Original Research Article

Prognostic factors affecting outcome of hospitalised infants 1-6 months with severe acute malnutrition in North India

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ABSTRACT

Background: Emerging evidences show that severe acute malnutrition is prevalent in infants below 6 months of age. This study is focused on the prognostic factors which decide the outcome of management of these infants in a hospital.

Methods: Admitted patient for severe acute malnutrition and related complications were observed during their stay in the hospital. Detailed history to find out contributing factors that cause severer acute malnutrition in this age group was taken. Anthropometry, related morbidities were recorded and outcome was assessed.

Results: A total of 115 infants of 1 to 6 months of age were enrolled to study. Birth characteristics such as birth weight (p-value 0.0133), prematurity (p-value 0.023), birth spacing (p-value 0.0064), infant feeding characteristics as giving pre-lacteal feed (p-value 0.011), exclusive breast feeding (p-value 0.0473), deprivation of colostrum (p-value 0.003), maternal characteristics as age at first conception (p-value <0.0001), maternal literacy status (p-value 0.0453); presence of sepsis, incomplete immunization, presence of bilateral pedal edema, visible severe wasting, all these variables were found to affect the recovery of an infant during hospital stay.

Conclusions: The present study helps to identify significant risk factors associated with severe acute malnutrition in less than 6 months old infants which can be included in management, prevention and policy making in future.

Keywords: Infant feeding, Maternal characteristics, Prematurity

INTRODUCTION

Severe acute malnutrition is increasingly being recognized in infants who are less than 6 months of age.¹ In addition to aetiologies such as low birth weight, persistent diarrhoea and recurring sepsis or chronic underlying diseases or disability, the development of severe acute malnutrition in this age group commonly reflects suboptimal feeding practices, especially breastfeeding practices.

Early infancy represents a period of transition from neonatal life to childhood during which there is rapid growth, neurological and immunologic development, and

changes in the mode of feeding. Nutrition programs and surveys have traditionally excluded infants under 6 months of age because adequate nutrition is assumed to be ensured by breastfeeding.^{2,3} However, there is increasing recognition that malnutrition occurs before age 6 months and is associated with mortality.⁴ According to recent studies 4.7 million infants under 6 months of age worldwide are moderately wasted and 3.8 million are severely wasted.⁵

According to NFHS 1 data prevalence of severe acute malnutrition as per weight for height was 2.0% and moderate acute malnutrition i.e. weight for height between -2sd to -3sd was 4.5%.⁶ In NFHS 2 data

prevalence of severe acute malnutrition as per weight for height was shown 0.0% might be due to lack of data or of small sample size (35 cases only).⁷ But in NFHS 3 data prevalence of severe acute malnutrition as per weight for height was 13.1% as bigger sample size was analysed (3845 cases).⁸

These data are showing rising percentage of cases but reason could be taking a bigger sample size and better analysis of data as data collection is improving. But even this figure might not be showing actual burden in the country. In Madhya Pradesh there were 79,458 children of severe acute malnutrition were admitted in nutrition rehabilitation centres during April 2016 to March 2017, out of which 3,587 (4.51%) were less than 6 months of age. A study with data collection and focus on severe acute malnutrition in less than 6 months old infants is needed.

METHODS

The present study was conducted in Department of Pediatrics, Kamala Raja Hospital, Gajra Raja Medical College, Gwalior (M.P.).

Ethical approval for this study was obtained from Institutional Ethical Committee of hospital. The study was conducted in children 1 months to 6 months.

Infants admitted for severe acute malnutrition and related complications were observed during their stay at department of paediatric KRH hospital. Written and informed consent was obtained from the parents or legal guardians prior to study. All infants in the study were examined and relevant baseline characteristics (anthropometric measurements, breast feeding history, pre-lacteal feed, time of initiation of breast feed after birth, colostrum, adequacy of method of feeding, immunization,) were taken.

Weight was recorded after removing all clothes on an electronic weighing machine up to 5gm nearest. Length recorded using infantometer using standard technique. The same observer recorded all the measurements. Detailed history taken from mother to assess maternal characteristics contributing to severe acute malnutrition occurrence in these infants.

Birth interval: Publications by the World Health Organization (WHO) and other international organizations recommend waiting at least 2-3 years between pregnancies to reduce infant and child mortality, and also to benefit maternal health, recent studies supported by the United States Agency for International Development (USAID) have suggested that longer birth spacing, 3-5 years, might be more advantageous.

Preterm: Preterm is defined as babies born alive before 37 weeks of pregnancy are completed.

There are sub-categories of preterm birth, based on gestational age:

- extremely preterm (less than 28 weeks)
- very preterm (28 to 32 weeks)
- moderate to late preterm (32 to 37 weeks).

Pre-lacteal feed: A prelacteal feed is any food except mother's milk provided to a newborn before initiating breastfeeding.

Time of initiation of breast feed after birth: Provision of mother's breast milk to infants within one hour of birth is referred to as "early initiation of breastfeeding" and ensures that the infant receives the colostrum, or "first milk", which is rich in protective factors.

BMI cut-off for Asian adults

- Underweight: $<18.5 \text{ Kg/m}^2$
- Normal range: $18.5\text{-}22.9 \text{ Kg/m}^2$
- At risk: $23\text{-}24.9 \text{ Kg/m}^2$
- >25 Obesity.

Inclusion criteria

- weight for length (W/L) < -3 standard deviation (SD) (if length $> 49 \text{ cm}$)
- visible severe wasting or
- oedema of both feet.

Exclusion criteria

- infants less than 1 month of age
- diagnosed organic diseases
- postoperative cases

Congenital malformations (e.g. cleft lip, cleft palate)/Chromosomal syndromes.

Infant feeding was observed, and daily weight was recorded and weight gain in per kilo gram per day was calculated. Infants were managed and discharged according to the set guidelines issued by WHO.

The outcome indicators

- Cured: Infants meeting the discharge criteria
- Non-responders: Infants not responding to the treatment and nutritional rehabilitation during hospital stay
- Relapse: A patient who has been discharged as cured from the hospital within the last 2 months but is again eligible for admission
- Death.

Conclusion was drawn statistically to correlate the outcome.

Statistical analyses

Statistical analysis was done using SPSS software version.20 and Microsoft Excel. P values were calculated to establish significance

RESULTS

A total of 115 infants of 1 to 6 months of age were enrolled to study. The outcome is, out of 115 cases 79(68.69%) were cured, 32(27.82%) were non-responders, 3(2.60%) expired, 1(.8%) relapsed, was declared cured and again admitted with severe acute malnutrition.

Good prognostic factors were term gestation, exclusive breast feeding, birth weight >2.5 kg, literate mother, provision of colostrum, breast feeding initiated within 1 hour, completed immunization.

Bad prognostic factors were prematurity, birth order >3, malnourished mother, mother age <18 at time of first conception, bilateral pedal edema, visible severe wasting, presence of sepsis, prelacteal feed.

Cases with Birth weight <2.5kg were having 45.09% non-responders (23/51) while cases with Birth weight >2.5kg were having only 12.73% non-responders (7/55) which is statistically significant and shows their increased risk for treatment failure (p-value = 0.0133). Among the pre-term births the non-responders were 63.15% (12/19) as compared to 21.05% (20/95) of the term births which is statistically significant (p value = 0.0230).

Among the cases with birth spacing of >3 years the non-responders were only 5% (1/20) in comparison to 34.78% (24/69) in cases where birth spacing was <3 years showing high significance in the outcome of these hospitalized babies (p value = 0.0064) (Table 1).

Table 1: General characteristics and birth factors.

Characteristics	Total	Cured (%)	Non responders (%)	Relapse	Death (%)	p-value
Birth weight (kg)						
<2.5	51	26 (51)	23 (45.1)	00	02 (3.9)	0.0133
>2.5	55	46 (83.6)	07 (12.7)	01 (1.8)	01 (1.8)	
Unknown	09	07 (77.8)	02 (28.6)	00	00	
Gestational age						
Pre-term	19	07 (36.8)	12 (63.1)	00	00	0.0230
Term	95	71 (74.7)	20 (21.1)	01 (1.1)	03 (3.1)	
Post term	1	01 (100)	00	00	00	
Birth spacing						
>3	20	16 (80)	01 (5)	01 (5)	02 (10)	0.0064
<3	69	44 (63.8)	24 (34.8)	00	01 (1.4)	

Table 2: Feeding characteristics.

Characteristics	Total	Cured	Non Responders	Relapse	Death	p-value
Time of initiation of breastfeeding						
<1 hour	57	44(77.2%)	11(19.3%)	00	02(3.5%)	0.140
>1 hour	58	35(60.3%)	21(36.2%)	01(1.7%)	01(1.7%)	
Pre-lacteal feed						
Given	38	17(44.7%)	18(47.4%)	01(2.6%)	02(5.3%)	0.011
Not given	77	62(80.5%)	14(18.2%)	00	01(1.3%)	
Exclusive breast feed						
Given	43	36(83.7%)	07(16.3%)	00	00	0.0473
Given	72	43(59.7%)	25(34.8%)	01(1.4%)	03(4.2%)	
Colostrum						
Given	68	55(80.8%)	13(19.1%)	00	00	0.003
Not given	47	24(51.1%)	19(40.4%)	01(2.1%)	03(6.4%)	

Out of 115 infants 38 (33.04%) were given pre-lacteal feed, out of which, on outcome 18 (14.78%) still remain in SAM showing statistical significance (p-value = 0.011). Among the exclusively breast feed infants only

16.27% (7/43) were non-responders which is very low as compared 34.72% (25/72) who were top feed which is statistically significant (p-value = 0.0473). Infants who received colostrum were only 18.30% (13/68) non-

responders as compared to 54.54% (19/47) in infants who were not given colostrum and was significant (p-value = 0.003) (Table 2).

According to maternal age at first conception 52.94 % (9/17) infants found to be non-responders among 15-18 year age of mothers which decreased to 28.16% (20/71) among 18-21 year age mother and further to 11.11% among 21-30 (3/27) year age mothers (p value = 0.030). Distribution according to mother's BMI shows that in the

category of >18.5 kg/m² there were 54.8% (17/31) non-responders which decreased to 23.21% (13/71) in 18.5-22.9 kg/m² category and further decreased to 22.22% (2/12) in 23-24.9 kg/m² category which was highly significant (p value <0.001). In the literacy status of mother, the non-responders were 35.44% (28/79) among illiterate mothers as compared to 13.88% (4/36) among literate mothers which is statistically significant (p value = 0.0453) (Table 3).

Table 3: Maternal characteristics.

Characteristics	Total	Cured	Non responders	Relapse	Death	p-value
Mother's age at first conception						
15-18	17	08(47.0%)	09(52.9%)	00	00	0.030
18-21	71	48(67.6%)	20(28.7%)	00	03(6.2%)	
21-30	27	23(85.2%)	03(11.1%)	01(3.7%)	00	
Mother's BMI						
<18.5	31	14(45.2%)	17(54.8%)	00	00	0.000
18.5-22.9	71	56(78.9%)	13(18.3%)	01(1.4%)	01(1.4%)	
23-24.9	12	09(75%)	02(16.7%)	00	01(8.3%)	
>25	01	00	00	00	01(100%)	
Mother's education status						
illiterate	79	48(60.7%)	28(35.4%)	01(1.3%)	02(2.5%)	0.0453
literate	36	31(86.1%)	04(11.1%)	00	01(2.8%)	

Table 4: Postnatal factors.

Characteristics	Total	Cured	Non responders	Relapse	Death	p-value
Milestones						
Achieved	57	48 (84.2%)	07 (12.3)	01(1.7%)	01(1.7%)	0.002
Not achieved	58	31 (53.4%)	25 (43.1%)	00	02(3.4%)	
Sepsis						
Present	82	49 (59.7%)	29 (35.4%)	01(1.2%)	03(3.6%)	0.0130
Absent	33	30 (90.9%)	03 (9.1%)	00	00	
Oedema of bilateral foot						
Present	15	4 (26.3%)	11 (73.3%)	00	00	0.0005
Absent	100	75 (75%)	21 (21%)	01(1%)	03(3%)	
Visible severe wasting						
Present	36	15 (41.6%)	18 (50%)	01(2.8%)	02(5.5%)	0.0003
Absent	79	64 (81.1%)	14 (18.9%)	00	01(1.3%)	
Immunization						
Complete	38	34 (89.5%)	04 (10.5%)	00	00	0.009
Incomplete	77	45 (58.4%)	28 (36.4%)	01(1.3%)	03(3.9%)	

Booked pregnancy cases shows only 19.23% (15/78) of non-responders while unbooked pregnancies were having 45.94% (17/37) of the non-responders which is highly significant statistically showing that the infants of unbooked pregnancies are more prone to malnutrition and treatment failure in outcome (p value = 0.008). Among the infants with sepsis 35.36% (29/82) were non-

responders and without sepsis 10% (3/30) were non-responders (p value = 0.0130).

Infants with visible severe wasting 50% (18/36) were non-responders as compared to only 17.72% (14/79) without visible severe wasting (p value = 0.0003). Infants with bilateral pedal oedema were 13.04% (15), out of them 73.33% (11/15) were non-responders as compared

to only 26.92% (21/100) in infants without oedema (p -value = 0.0005). Infants with complete immunization were only 10.52% (4/38) non-responders as compared to 36.36% (28/77) in infants with incomplete immunization (p -value = 0.009).

Among the infants who achieved their milestones on time only 12.28% (7/57) were non-responders where as those who didn't achieved their developmental milestones were 43.10% (25/58) non-responders (p value = 0.002) (Table 4).

DISCUSSION

As the recognition of severe acute malnutrition in an infant of less than 6 months of age is a relatively newer entity, risk factors affecting malnutrition, the awareness and skills of health professionals to manage play an important role in final outcome. The average weight gain in this study was 9.8 g/kg/d.

Birth weight have influence on the nutritional status of an infant as shown in previous studies.⁹ In another study in Bangladesh have shown that the prevalence of malnutrition was markedly higher in children with LBW than those with normal birth-weights.¹⁰ This is consistent with present study which shows significant co relation with the low birth weight to the outcome. As depicted in a study of premature infants cases, in the present study also the preterm babies were more prone to be non-responder as compared to term babies.¹¹ This is an obvious finding keeping in mind that the preterm infants have their own challenges for survival and are in nutritional debt since even before their birth.

In a study it was shown that short birth intervals significantly increase the risk of stunting.¹² Same analysis also shows a strong association between short birth intervals and underweight, with decrease association after an interval 36 months or longer. In our study we found that infants with birth interval of more than 3 years were having fewer non-responders to treatment as compared to the infants with birth interval under 3 years.

During antenatal care mothers receive full instructions about baby caring, which has a good impact on infant health. Appropriate caring of the infant can prevent infection, which are the major causes for malnutrition. Antenatal care services also instruct about importance and procedure of breastfeeding and weaning. These help to prevent infant malnutrition. In our study comparison of booked pregnancies with unbooked pregnancies shown significant relationship in respect of final outcome. This was supported by the study in Bangladesh for analysis of ANC effect on infant malnutrition which shown that, good antenatal care was associated with reduced risk of infant stunting.¹³ Association of maternal characteristics was shown in a previous study, the literacy rate of mothers were high among controls than the cases.¹⁴ Majority of the primary care givers were house makers

both among cases and controls. Low birth weight was also common among cases as compared to controls. In the present study the maternal age was found a significant factor with 52.94% infants found to be non-responders among 15-18 year age of mothers which decreased to 28.16% among 18-21 year age mother and to 11.11% among 21-30 year age mothers. This is consistent with the previous study odds ratios for preterm birth were higher among mothers aged 19 years and younger which is a risk factor for malnutrition in young infants.¹⁵ In the present study author do not have sufficient data to investigate the effect of weight gain during pregnancy, so author took mother's BMI at the time of admission and the relationship of the same with the final outcome of infant was highly correlated. In a study, mothers who were educated up to primary level, the probability of their children being under weight or severely underweight is twice high than the mother who educated above primary level.¹⁶ These findings are consistent with our study too, when compared the outcome among the illiterate and literate mother, it shown greater response to treatment in the infants of literate mothers.

Adherence to the optimal breastfeeding practices that could reduce infant morbidity and enhance growth are still low (only 37.39% exclusively breast feed). When compared between exclusive breast feeding with other methods of feeding the results were significant in the present study. The result is consistent with the results shown in the study done in Bangladesh which shown the rate of malnutrition being higher among infants who were not exclusively breast fed.¹⁷ As shown in previous studies the relationship of occurrence of severe acute malnutrition was strongly associated with introduction of pre-lacteal feed.^{18,19}

In present study out of 115 infants 38 (33.04%) were given pre-lacteal feed, out of which, on outcome 18 (14.78%) still remain in SAM showing statistical significance. With-holding colostrum is a risk factors for underweight at six months of age as in our study, infants that fed colostrum had better nutritional status than those who didn't which is consistent with previous studies.²⁰

Though immunization prevents the infectious diseases as the child grows but in this study the infants who received up to date immunization did better. This might be due to the fact that the immunization presents the opportunity to the health care giver to assess the baby and if baby is lagging behind in any domain they can start intervention before it is too late. The bilateral pedal edema and visible severe wasting came out to be as predictors of poor outcome as they were having poor cure rates of 26.26% and 41.66% respectively.

CONCLUSION

Pre-natal and post-natal both factors are contributory in determination of outcome in 1-6 month old infants with severe acute malnutrition. Lack of awareness regarding

correct and adequate infant feeding practices is a big reason behind failure of treatment in infant of 1-6 month age. Early identification is difficult but is necessary to prevent the damage due to malnutrition in the form of development of oedema and severe wasting. Policy makers should pay attention to this window of opportunity for better management and prevention of severe acute malnutrition as a whole.

Recommendations

More awareness to identify the cases and their aggressive management is needed. Health care workers should be trained about their peculiarity as how they are different than the older SAM children. Targeted approach to educate the mothers in view of early initiation, duration and exclusive breast feeding is needed.

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