Original Article

Infant and maternal risk factors of severe acute malnutrition under 6 months of age

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ABSTRACT

Aims: This study aims to analyze and focus on the factors associated with risk of severe acute malnutrition (SAM) under 6 months infants. **Materials and Methods:** This hospital-based prospective study was conducted in the Department of Pediatrics of a Medical College in Central India from March 2019 to March 2020. Infant under 6 months of age admitted for SAM and related complications were observed during their stay in the hospital. After obtaining informed consent and detailed history including contributing factor, complete physical examination, anthropometry, comorbidities, and outcome were also recorded. SAM was classified according to the WHO criteria. **Results:** A total of 126 infants, 1–6 months of age, were enrolled in the study with a male-to-female ratio of 2.3:1. Birth weight (p=0.037), prematurity (p=0.0021), birth spacing (p=0.001), infant feeding characteristics as giving prelacteal feed (p=0.001), initiation of breastfeed after 1 h (p=0.003), exclusive breastfeeding (p=0.037), deprivation of colostrum (p=0.002), maternal characteristics age at first conception (p<0.014), maternal BMI <18.5 (p=0.0004), maternal literacy status (p=0.007), infant characteristics like sepsis (p=0.003), incomplete immunization (p=0.006), bilateral pedal edema (p=0.017), visible severe wasting (p=0.0001), and delayed milestone (p=0.0001) were found to affect the recovery of an infant. **Conclusion:** The present study identifies the maternal and sociodemographic factors associated with SAM in infant under 6 months of age. The risk factors insights identified in this study should provide a good basis to explore modification of the existing approach as a starting point to strengthen the community-based management of uncomplicated SAM in infants under 6 months.

Key words: Breastfeeding, Infant under 6 months, Severe acute malnutrition

The United Nations International Children's Education Fund estimates of 2018, 49 million children under 5 years of age were wasted globally, of which 17 million were severely wasted [1]. Of these, more than half lived in South Asia, and the prevalence of wasting in South Asia is the highest at 15.2% [1]. As per the National Family Health Surveys of 2015–16, 21% of children under 5 years in India are wasted, and 7.5% are severely wasted [1]. The World Health Organization (WHO) defines severe acute malnutrition (SAM) as very low weight-for-height (Z-score below −3 standard deviations [SD] of the median WHO growth charts), or a mid-upper arm circumference <115 mm, or by the presence of nutritional edema [2]. However, there is increasing recognition that malnutrition occurs before 6 months of age with associated mortality. Globally, there are an estimated 3.8 million cases of SAM in infants <6 months of age [3], the prevalence in India is yet to be established.

In terms of health policy, this age group falls between guidelines for neonatal care and those for the management of malnutrition [4]. In 2013, the WHO updated guidelines for the management of SAM to include under 6 months infants. However, these guidelines are based on "very low quality" evidence [5]. SAM also has shown more adverse outcomes for young infants as compared to older children [3] and treating infants under 6 months is more difficult [4]. Infant with SAM requires immediate attention along with nutritional rehabilitation not only to decrease mortality but also to achieve full potential after recovery [6]. Early detection, treatment, and prevention are of utmost importance as it would not only reduce malnutrition-associated mortality in the short term but also influence the long-term health and development of these children. A study in Bangladesh found poor maternal education, non-exclusive breastfeeding and infant illnesses associated with malnutrition [7].

There is a lack of systemic reporting of SAM in this age group and a paucity of literature on the clinical and laboratory characteristics of SAM in infants <6 months of age. Therefore, a study is needed to analyze and focus on factor associated with risk of SAM under 6 months infants.

MATERIALS AND METHODS

The present study was conducted in SAM treatment unit, Department of Pediatrics of a medical college in MP, India. The

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period of the present study was 1 year from March 2019 to March 2020. Infants, admitted for SAM and related complications, were observed during their stay in the hospital. Written and informed consent was obtained from the parents or legal guardians before study. Infants <1 month of age, known case of organic diseases/ metabolic disease, congenital malformations (e.g., cleft lip and cleft palate)/chromosomal abnormalities, post-operative cases, and patient those who were abscond and leave against medical advice excluded from the study.

Detailed history was taken from mother to assess the maternal characteristics and all infants were examined thoroughly. Relevant baseline characteristics (anthropometric measurements, birth interval, gestational age, breastfeeding history, prelacteal feed, time of initiation of breastfeed after birth, colostrums, adequacy of method of feeding, and immunization) were recorded. Infant feeding was observed, and daily weight was recorded and weight gain in per kilogram per day was calculated. All cases were managed and discharged as per guidelines by the WHO.

Weight was recorded after removing all clothes on an electronic weighing machine up to ±5 g nearest. Length recorded by infantometer using standard technique. The same observer recorded all the measurements. Weight-for-length <−3 SD (if length >49 cm), visible severe wasting, or edema of both feet were taken to define SAM in infants included in the study.

The outcome was defines as Cured: Infants meeting the discharge criteria, non-responders: Infants not responding to the treatment and nutritional rehabilitation during hospital stay, and relapse: A patients who has been discharged as cured from the hospital within the past 2 months but is again eligible for admission, death. Statistical analysis was done using SPSS software version 20 and Microsoft Excel. P values were calculated to establish significance.

RESULTS

A total of 126 infants of 1–6 months of age were enrolled to study. Out of 126 cases, 62.69% (n=79) were cured, 30.95% (n=39) were non-responders, 3.96% (n=5) expired, and 2.38% (n=3) had relapse. Term gestation, birth weight >2.5 kg exclusive breastfeeding, breastfeeding initiated within 1 h, provision of colostrum, literate mother, and complete immunization were good prognosticating factors while maternal BMI <18.5, mother age <18 years at the time of first conception, prematurity, prelacteal feed, birth order >3, bilateral pedal edema, visible severe wasting, presence of sepsis, mother's poor nutritional knowledge, working mother, father smoker/alcoholic, sibling malnourished, and family size >4 were the bad prognosticating factors.

Cases with birth weight <2.5 kg had 43.47% non-responders (30/69) while cases with birth weight >2.5 kg had only 14.89% non-responders (7/47) which shows significantly increased risk for treatment failure (p=0.037). Among pre-term births, non-responders were 61.90% (13/21) as compared to 24.03% (25/104) among term births which was statistically significant (p=0.0021).

Among the infants with sepsis, 35.95% (32/89) were non-responders and without sepsis, 10.81% (4/37) were non-responders (p=0.003). In infants with visible severe wasting, 46.15% (18/39) were non-responders as compared to only 19.54% (14/79) non-responders without visible severe wasting (p=0.0001). Total 50% (13/26) of infants with bilateral pedal edema were non-responders as compared to only 21% (21/100) infants without edema (p=0.017). Only 9.52% (4/42) of infants with complete immunization were non-responders as compared to 39.69% (31/84) infants with incomplete immunization (p=0.006) (Fig. 1).

Cases with birth spacing of >3 years, non-responders were only 4.54% (1/22) in comparison to 36.84% (28/76) in cases where birth spacing was <3 years showing a high impact in the outcome of these babies (p=0.001). Cases according to the time of initiation of breastfeeding within 1 h of birth show non-responder in 16.12% (10/62) of cases as compared to 40.62% (26/64) in those with initiation after 1 h of birth (p=0.003) (Fig. 2).

Out of 126 infants, 42 (33.33%) were given pre-lacteal feed, out of which, 19/42 (45.23%) still remain in SAM (p=0.001). Among the exclusively breastfeed infants, only 23.40% (11/47) were non-responders as compared to 38.88% (28/72) among top fed infants (p=0.037). Only 21.62% (16/74) were non-responders among infants who received colostrum as compared to 38.46% (20/52) in infants who were not given colostrum (p=0.002).

According to maternal age at first conception, 51.72% (15/29) infants were non-responders among 15–18 years age of mothers which decreased to 28.20% (22/78) among 18–21 years age mother and further to 15.78% among 21–30 (3/19) years age mothers (p=0.014). Distribution according to mothers' BMI showed that in the category of >18.5 kg/m^2, there were 52.77% (19/36) non-responders which decreased to 18.18% (14/77) in 18.5–22.9 kg/m^2 category and further decreased to 16.66% (2/12) in 23–24.9 kg/m^2 category (p<0.0004). In the literacy status of mother, non-responders were 40.69% (35/86) among illiterate mothers as compared to 15% (6/40) among literate mothers (p=0.007).

Booked pregnancy cases had only 20.93% (18/86) non-responders while unbooked pregnancies had 42.5% (17/40) non-responders showing that infants of unbooked pregnancies were prone to malnutrition and treatment failure (p=0.024). Among the infants who achieved their milestones on time, only 12.90% (8/62) were non-responders as compared to 45.31% (29/64) non-responders in those who did not achieve developmental milestones on time (p=0.0001).

DISCUSSION

There is a misconception that SAM in infants <6 months of age is rare. Only 37.3% of young infants were exclusively breastfeed and 62.69% of the mothers had insufficient milk issues as a reason for introduction of top feeding in our study and hence babies were shifted to top feeding. This could be the main contributory factor for SAM in young infants.

In this study, 71.4% (n=90) of infants were between 1 and 3 months age, lived in urban slum areas, were first- and second-born children, had unemployed primary caregivers, low birth weight, term gestation, and birth spacing 2–3 years, were breastfeed <7 times a

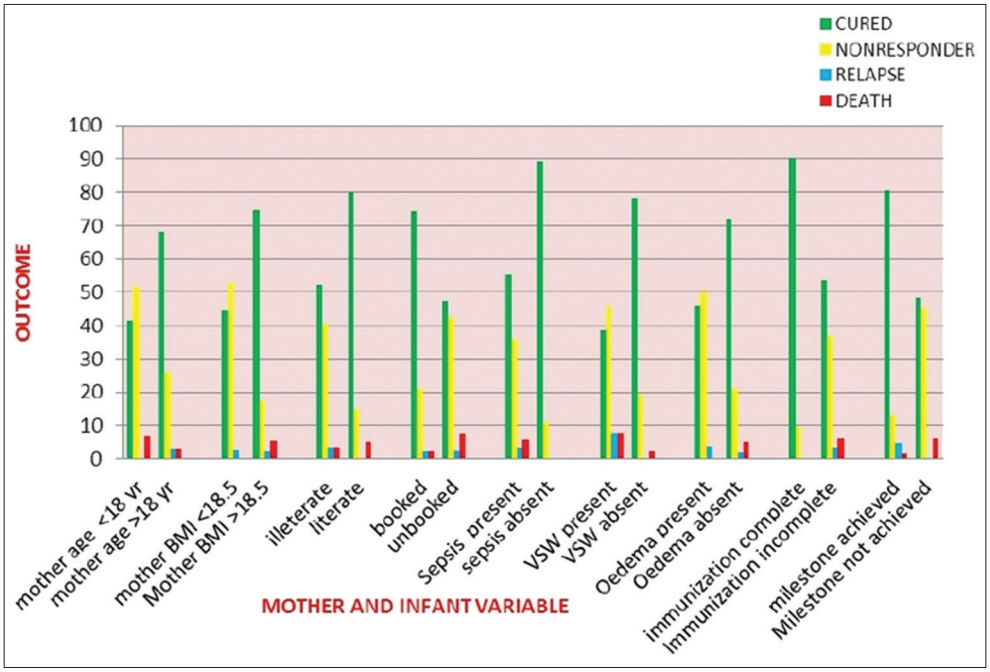

Figure 1: Maternal and infant variables with outcome

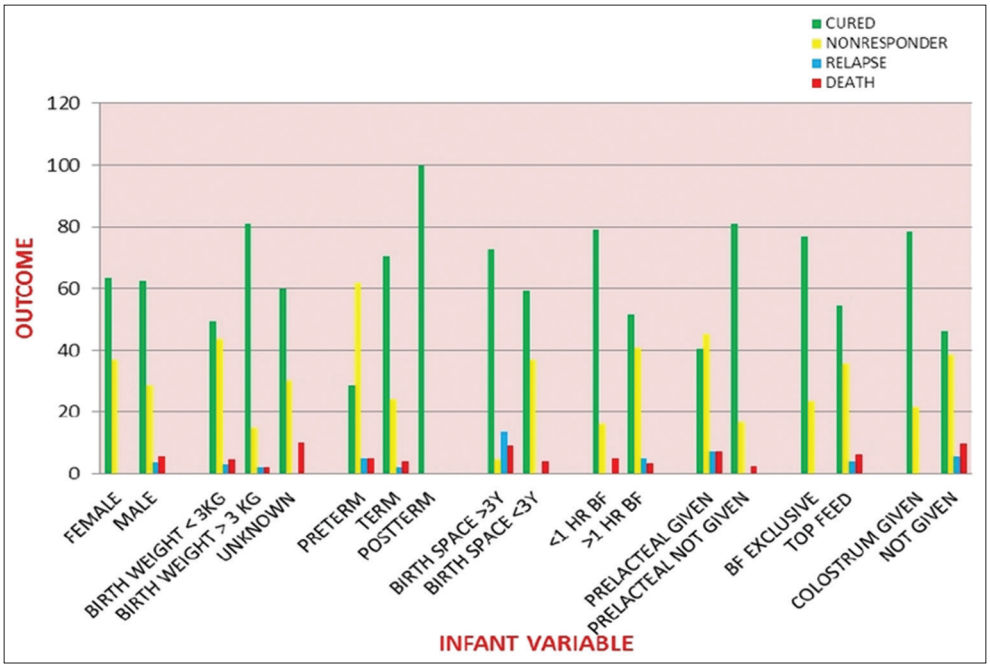

Figure 2: Infant variables with outcome

day, and were given top feed, having sibling <2, time of initiation of breastfeeding more than 1 h of birth, and mothers' age >18 years. These are risk factors for malnutrition under 6 months.

Comorbidities encountered in SAM were the main hindrances in its management, treatment failure, and prolonged length of stay in hospital. Pneumonia (33.33%), sepsis (33.33%), diarrhea (26.19%), anemia (4.76%), and meningitis (2.38%) were the common comorbidities. In our study, of the 126 children <6 months of age, 62.69% of cases were discharged as per the operational guidelines on facility-based management of SAM [6,8]. This was lower than the national and international standard of care (>75%) for the programs that treat children with SAM [6,8]. The average weight gain was 9.8 g/kg/day which is acceptable at nationally and internationally agreed on minimum average weight gain (>8 g/kg body weight/day) for programs that treat children with SAM as per the operational guidelines on facility-based management of SAM [8,9].

Kerac *et al*. [10] analyzed the data from Demographic and Health Surveys conducted in the past 10 years in 20 countries, for risk factors of wasting under 6 months age. They found that low birth weight (OR: 1.32, p<0.01, 95% CI: 1.10–1.58), prelacteal feeds (OR: 1.34, p<0.001, 95% CI: 1.18–1.53), and recent diarrhea (OR: 1.37, p<0.01, 95% CI: 1.12–1.67) were significantly associated with wasting.

Infants receiving prelacteal feed were more prone to be non-responder as compared to those who have not received (p<0.001).

Kerac *et al*. did not find any association of malnutrition with the age, sex, or their birth order, which was expected considering maternal inexperience and therefore possible increased risk of malnutrition in the first born [10]. In our study, there were 69.8% of male and 30.15% of female infants with SAM and 36.84% of female were non-responder as compared to 28.40% of male infants (p=0.25). This may reflect poor health-seeking behavior of the families as more patients are severely malnourished, and possibly that medical care was sought out more for the male infants than females.

In a study, mothers who were educated up to primary level, the probability of their children being underweight or severely underweight is twice high than the mother who educated above primary level [11]. In this study, non-response was more common in infant whose mothers were illiterate (40.69%) as compared to literate (15%) mothers (p=0.007) and whose fathers were laborers. This was consistent with the other studies [12,13]. This may be attributed to the lack of awareness and ignorance among the lower socioeconomic classes about the importance of exclusive breastfeeding. A study in Sudan, 5.5% of children died, 21.6% discharged against medical advice, and 72.8% were discharged. Of the children who died, 18.0% had septicemia followed by diarrhea and respiratory tract infections.

The birth weight is influenced by many socioeconomic factors like being rural or urban, wealth, caste, religion, education, and tobacco use by mother [14]. In this study, 54.76% of the cases had birth weights <2.5 kg. The association between the low birth weight and non-responder among the SAM case was statistically significant (p<0.05). The above finding was consistent with other studies [15,16]. A study done in Ghana showed that preterm babies were prone to develop malnutrition in later life.

In this study, a significant association (p=0.006) between incomplete immunization and non-response among SAM cases. We found that a single child 19.84% (n=25) in the family was a protective factor for SAM. This may be due undivided parental attention and nutritional care to only child. Medical illnesses such as sepsis, diarrhea, and pneumonia, at the time of interview, were significantly associated with malnutrition. Reducing oral feed intake during acute illness was the most commonly followed practice and could be the reason of malnutrition.

In the current study, 64.22% of cases did not receive exclusive breastfeeding. There was a significant association between the lack of exclusive breastfeeding and non-responder among SAM cases with p=0.037. A similar finding was observed in the study done in Ethiopia [17]. In this study, non-response decreased with increasing maternal age (p=0.014). This is similar to the previous study where the odds ratios for preterm birth were higher among maternal age 19 years and younger is a risk factor for malnutrition in young infants [18].

In a study, it was shown that short birth intervals significantly increase the risk of stunting [19]. Same analysis also showed 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 <3 years.

With-holding colostrum was a risk factor for underweight at 6 months of age in our study. Infants fed colostrum had better nutritional status than those who did not which is consistent with the previous studies [20]. In this study, irregular antenatal checkups have shown a significant relationship with SAM, as shown in other studies also [21]. In this study, 10.31% of mothers of cases had chronic illness as shown in a study done in South Africa [22]. The factors contributing to SAM were early cessation of breastfeeding, poor nutritional care, and support due to mother's illness.

Paternal smoking has been shown to divert expenditure from food to tobacco, putting the children at greater risk of developing chronic malnutrition. In this study, 50% of fathers of cases had history of smoking and 54.76% of father of cases had a history of alcoholism, similar results were shown in study done in Indonesia [23]. The association between the mother's low BMI and non-response was significant and this is similar to the results of a previous study done using the NFHS III data [24].

Focus should be on measurement and proactive screening for infants under 6 months SAM because the currently dominant clinical assessment may miss many cases. Acute malnutrition in under 6 months infants is not a common reason for seeking medical attention by caregivers. Infants often present "late," when sick or self-referred cases, meaning that the mother had noted a problem for which she sought help, early identification, recognition, and intervention are a key to the community-based model.

Limitation of this study was small sample size as the study was done in a tertiary care hospital which is a referral center as most cases came for admission either as complicated SAM or referred by the peripheral health center.

CONCLUSION

The present study identifies the maternal and sociodemographic factors associated with SAM in infant under 6 months of age. Supporting breastfeeding is a vital part of any future intervention package. The community insights identified in this study should provide a good basis to explore modification of the existing approach as a starting point to strengthen the community-based management of uncomplicated SAM in under 6 month infants.

AUTHORS' CONTRIBUTIONS

Dr. Ghanshyam Das design and review the study, Dr. Ashutosh Kumar Sharma collected the data and analyzed.

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