Original Research Article

Predictors of mortality in children hospitalized with severe acute malnutrition

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ABSTRACT

Background: Severe acute malnutrition (SAM) is a leading cause of morbidity and mortality in children worldwide. Identification of factors contributing to mortality is crucial to decrease the mortality due to SAM. This study aims at identification of factors affecting mortality in hospitalized SAM children.

Methods: This study was done in general pediatric wards of a Government tertiary care center from July 2015 to June 2016. Total 200 children admitted to the hospital with Severe Acute Malnutrition (SAM) as per World Health Organization (WHO) criteria were enrolled. Demographic and clinical data were recorded in structured proforma. These children were followed up till death or discharge and their progress and outcome were noted. The risk factors considered were younger age (infancy), female sex and presence of systemic illness, sepsis, retroviral positivity, severe anaemia, pneumonia and diarrhea and these were compared between those who died and survivors. Univariate analysis and logistic regression analysis were performed to determine the significant risk factors.

Results: The mortality rate was 10.5%. Presence of systemic illness, sepsis and retroviral positivity were significant risk factors at the end of univariate analysis and multivariate logistic regression, while the others were insignificant.

Conclusions: Systemic diseases, sepsis and retroviral disease are poor prognostic features and are risk factors of mortality in hospitalized SAM children.

Keywords: Mortality, Prognostic factors, Risk factors, Severe acute malnutrition

INTRODUCTION

Worldwide, severe acute malnutrition (SAM) is a leading cause of morbidity and mortality in children. In the year 2017, the global prevalence of SAM in under-five children was 2.4% amounting to 16.4 million.¹ Central Africa and South Central Asia account for majority of children with SAM. According to NFHS-4 (2015-16) data, 7.5% of under-five children in India are severely wasted.² Malnutrition is responsible directly or indirectly for 35% of deaths among children under five years of age.³

SAM may be a consequence of poor nutritional intake or underlying systemic illness. Irrespective of the cause, studies have shown that the mortality of children with SAM is ten times higher than children who are not wasted.⁴ SAM children who have medical complications and fail appetite test are hospitalized and treated as inpatients.⁵ It is estimated that such complicated SAM account for 15% of total SAM patients and will need initial facility based care.⁶ Though nutritional rehabilitation is the mainstay of therapy in hospitalized SAM children, their outcome is dependent on co morbidities present.⁷

Identification of factors contributing to mortality is crucial to decrease the mortality due to SAM. This study aims at identification of factors affecting mortality in hospitalized SAM children.

METHODS

This study was conducted in general paediatric wards of a Government tertiary care facility from July 2015 to June 2016. All children admitted to the hospital with SAM as per World Health Organization (WHO) criteria were included in the study; there were no specific exclusion criteria.⁵ A convenient sample size of 200 was planned. The study was commenced after obtaining clearance from institutional ethics committee.

Consecutive 200 SAM children admitted as inpatients in the wards were recruited. After obtaining informed consent from parents, demographic data like age, sex, locality and socioeconomic status of the family as per modified Kuppusamy classification were collected. Anthropometry like weight, height/length and mid upper arm circumference were measured as per standard procedures. Supine length was recorded using infantometer in children less than 2 years of age to nearest 0.1 cm whereas standing height was recorded using a stadiometer in children above the age of 2.

Weight was recorded using electronic weighing scale in all children. Mid upper arm circumference was measured to nearest 0.1 cm midway between acromion and olecranon using flexible, non-stretchable tape. Presence of edema or wasting was noted. Detailed systemic examination was done. All relevant investigations done were noted from case record. Case management was in line with WHO guidelines and hospital protocol.

This cohort of 200 SAM children was followed up till death or discharge and their progress and outcome were noted. Those who died were considered cases while those who improved were considered controls. The factors considered as predictors of mortality were younger age (infancy), female sex, presence of systemic illness, sepsis, retroviral positivity, severe anaemia, pneumonia and diarrhoea.

Systemic illness was defined as any disease involving major organ systems namely cardiovascular system, nervous system, gastrointestinal system and respiratory system. Cardiac illness described in the study included congenital cardiac defects diagnosed by echocardiogram. Neurological illness included cerebral palsy diagnosed clinically by paediatric neurologist. Gastrointestinal disease included chronic diarrhoea with malabsorption diagnosed by small bowel biopsy. Sepsis included cases with polymorphonuclear leucocytosis and CRP positivity with accompanying SIRS response with or without blood culture positivity. Retroviral infections included serologically positive cases.

Severe anaemia was defined as haemoglobin concentration less than 7 mg/dl. Pneumonia was diagnosed clinically in a child presenting with cough, cold, fever and respiratory distress as per WHO criteria. Acute gastroenteritis was defined as passing watery stools more than thrice in 24 hours.

Statistical analysis was done in SPSS (version 21). Univariate analysis was done to determine factors affecting mortality. The factors found to be significantly associated with mortality in univariate analysis were subjected to multivariate logistic regression to determine significant independent risk factors of mortality. The strength of association was expressed as odds ratio with 95% confidence interval.

RESULTS

Totally 200 hospitalized SAM children were included in the study. The median (Interquartile range) age of included children was 15 (11- 21.75) months. As much as 68 (34%) children were infants and 93 (46.5%) were males. Among 200 hospitalised SAM children, 122 (61%) children were from rural area and 78 (39%) were from urban area. 1 (0.5%) child belonged to upper middle class, 16 (8%) to lower middle class, 89 (44.5%) belonged to upper lower class and majority 94 (47%) belonged to lower lower class as per kuppusamy scale.

Systemic illness was seen in 34 (17%) children, out of which 26 (76%) children had congenital heart defects, 6 (18%) had cerebral palsy and 2 (6%) children had chronic diarrhoea. Further 26 (13%) had sepsis, while 7 (3.5%) were retrovirus positive. As many as 54 (27%) children had severe anaemia, 89 (44.5%) had pneumonia and 115 (57.5%) had acute watery diarrhoea. The various co morbidities present are shown in figure 1. Out of 200 hospitalized SAM children, 21 died and 179 recovered amounting to a case-fatality rate of 10.5%. Notably, all retrovirus positive SAM children died.

Figure 1: Co morbidities in hospitalized SAM children.

The result of univariate analysis is given in table 1. Presence of systemic illness, sepsis and retroviral positivity were significant risk factors at the end of univariate analysis, while the others were insignificant. Multivariate logistic regression as given in table 2 confirmed these three factors as significant independent risk factors predicting mortality in hospitalized SAM children.

Table 1: Univariate analysis of risk factors.

Risk Factor	Died (n=21)	Survived (n=179)	p value
Infancy	8	60	0.8
Female sex	11	96	1.0
Systemic illness	10	24	0.001
Sepsis	11	15	<0.001
Retroviral positivity	7	0	<0.001
Severe anemia	6	48	0.8
Pneumonia	13	76	0.1
Acute Gastroenteritis	8	107	0.06

Table 2: Multivariate Logistic regression.

Risk factor	Adjusted odds	95% confidence interval	Significance
Systemic illness	19.123	3.7-96	p<0.001
Sepsis	31.047	6.05-159	p<0.001

DISCUSSION

In this study of 200 hospitalized SAM children, presence of systemic illness, sepsis and retroviral positivity emerged as significant independent risk factors for mortality. This was a meticulously planned and well executed study. Further, this study was done in a tertiary health care centre with all facilities available for appropriate nutritional management as well as aggressive management of co morbidities. The only limitation of the study was the small sample size.

The case fatality rate observed in our study was similar to that observed in many studies done in Africa.⁸⁻¹⁰ But it was much higher than the case fatality rate of 2.7% reported in an Indian study, which was a community based study which included SAM cases without co morbidities and hence had a lower fatality rate.¹¹

Sepsis has been implicated as a predictor of mortality in SAM children by previous African studies SAM children are prone for life threatening infections including sepsis which has a 31 fold odds of dying. Retroviral disease as a predictor of mortality in SAM has been described by previous studies.^{8,12,13} Notably in our study, all patients who had SAM with retroviral disease died in spite of the

fact that all were on anti retroviral therapy. Co-existence of SAM with retroviral disease indicates advanced stage of infection which understandably has high mortality rates. However, the effect of systemic disease on mortality of SAM children has not been described previously, though studies describing common occurrence of SAM in children with congenital heart defects are available.^{14,15}

Systemic illnesses constitute an organic cause of malnutrition or failure to thrive and children with systemic disease and SAM have 19 fold odds of dying. A child with congenital heart defect needs increase calorie intake for increased cardiac work, sympathetic over activity, recurrent respiratory infections, and hypoxia, in addition, congestive cardiac failure causes difficulty in feeding with poor intake and malabsorption. Hence growth failure is inevitable in symptomatic children with congenital heart disease. Severe anaemia and younger age have been found to be predictors of mortality in SAM children by previous studies, but our study found these factors to be insignificant.^{11,13,16,17}

At present in India, authors may not be correct in assuming that all the cases of malnutrition are due to lack of availability of proper diet due to poor socio-economic background. Even though it is an important problem to be addressed by our society, authors should not lose sight of the fact that in some cases the malnutrition could be secondary to some medical disease like systemic disease or retroviral infection or these diseases may be a contributing factor. In such cases the underlying medical disease may act as predictor of mortality as well. Among the risk factors of mortality, systemic illness and retroviral disease may be the underlying illness for SAM while sepsis is a life-threatening complication. Irrespective of whether these conditions are cause or effect of SAM they are implicated as poor prognostic features. The implication of this finding is that both appropriate nutritional management and aggressive treatment of underlying cause/complication should go hand in hand in these patients.

CONCLUSION

Systemic diseases, sepsis and retroviral disease are poor prognostic features and are risk factors of mortality in SAM children. In any child presenting with SAM, these factors have to be looked for to determine the prognosis.

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