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Original Research Article

Risk factors of mortality in hospitalized children with severe acute malnutrition

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ABSTRACT

Background: Severe acute malnutrition (SAM) is a major cause of morbidity and mortality in children around the world. It is critical to identify the factors that contribute to mortality to reduce SAM related mortality. This study aimed to analyze the risk factors of mortality in hospitalized children with SAM.
Methods: This case-control study was conducted in the SAM unit, department of pediatrics, institute of child and mother health, Matuail-1362, Dhaka, from January 2021 to December 2021. Data analysis was conducted using SPSS version 22. Univariate analysis was done to determine factors affecting mortality, and multivariate logistic regression was used to determine significant independent risk factors.
Results: Mean age of the study subject was 6.38±3.45 months and 10.90±10.00 months in the case and control groups respectively. So, death was more common in younger children. The percentage of death was more (61.5% vs 54.6%) in males. Mortality was more common in family income <10,000 Tk/ month, 53.8% in the case group and 21.9% in the control group. The mean age of the mother was 19.23±0.60 years and 21.78±4.78 years in the death and survived group. Among risk factors of mortality, dermatosis (46.2% vs 4.9%), oral ulcer (46.2% vs 5.5%), hypoglycemia (46.2% vs 3.8%), severe anemia (38.5% vs 2.2%), septicemia (76.9% vs 29.5%) in case and control group respectively. These risk factors were significantly higher in the death group compared to the surviving group. After doing multivariate logistic regression analysis it was observed that hypoglycemia (OR=9.17 with 95% CI 1.44 to 58.29) and severe anemia (OR=13.42 with 95% CI 1.42 to 126.13) were the strongest predictors of mortality among the hospitalized children with SAM.
Conclusions: Hypoglycemia and severe anemia were the main contributing factors of mortal among the children with SAM in the hospital.

Keywords: Hypoglycemia, Severe Anemia, SAM, Septicemia

INTRODUCTION

Severe acute malnutrition (SAM) is a serious public health concern in low- and middle-income countries. Worldwide, SAM affects an estimated 16.6 million children under the age of 5 years.[1] It is highly associated with childhood morbidity and mortality. In its acute form, it affects about 50 million children under 5 worldwide, including 48 million in Africa and Asia.[2] Undernourished children can be classified into moderately malnourished moderate acute malnutrition, or severely malnourished SAM. Complicated SAM with medical complications such as systemic or respiratory infection or profound diarrhea requires in-patient treatment.[3] In low and middle-income countries SAM impairs the cognitive and neuro-developmental outcomes of children. The

prognosis of SAM depends on the type of malnutrition. In uncomplicated SAM, the mortality rate is <5% and in complicated SAM mortality rate is 10-40%.[2] Children with SAM tend to demonstrate less reliably the classic clinical signs of decompensation or severe infection (e.g., fever, tachycardia, and tachypnoea), and therefore the severity of illness may be under-recognized.[1] Several risk factors are associated with SAM and its persistent high mortality was seen in very low anthropometry, edema, and gastro-intestinal dysfunction leading to diarrhea.[3] Gut microbiota plays crucial etiological role in gastrointestinal dysfunction and Several studies revealed that malnourished children had an 'immature' microbiota, characterized by decreased microbial diversity.[3] High mortality in children admitted with SAM was identified by this WHO danger signs like; lethargy, hypoglycemia, and hypothermia and bradycardia, capillary refill time greater than 3 seconds, weak pulse volume, and impaired level of consciousness.[4] Also, patients with complicated SAM present with altered physiology within a wide range of organ systems and have increased in-hospital and post-discharge mortality.[1] Besides, the higher number of family members in the household more will be the burden to households to provide optimum nutritious food to all the family members and children. Higher the number of children in households, it is unlikely that every child gets proper care and time, putting them at a higher risk of being malnourished. Children of mothers who are illiterate are more prone to the development of severe malnutrition. If mothers have better understanding of child nutrition that acts as protective factor against under-nutrition, like exclusive breastfeeding which provides protective nutrition to children for an extended period.[5] High mortality due to SAM in hospitalized children has been commonly attributed to lack of maternal participation in feeding program, inadequate care, prescription errors and over prescription of intravenous therapies and blood transfusions.[4] Evaluation of risk factors and taking appropriate measures to it has great significance to decrease mortality among children with SAM. In Bangladesh, the prevalence of SAM according to ICDDRB is 16%.[6] Globally, SAM is responsible for 14.6% of all causes of death in children under 5 years of age. In Bangladesh, with support of UNICEF and GOB several SAM corners are operating in tertiary care hospitals and Sadar hospitals to decrease mortality. In this context, this study was designed to identify risk factors of mortality in hospitalized children with SAM in a tertiary care hospital in Bangladesh.

Objectives

Objectives were to identify the risk factors of mortality in hospitalized children with SAM in a tertiary care hospital in Bangladesh.

METHODS

This case-control study was conducted in the SAM unit, department of pediatrics, institute of child and mother health, Matuail-1362, Dhaka, from January 2021 to December 2021 for one year. During the study period among the hospitalized children with SAM, children who died were enrolled as cases, and simultaneously survived children were taken as control. A convenient sampling technique was used in this study. All the information related to socio-demographic, clinical, and laboratory parameters were recorded in the data collection sheet. Data analysis was carried out by using SPSS version 22. Student's t test and Chi-Square test were used to compare continuous and categorical variables, respectively. Univariate analysis was done to determine factors affecting mortality. Multivariate logistic regression was done to determine significant independent risk factors of mortality. A level of $p<0.05$ was considered statistically significant. Before the commencement of this study, informed written consent was taken from the guardians and the research protocol was approved by the institutional review board (IRB) of the institute of child and mother health (ICMH), Material. The inclusion and exclusion criteria of the study were as follows:

Inclusion criteria

SAM children who died in hospital, SAM children who survived in hospital and children of 0 to <6 months: Presence of one or more of the following--WLZ <-3, bipedal edema and visible severe wasting. Children of 6-59 months: Presence of one or more of the following--MUAC: <115 mm, WLZ/WHZ: <-3, bipedal edema. Children of both sexes and patients who had given consent to participate in the study were included in the study.

Exclusion criteria

Known cases of children who had malignancy, known cases of children with preterm birth or intrauterine growth retardation (IUGR) at birth, known cases of inborn error of metabolism, congenital anomalies, and chromosomal abnormalities, children who were referred for further management and known cases of children with cerebral palsy or any chronic disease were excluded from the study.

RESULTS

The average age of children with SAM who died was 6.38±3.45 months, and 10.90±10.00 months for those who survived. Death was more common in younger children. The percentage of death was more (61.5% vs 54.6%) in males. Mortality was more common in family income <10,000 Tk/ month, 53.8% in the case group and 21.9% in the control group. The mean age of the mother was 19.23±0.60 years and 21.78±4.78 years in the death and survived group (Table 1).

None of the study subjects had hypothermia. All the study subjects had tachycardia and tachypnea. Dermatosis (46.2% vs 4.9%), oral ulcer (46.2% vs 5.5%),

hypoglycemia (46.2% vs 3.8%), severe anemia (38.5% vs 2.2%), septicemia (76.9% vs 29.5%) in case and control group respectively. These risk factors significantly higher in death group compared to surviving group (Table 2).

Binary logistic regression was performed to assess the impact of several factors on mortality among children with SAM. Model contained 7 independent variables (Age, family income, dermatosis, oral ulcer, hypoglycemia, severe anemia, and septicemia). The strongest predictor of mortality was hypoglycemia and severe anemia (Table 3).

Table 1: Socio-demographic risk factors of the study children with SAM, (n=196).

Socio-demographic risk factors	Case, (n=13) (%)	Control (n=183) (%)	P value
Age (Months)			
<6	7 (53.8)	68 (37.2)	0.232
6-59	6 (46.2)	115 (62.8)	
Mean ± SD	6.38±3.45	10.90±10	[b]0.036
Gender			
Male	8 (61.5)	100 (54.6)	[a]0.629
Female	5 (38.5)	83 (45.4)	
Residence			
Urban	8 (61.5)	136 (74.3)	[a]0.313
Rural	5 (38.5)	47 (25.7)	
Monthly family income (Tk./month)			
<10,000	7 (53.8)	40 (21.9)	[a]0.009
≥10,000	6 (46.2)	143 (78.1)	
Mother's age (Years)	19.23±0.60	21.78±4.78	[b]0.056
Number of family members	5.00±0.82	5.37±1.34	[b]0.323

[a]Chi-square test and unpaired t-test were done.

Table 2: Clinical and laboratory risk factors of the study children with SAM, (n=196).

Clinical and laboratory risk factors	Case, (n=13) (%)	Control, (n=183) (%)	P value
Hypothermia	0	0	
Tachycardia	13 (100.0)	183 (100.0)	
Tachypnea	13 (100.0)	183 (100.0)	
Dermatosis	6 (46.2)	9 (4.9)	<0.001
Oral ulcer	6 (46.2)	10 (5.5)	<0.001
Hypoglycemia	6 (46.2)	7 (3.8)	<0.001
Severe anemia	5 (38.5)	4 (2.2)	<0.001
Diarrhoea	5 (38.5)	77 (42.1)	0.798
Pneumonia	5 (38.5)	81 (44.3)	0.684
Septicemia	10 (76.9)	54 (29.5)	<0.001

A chi-square test was done.

Table 3: Factors associated with the mortality among children with SAM using binary logistic regression, (n=196).

Variables	B	S.E.	P value	OR	95% CI for OR	
					Lower	Upper
Age (Months)	0.052	0.066	0.428	1.053	0.926	1.198
Family income (<Tk. 10,000)	-0.753	0.822	0.360	0.471	0.094	2.360
Dermatosis	-1.658	1.101	0.132	0.191	0.022	1.648
Oral ulcer	-0.016	1.097	0.989	0.984	0.115	8.447
Hypoglycaemia	2.216	0.943	0.019	9.174	1.444	58.290
Severe anaemia	2.597	1.143	0.023	13.424	1.429	126.128
Septicemia	-1.355	0.865	0.117	0.258	0.047	1.405

DISCUSSION

Children with SAM are usually admitted with different co-morbidities and complications. Mortality of these depends upon different socio-demographic factors, and several clinical and laboratory parameters. This study aimed to determine the risk factors of mortality in hospitalized children with SAM. A total of 13 children with SAM who died in the hospital were enrolled as cases and simultaneously 183 surviving children with SAM

were enrolled as control. In this study, the mean age of the study subject was 6.38±3.45 months and 10.90±10.00 months in the case and control groups respectively. So, death was more common in younger children. The percentage of death was more (61.5% vs 54.6%) in males. Mortality was more common in family income <10,000 Tk/ month, 53.8% in the case group and 21.9% in the control group. The mean age of the mother was 19.23±0.60 years and 21.78±4.78 years in the death and survived group. Baskaran et al revealed that among 200 hospitalized SAM children. One (0.5%) child belonged to the upper middle class, 16 (8%) to the lower middle class, 89 (44.5%) belonged to the upper lower class and the majority 94 (47%) belonged to the lower class as per the Kuppusamy scale.[7] Banga et al revealed that the mortality rate was higher among younger children, males, children from rural areas, and low-income families.[8] Younger age was found to be a predictor of mortality in SAM children by previous studies.[9,10] Males constituted 72 (65.5%) of the children; 51 (46.6%) of the children were in the age group of 13 to 36 months in another study.[11] In the present study, among risk factors of mortality, dermatosis (46.2% vs 4.9%), oral ulcer (46.2% vs 5.5%), hypoglycemia (46.2% vs 3.8%), severe anemia (38.5% vs 2.2%), septicemia (76.9% vs 29.5%) in case and control group respectively. These risk factors were significantly higher in the death group compared to the surviving group. Sepsis has been implicated as a predictor of mortality in SAM children by previous studies. SAM children are prone to life-threatening infections including sepsis which has a 31-fold odd of dying.[10,12] In the study of Baskaran et al 6% of children had chronic diarrhea, 13% had sepsis, 27% children had severe anemia, 44.5% had pneumonia and 57.5% had acute watery diarrhea.[7] In the current study, after doing multivariate logistic regression analysis it was observed that hypoglycemia (OR=9.17 with 95% CI 1.44 to 58.29) and severe anemia (OR=13.42 with 95% CI 1.42 to 126.13) were the strongest predictors of mortality among the hospitalized children with SAM. These findings are correlates with previous studies, where severe anemia was a predictor of mortality in SAM children.[9,13] Hypoglycemia was found in 12.5% of severely malnourished children and it was significantly associated with adverse outcomes.[14]

Limitations

Study conducted in a single hospital with a small sample size. So, results may not represent whole community.

CONCLUSION

This study concluded that hypoglycemia and severe anemia were the main contributing factors to mortality among children with SAM in hospitals.

Recommendations

Early identification and prompt management of hypoglycemia and severe anemia contributing to death can reduce the mortality due to SAM in the hospital. The clinician should be more vigilant about immediate care of SAM children with complications after admission. Moreover, further studies should be conducted involving a large sample size and multiple centers.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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