiological factors leading to SAM. 81.5% children gained weight during 14 days NRC stay. Weight gain was noted at follow-up. Defaulter rate increased from 9.9% at discharge to 28.5% at 2 months follow-up. Weight was static for 9% children. 34.4% children were from rural area and 65.6% from urban area. 23.8% children had received pre lacteal feed. Timing of complementary feeding was incorrect in 29%. There were no deaths.
Conclusions: Small for gestational age, joint family, low birth spacing, and incorrect feeding practices and urban residence were etiological factors. NRC stay (defaulter rate 26%), produced weight gain in SAM children.

Keywords: SAM, Severe acute malnutrition, Etiological factors, Nutrition rehabilitation centre

INTRODUCTION

Worldwide, the prevalence of severe acute malnutrition (SAM) is 1–2% in developing and in least developed countries.[1] Mortality in SAM children is 9 times higher than nourished children and continues to be an important major mortality factor.[2]

In India, SAM continues to be a significant public health issue. As per National Family Health Survey-4 (NFHS-4), nearly 8.1 million children aged <5 years (6.4%) suffer from SAM.[3] SAM increases mortality, morbidity, impairs physical and mental capabilities of child so require urgent attention with nutritional rehabilitation.

Nutritional rehabilitation centre (NRC) is a unit in a district health facility where SAM children are admitted and provided medical and nutritional therapeutic care as per SAM management guidelines by World Health Organization (WHO) and Indian academy of paediatrics.[4,5]

The Nutritional Rehabilitation Centres are facility based care units where severely acute malnourished (SAM) children below five years are admitted with their mothers for treatment, stabilization.

Previous studies regarding effectiveness of NRC have shown a definite impact in reducing case fatality rates; however, defaulter rates in their subsequent follow-ups have been high.[6-8]

Furthermore, to reduce occurrence and long-term consequences of malnutrition, there is an urgent need for recognizing risk factors/determinants of malnutrition and implement interventions to rectify them.

Aims and objectives

This prospective observational study aimed to determine clinico-epidemiological factors responsible for severe wasting among 6 months to 5 years old children admitted at baby medical ward and NRC, a tertiary care teaching hospital, Bhavnagar; to determine the socio-demographic factors of severe and moderate acute malnutrition (SAM and MAM); and to assess the effect of NRC in SAM.

METHODS

Design of study

A prospective observational study was conducted in baby medical ward and NRC, pediatrics department in tertiary care centre Sir T. Hospital, Bhavnagar, Gujarat.

Sample size

151 children aged between 6 months to 5 years were enrolled if they met the study criteria. These included patients admitted in baby medical ward and NRC that were identified at the outpatient department of the hospital. Informed and written consent was taken from parents of the children after explaining them about study. All children included in criteria of severe acute malnutrition.

Ethical approval

The study was approved by the research and ethics committee of institutional review board (IRB)/human ethics committee (HEC) of Government Medical College, Bhavnagar No.799/2018. Written informed consent was obtained from the parents for participation and publication of medical details.

Study duration

The duration of the study was from January 2019 to August 2019.

Inclusion criteria

Children of 6 months to 5 years of age with severe acute malnutrition satisfying following criteria will be included and admitted to day-care NRC: weight-for-height less than -3 SD and/or; visible severe wasting and/or; mid upper arm circumference (MUAC) <12 cm and/or bipedal oedema.

Exclusion criteria

Patients with left lip, cleft palate, gastro-esophageal reflux disease (GERD), other surgical conditions, chronic renal failure, congenital heart diseases, liver disorders, asthma, mental retardation, cerebral palsy, suspected case of inborn error of metabolism and children less than 6 months of age were excluded from the study.

Etiological factors were collected by questionnaire method. The nutritional status was assessed by anthropometric measurements (weight, height/length, MUAC, weight for height, edema) at admission. Weight of the children was measured using electronic weighing scales. Height was measured against a non-stretchable tape fixed to a vertical wall, with the participant standing on a firm/level surface and it was measured to the nearest 0.5 cm. Recumbent length (for children <24 months of age) was measured using an infant measuring board and MUAC measured by an MUAC tape designed by UNICEF and based on Shakir's tape for measuring MUAC.

Detailed history, clinical and systemic examination and anthropometry to detect presence/absence of medical complications based on the criteria for the integrated management of neonatal and childhood illness was done.

Therapeutic nutrition was given to babies for a minimum period of 14 days. Children with medical complications, and/or bilateral pitting edema, and/or with poor appetite were fed F−75 to provide (75 cal and 0.9 g protein/100 ml). These children were fed F−75 diet every 2 hours at first day while their medical complications were treated and monitored by a physician. After completion of initial 24 hours in NRC, children were fed F−100 (100 cal and 2.9 g protein/100 ml) diet until the child was discharged from the unit. Along with that additional daily meal as child can take were given. Mothers were counselled regarding hygiene, health, and nutrition. Daily weight was monitored.

Children were discharged on 14th day if weight gain. If there is no weight gain then they have to complete total 21 days at NRC.

Analysis

Multivariate analysis was used to find the association between the socio-demographic parameters, child feeding practices and nutritional status. The nutritional status was assessed by calculating the height for age (wasted) for each child and was compared with the CDC 2000 value. The z-scores±2 SD were considered as the cut-off values and were considered as normal. And between 2 to 3 SD consider as moderate acute malnutrition.

Parents were paid Rs. 100/- per day for 14 days NRC stay with Rs. 200/- for transportation by the state government. Defaulted children were not given any payment. During

admission 2 times food and breakfast were given to caregivers and siblings by government. At discharge that is, day 14, outcome measures were taken as responders, non-responders, and defaulters. Children were called for follow-up for the 2 months, every 15 days interval, to monitor weight gain. At 2 months follow-up, outcome measures were classified as: recovered, not recovered and defaulters.

At discharge

Responder had weight gain >5 g/kg/day for three successive days after feeding; not responder had no weight gain after 14 days of NRC admission; and defaulters had not completed 14 NRC days

On follow up

Recovered had weight gain >5 g/kg/day for three successive days after feeding; non recovered had no weight gains after 2 months follow up; and defaulter had not came for regular follow up.

RESULTS

Of 151 SAM children, there were 76 (50.33%) females and 75 (49.67%) males. Majority were <3 years 114 (76.16%). In 6-35 months age group 58 (38.41%) females and 56 (37.08%) males. 36-60 month's age group 18 (11.92%) females and 19 (12.58%) males.

63 (41.72%) children had weight for height/length z score (WHZ) below -3 SD, 49 (39.45%) had z-score is -2, 8 (5.29%) had an MUAC <120 mm, 63 (41.72%) had both a WHZ below -3 SD and an MUAC <200 mm; 3.31% had oedema at presentation.

As per Table 1, most children are born full term 128 (84.77%); and birth weight between 2.1-2.5 kg are 57 (37.75%). Exclusive breastfeeding up to 6 months was carried out in 123 (81.46%). Out of total 151 children, 28 (18.54%) children started complementary feeding before 6 months age, 108 (71.52%) between 6-9 months and 15 (9.93%) after 9 months. According to integrated management neonatal childhood illnesses (IMNCI) (nutritional status-malnutrition and anaemia) guidelines, adequate complementary feeds mean semi-solid/solid/soft food-one bowl size serving 3 times/day if breastfed and 5 times/day if not breastfed among 6-12 months children, and one and half bowl serving 5 times/day among >12 months children (Table 2). Among 151 children only 5 (3.31%) children presented with oedema, 54 (35.76%) were lethargic, 37 (24.50%) presented with diarrhoea and 27 (17.88%) had baggy pant appearance. 81.46% SAM children were responders to nutritional rehabilitation at the NRC. Defaulter rate was 9.93% (Table 2). At 2 months follow-up, 93 (61.59%) had recovered from SAM, defaulter rate being 28.46% (Table 2).

As depicted in Table 3 there were 113 children (41.72% SAM, 33.11% MAM, 25% low MAUC) among total 151 admissions in Baby medical ward and NRC. From which 84.1% SAM, 70% MAM and 92% low MAUC completed 14 days of NRC admission. And 63.5% SAM and 58% MAM and 76.3% low MAUC completed 2 weekly, total 2 months follow up.

Table 4 depicts that children with small for gestational age, joint family and low spacing as etiological factors in study, had recovered at discharge and follow up. There was no statistical difference observed. There were no deaths during NRC stay.

Table 1: Demographic, family and social factors among SAM children.

Variables	N	%
Term		
Full term	128	84.77
Preterm	23	15.23
Birth weight (kg)		
<1	1	0.66
1.1-1.5	7	4.64
1.6-2	33	21.85
2.1-2.5	57	37.75
< 2.5	98	64.9
2.6-3	24	15.89
>3	29	19.21
>2.5	53	35.1
Birth order		
1	61	40.39
2	65	43.04
>3	25	16.55
Spacing (months) excluding first born		
0-24	90	59.6

Continued.

Variables	N	%
24-48	22	14.57
>48	0	0
Immunization		
No	0	0
Fully	131	86.75
Partially	20	13.24
Mother literacy		
Literate	97	64.24
Illiterate	54	35.76
Iron folic acid		
Yes	148	98.01
No	3	1.98
Sanitation*		
Present	126	83.44
Absent	25	16.56
Type of family		
Nuclear	61	40.39
Joint	90	59.60
Residence		
Rural	52	34.44
Urban	99	65.56
Pre lacteal feed		
Yes	36	23.84
No	115	76.16
Start of complementary feeding (months)		
<6	28	18.54
6-9	108	71.52
>9	15	9.93
Exclusive breast feeding for 6 months		
Yes	123	81.46
No	28	18.54
Non-vegetarian		
Yes	15	9.93
No	136	90.06

*Sanitation: access to use of facilities and services for the safe disposal of human urine and faeces as per WHO guidelines on sanitation and health.[9]

Table 2: Effectiveness of NRC in management of SAM.

Outcome	No.	%
Effectiveness of NRC at day 14		
Responder	123	81
Non responder	13	09
Defaulters	15	10
Assessment at 2 months		
Recovered	93	62
Not recovered	15	10
Defaulters	43	28

Table 3: Outcome and grade of malnutrition.

Grade	Admission		Discharge after 14 days NRC stay		Follow-up at 2 months after 14 days NRC stay	
	N	%	N	%	N	%
Severe	63	42	53	84	40	63.5
Moderate	50	33	35	70	29	58

Continued.

Grade	Admission		Discharge after 14 days NRC stay		Follow-up at 2 months after 14 days NRC stay	
	N	%	N	%	N	%
Total	113	75	88	78	69	61
Only low MUAC	38	25	35	92	29	76
Total	151	100	123	81.5	98	65

MUAC: mid upper arm circumference

Table 4: Major etiological factors in different grades of wasting, n (%).

Grade-n (%)		SGA, 80 (53)		Joint family, 90 (60)		Low spacing, 91 (60)	
151 (100)		D	F	D	F	D	F
Severe 63 (41.72)	R	28	28	29	30	35	34
	NR	3	0	3	0	3	2
	Df	2	5	3	5	1	3
Moderate 50 (33.11)	R	20	22	25	22	21	16
	NR	6	2	2	3	1	3
	Df	5	7	4	6	4	7
Only low MUAC 38 (25.16)	R	13	14	19	20	24	18
	NR	2	1	3	1	0	1
	Df	1	1	2	3	2	7
Total		80	80	90	90	91	91

SGA- small for gestational age; low spacing- less than 24 months interval between two births, D- discharged patient after completion of 14 days at NRC; F- those who came for follow-up 2 months after discharge; R- responded at discharge or recovered at follow-up; NR- nonresponder at discharge or not recovered at follow-up; Df- defaulter; only low MAUC- whose z-score is >-2; and mid upper arm circumference is <12 cm

DISCUSSION

Out of 151 patients, 76 (50.33%) were females and 75 (49.67%) were males. As male gender was a helpful social factor and female gender was a risk factor for the occurrence of malnutrition. Statistical significance was not there according to gender in our study.[10,11]

The primary care is taken by mother in India. We have considered her cognitive, social skills to understand and use information to promote and maintain good health of her child, as literacy. In rural India, the literacy rate among females is 57 per cent. The overall literacy rate in urban India is 80% and 75% females are literate. Majority mother had their schooling till primary. Mother's practical knowledge about nutrition is more important than formal maternal education which affects nutrition status in children.[12] More than half 97 (64%) of the mothers in this study were literate as she had studied at least up to primary school. Residing in a joint/extended family, adds onto her responsibilities compromising her time with children. According to several studies large family size adversely affects the nutritional status of children.

148 (98%) mother had received iron folic acid supplements (Table 1) but not all had taken for as per guideline.[13] It is difficult for vegetarians to get adequate iron in their vegetarian diet alone. In our study 91% family were eating vegetarian food. It may also affect the child and it could be the reason for SAM and anemia.

52 (34%) children were from rural area (Table 1) so to link them to anganwadi is necessary. Anganwadi is a rural child care centre in India, started by the Indian government in 1975 as part of the integrated child development services (ICDS) program to combat child hunger and malnutrition. ASHA, a community health worker, appointed by the government of India's Ministry of Health and Family Welfare (MoHFW) as a part of the National Rural Health Mission (NRHM). ASHA is local women trained for health education and she promotes it in communities. She creates awareness on health and social factors, helps her to mobilize the community towards local health plan which increase utilization of the existing health services. ANM, a village-level female health worker in India, is the first contact person between the community and the health services. They are the grass-roots workers in the health organisation. Their services are important to provide safe and effective care for village communities. Their role helps communities to achieve the targets of national health programmes. Anganwadi workers are key informants of healthcare issues. They are also being called as social workers; many more activities are being added to their job profile.

Lack of exclusive breastfeeding for the first 6 months was significantly associated with SAM in studies.[14,15] In our study, 28 (18.5%) children were not exclusively breastfed (Table 1); this rate is similar to study by Kumar.[16] There was four-fold increased risk of SAM with the lack of breastfeeding in study by Islam.[17] Increased risk of malnutrition either with early introduction or with delayed

initiation of complementary feeding has been documented.[14]

36 (24%) were given pre lacteal feed (Table 1). Although pre-lacteal feeding is a barrier for implementation of optimal breastfeeding practices, still it is continued as a deep-rooted traditional nutritional practice in developing countries and it increases the risk of neonatal illness and mortality.[18]

20 (13.3%) children were partially immunized (Table 1). Risk of SAM is independently associated with partial immunization status.[15] Update vaccinations were protective against malnutrition.[19]

126 (83%) of SAM children were found to have sanitation present in house (Table 1). So, only 24% children present with diarrhoea. Types of family and type of residence have an impact on malnutrition.[14,15] According to WHO sanitation and health in 2017, 45% of the global population (3.4 billion people) used a safely managed sanitation service.

90 (60%) families were joint (Table 1) and in 25 (16.6%) birth order of the affected child was more than 3 (Table 1). Malnutrition to be significantly higher in families having more than 3 children due to lower per capita income and poor childcare practices. According to a UNICEF data, globally, over one-third of children in rural households are malnourished.

At discharge 81.5% improved at nutritional rehabilitation facility indicating that NRC is feasible and efficacious for inpatient management of both types of SAM (Table 2). There is a difference between weight at discharge and admission in our study. We found a linear relationship between weight at admission and discharge as well as at follow-up. There was also weight gain at 2 months follow-up compared to the weight at admission.

About 9.9% had defaulted before 14 days stay, mainly as these mothers had some family issues which hampered them to continue staying in the hospital. Two weeks stay in the hospital is a constraint for some. Our limitation is that we were not able to find that whether whoever had defaulted during NRC days had either recovered, not recovered or again defaulted at follow-up after recovery.

Follow-up showed a weight gain at every visit. During 2 months follow-up, recovery rate is 61.6%. Defaulter rate (28.5%) had increased by 3 times on follow-ups compared to during the stay period (Table 2). Day-care stay format, distance factor from residence to NRC, travelling and food expenses, loss of daily wages deter parents to be compliant with follow-ups. Rana in a study of 12 child malnutrition treatment centres (CMTC) at sub-district level (1042 children) in Gujarat found average defaulter rate to be acceptable (<15%) at 4%; however recovery rate was 5% only and average daily gain in weight was 8.25 (0.7) g/kg body weight/day (acceptable level of care, ≥ 8 g/kg body weight/day). Average weight gain among all discharged children was only 3.44 (2.3) g/kg body weight/day that is much less than acceptable level of 8 g/kg body weight/day.[20]

Limitations

58 children had defaulted after admission and could not be traced. Recovery or mortality among defaulted children remains unknown. The study instruments might not have captured all the differences. We did not look into tobacco use in mothers.

CONCLUSION

A child's birth weight, joint family, narrow birth interval were identified as major determinants of SAM in Bhavnagar. Prelacteal feeding, exclusive breast feeding and complementary feeding were minor factors. Day-care NRC was effective in 81.46% children as per weight on discharge and 61.59% on fourth follow up. However, the results were not sustained in view of defaulter rates increasing from 9.93% to 28.46% at discharge and on follow up, respectively.

Recommendations

Children should be discharged from NRC only when their weight‑for‑height/length is at least ≥ -2 z score and they have had no edema for at least 2 weeks, or mid‑upper‑arm circumference is ≥ 125 mm and they have had no edema for at least 2 weeks. But due to longer duration of stay, children were defaulting. So it may be a good idea to give break into continuous total 14 days stay, or to decrease stay duration to 10 days who have improved and want to go home early.

Increasing community awareness of SAM, educating parents/caretakers, providing outreach workers for home visits, could decrease the defaulter rate. Outreach workers could keep track of follow-up schedules of admitted children, personally visit their residences and check the compliance and monitor the risk factors. These personal visits would help follow-ups of those children who do not have accessibility to Anganwadi centres. All these measures would aid frontline community workers (AWW, ASHA, and ANM) who should be involved in the follow-up to improve promotion of better child caring practices specifically, child and maternal feeding practices and prevention and treatment of acute illnesses.

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