Triage of Children with Severe Acute Malnutrition and its Outcome: Single Centre Cross-sectional Study

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ABSTRACT

Introduction: World Health Organisation (WHO), Emergency Triage, Assessment and Treatment (ETAT) guidelines categorised three most common presentations of sick children at admission; these are Respiratory distress and Hypoxemia, Severely impaired circulation or Shock and Seizures with Altered consciousness. Limited data is available on triage in sick children with Severe Acute Malnutrition (SAM).

Aim: To describe the triage of children with SAM at time of hospitalisation and its outcome.

Materials and Methods: This was a prospective cross-sectional study, conducted on malnourished children recruited from September 2017 to August 2018, over one year period at Department of Paediatrics, Banaras Hindu University. The inclusion criteria were children aged 6 to 60 months fulfilling the WHO criteria of SAM. Triage of SAM children was done in paediatric emergency by resident on duty and A (airway), B (breathing), C (circulation, coma and convulsion), D (severe dehydration) model was used to identify the presence of emergency sign. Outcome was defined as discharge and/or death. Criteria used to indentify the clinical status were taken from WHO-ETAT2016. The demographic characteristics, clinical information is presented as frequencies with percentages. All data were entered into excel sheet and analysed by using SPSS version 18.

Results: There were 122 SAM children, out of these, almost two third children (63.2%) were male and most common affected age group of children was less than 3 year (77%). The common emergency sign was hypoxemia (37.96%) followed by dehydration (32.40%), hypoglycemia (21.29%), shock (18.51%), severe respiratory distress (18.5%), and convulsion (10.18%). SAM children with fatal outcome were 11.29 times more likely to have shock (0.001), 10.2 times more likely to have dehydration (<0.001), 7.2 times more likely to have severe respiratory distress (<0.001). There was presence of three or more emergency signs in SAM children who died.

Conclusion: Early recognition of clinical signs of shock, severe respiratory distress and dehydration would identify SAM children who are at risk of early death on arrival to facility.

INTRODUCTION

Severe acute malnutrition is a major cause of morbidity and mortality in children under 5 years of age, especially in developing countries [1-4]. There is an expansion of Nutritional Rehabilitation Centers (NRC) in our country, but if the children with Severe Acute Malnutrition (SAM) do not arrive in time and already irreversible pathophysiology has set in, then even the best standard of care may not give satisfactory results. Deaths in SAM children occur within the first 48 hours of admission, as delay in recognition, delay in seeking care and delay in provision of care upon their arrival at the health facility, is responsible for most of the deaths, which otherwise are amenable to available intervention [5]. Standard of care, WHO, ETAT guidelines categorised three most common presentations of sick children at admission, these are respiratory distress and hypoxemia, severely impaired circulation or shock and seizures with altered consciousness [6]. These guidelines recommend early recognition of emergency or priority signs present in sick children to provide appropriate emergency treatment for better outcome. In this study an attempt has been made to identify those emergency or priority signs which can be easily identified at peripheral health centers and are responsible for poor outcome if recognition is delayed.

MATERIALS AND METHODS

This was a prospective cross-sectional study, conducted on malnourished children recruited from September 2017 to August 2018, over one year period at Department of Paediatrics, Institute of Medical Sciences, Banaras Hindu University, Uttar Pradesh. The inclusion criteria were children aged 6 to 60 months fulfilling the WHO criteria of SAM [7]. The study was approved by the Ethics committee of the college (EC/454/2015-16) and informed consent was obtained from the parents of all patients before the study. We collected data on demography, anthropometry, history and clinical examination and relevant investigations were done, it included CBC, Arterial blood gas analysis, Serum electrolytes, Serum albumin, Blood sugar. Children were managed as per WHO SAM protocol [8]. Outcome was defined as discharge or death.

Triage includes rapid recognition of emergency or priority signs present in sick children. Presence of emergency signs needs simultaneous stabilisation of sick children; however presence of priority signs needs close observation and further evaluation of child. Triage of SAM children was done in paediatric emergency by resident on duty and A (airway), B (breathing), C (circulation, coma and convulsion), D (severe dehydration) model was used to identify the presence of emergency sign [8]. The emergency sign [6] are: (i) Obstructed and absent breathing; (ii) Severe respiratory distress; (iii) Central cyanosis; (iv) Signs of shock i.e., cold extremities with capillary refill time >3 sec and weak & fast pulse; (v) Coma, reduced level of consciousness; (vi) Seizures; (vii) Severe dehydration. Presence of priority signs in children warrants prompt assessment and treatment. They are: (i) Tiny baby (<2 months); (ii) Bleeding; (iii) Pallor (severe); (iv) Malnutrition: Visible severe wasting; (v) Respiratory distress; (vi) Trauma or other urgent surgical condition; (vii) Referral (urgent); (viii) oedema of both feet; (ix) Temperature <36.5°C; or >38.5°C (x) Restless, continuously irritable or lethargy; (xi) Poisoning; (xii) Burns (major).

Definitions used to Identify the Clinical Status are Mention Below

(i)   Severe respiratory distress is defined as presence of respiratory rate 70 per minute or more, severe lower chest in-drawing, use of accessory muscles for breathing, unable to feed due to respiratory distress, stridor in a calm child. Or hypoxemia i.e., peripheral capillary oxygen saturation (SpO_2) on room air <90% [6].

(ii) Central cyanosis is defined as presence of bluish/purplish discolouration of tongue or inside mouth of a child.

(iii) Shock is defined as presence of cold extremities with capillary refill time >3 sec and weak & fast pulse (If pulse rate is more than 160/minute in children below 12 months and more than 140/minute in children 12 months-5 years, it is considered to be a fast pulse).

(iv) Coma is defined as a child who does not wake to voice or being shaken or to pain is unconscious.

(v)   Convulsion is abnormal movement of body parts which may be associated with up rolling of eyes and frothing from mouth.

(vi) Severe dehydration is defined as presence of definite history of diarrhoea and history of a recent change in the child's eyes. History of diarrhoea includes three or more watery stools in past 24 hours [9].

(vii) Hypoglycaemia is defined as blood glucose <54 mg/dL.

STATISTICAL ANALYSIS

All data were entered into excel sheet and analysed by using SPSS version 18. The demographic characteristics, clinical information was presented as frequencies with percentages. Two tailed Fisher-exact test (when row or column had value less than 5) or Chi-square test was used to compare categorical variables. The critical level of significance of the results were considered at 0.05 levels i.e., $p < 0.05$ was considered significant.

RESULTS

Triage is a process of segregation of sick children on their arrival to health facility. In present study, triage was done as per WHO-ETAT on SAM children and it was found that 154 emergency signs and 293 priority signs were present at the time of admission. Therefore, out of 122 total children, 108 children who were analysed, at the time of presentation had 1 or 2 emergency and 2 or 3 priority signs; 18 children who died had 3 or 4 emergency signs at time of admission.

Demographic characteristic as shown in [Table/Fig-1]. Out of 122, 90 (73.77%) were discharged from hospital, 18 (14.75%) died and 14 (11.47%) Leave Against Medical Advice (LAMA, excluded from analysis) . Almost two third of the children (63.2%) were male and most common affected age group was less than 3 year (63%). SAM was found to be more prevalent in lower middle class (58%) as compared to upper lower class.

Characteristics		Number (122)	Percentage (%)
Age (months)	6-12	31	25.40
	13-36	51	41.80
	37-60	40	32.78
Gender	M	77	63.2
	F	45	36.8
Socioeconomic status	Upper lower-IV	48	39.34
	Lower middle-V	71	58.19
MUAC* (mean, SD)		9.5(1.1)	
Outcome	Discharged	90	73.77
	Died	18	14.75
	LAMA#	14	11.47

[Table/Fig-1]: Demographic characteristics and outcome of study populations.
#AMA- Leaves against medical advice
*MUAC- Mid upper arm circumference

As shown in [Table/Fig-2] the most common emergency sign was hypoxemia (37.9%) followed by dehydration (32.4%), hypoglycaemia (21.2%), shock (18.5%), severe respiratory distress (18.5%) convulsion (10.1%). Coma and apnea were the least common signs (1.8% each).

Emergency signs	Numbers (n=108)*	Percentage (%)
Hypoxemia	41	37.96
Dehydration	35	32.40
Hypoglycaemia	23	21.29
Shock	20	18.51
Severe respiratory distress	20	18.51
Convulsion	11	10.18
Coma	2	1.85
Apnea/Gasping	2	1.85

[Table/Fig-2]: SAM children presenting with emergency signs.
*LAMA children were excluded in final analysis

[Table/Fig-3] depicts the most common priority signs at the time of admission; respiratory distress (64.8%) followed by edema of both feet (60.1%), severe pallor (42.5%), lethargy (33.33%), visible wasting (27.7%), hyperthermia (27.7%), hypothermia (14.8%). No children with SAM presented with burn, trauma and poisoning.

Priority sign		Number (n=108)	Percentage (%)
Respiratory distress		70	64.81
Edema of both feet		65	60.18
Severe pallor		46	42.59
Restless, irritable and lethargy		36	33.33
Visible wasting		30	27.77
Temperature (Celcius)	(≤36.5)	16	14.81
	(≥38.5)	30	27.77

[Table/Fig-3]: SAM children presenting with priority signs.

[Table/Fig-4] reveals that SAM children who presented with severe respiratory distress (Odd-30.82), dehydration (Odd-7.3), shock (Odd-5.5), hypoxia (Odd-20.8), severe pallor (Odd-4.49) and hypoglycaemia (Odd-3.69) had significant risk of death, on univariate analysis. However, child with severe respiratory distress had much higher mortality (65%) as compared to respiratory distress (5.7%). Children presenting with dehydration, shock, coma and apnea had 77.7%, 55.5%, 100%, 100% mortality, respectively. Twenty eight percent deaths were found in SAM children admitted with severe pallor, however no significant difference in outcome was found in SAM children admitted with lethargy and edema. Children with fatal outcome were 11.29 times more likely to have shock (0.001), 10.2 times more likely to have dehydration (<0.001),7.2 times more likely to have severe respiratory distress (<0.001) [Table/Fig-4].

DISCUSSION

In this present study, we triaged the SAM children at the time of admission and determined the association of emergency or priority signs with mortality. The common emergency signs were dehydration, severe respiratory distress, shock, convulsion, desaturation and hypoglycaemia, and the common priority signs were respiratory distress (tachypnoea), oedema, pallor, lethargy, visible wasting, hyperthermia and hypothermia. In the present study SAM children with fatal outcome were 11.29 times more likely to have shock (0.001),10.2 times more likely to have dehydration (<0.001),7.2 times more likely to have severe respiratory distress (<0.001). Similar observation was seen by Barungi NN et al., and found that SAM children presenting with respiratory distress has 5 time odds of death (p=0.01) and hypoxia has two and half time odds of death (p=0.01) [10]. Retrospective analysis by Girum T et al., found that SAM children presenting with shock has 3 time odds of death (p<0.0001) and anaemia has two and half time odds of death (p=0.02) [11]. Wagnew F et al., reported similar observation and

Category	Features present at admission	Discharged (N=90)	Death (N=18)	Univariate analysis	Multivariate analysis
				P OR (95% CI)	P OR (95% CI)
Emergency signs					
	Dehydration (n=35)	21 (23.3)	14 (77.7)	<0.001,7.3 (2.79-20.12)	<0.001,10.02 (3.68-55.16)
	Hypoxia (n=41)	25 (27.7)	16 (88.8)	<0.0001,20.8 (4.45-97.12)	
	SRD# (n=20)	7 (7.7)	13 (72.2)	<0.001,30.82 (8.5-111.3)	<0.001,7.21 (2.05-46.13)
	Shock (n=20)	10 (11.1)	10 (55.5)	<0.001,5.5,2.53-11.39	0.001,11.29 (2.84-57.29)
	Hypoglycemia (n=23)	14 (15.5)	9 (50)	0.001,3.69 (1.66-7.89)	0.54,2.07 (0.20-21.16)
	Convulsion (n=11)	7 (7.7)	4 (22.2)	0.15,3.38 (0.87-13.10)	
	Coma (n=2)	0	2 (11.1)	0.02*,27.42 (1.25-597.97)	
	Apnoea (n=2)	0	2 (11.1)	0.02*,27.42 (1.25-597.97)	
Priority signs					
	Hypothermia (n=16)	10 (11.1)	6 (33.3)	0.026,4 (1.22-13.02)	
	Severe Pallor (n=46)	37 (41.1)	13 (72.2)	0.016,3.01 (1.21-7.79)	0.14,0.25 (0.04-1.61)
	Lethargic (n=36)	31 (34.4)	5 (27.7)	0.78,0.73 (0.23-2.24)	
	RD$ (n=70)	66 (73.3)	4 (22.2)	<0.001,0.10 (0.031-0.34)	
	Edema (n=65)	53 (58.8)	12 (66.6)	0.72,1.36 (0.48-4.05)	

[Table/Fig-4]: Risk factors for mortality in SAM children presenting with emergency and priority signs.
#SRD- Severe respiratory distress
$RD- Respiratory distress
*Fisher-exact test was use to calculate the value (as column values were less than 5), and rest values were calculated by Chi-square

concluded that SAM children presenting with shock has 8 time odds of death (p<0.0001) and anaemia has two time odds of death (p=0.02) [12]. To our best knowledge this was the first attempt to study triage of SAM children as per WHO-ETAT and to assess effect of emergency or priority signs on outcome at admission and it was found that not only emergency signs but presence of priority signs on arrival to facility like, Severe Pallor (Odd-4.49) and hypothermia (Odd-4) have significant increased risk of death in SAM children. Hypoxia (SpO_2 <95%) and hypoglycaemia (glucose <54 mg/dL) may not manifest clinically in SAM children however they co-exist with emergency or priority signs. And in present study children with fatal outcome were 20 times more likely to have hypoxia (p<0.0001), 3.6 times more likely to have hypoglycemia (p=.001). Addition of pulse oximetry to detect hypoxia and blood glucose to detect hypoglycaemia would affect the outcome of SAM children on triage, as SAM triage protocol did not consider oxygen saturation and blood glucose while segregation of sick children in emergency room.

The strength of present study is that it was a clinical study, and we determined independent signs associated with mortality during hospitalization. Clinical variables associated with poor outcome were easily identified by peripheral health workers.

LIMITATION

The sample size was small, children who opted for LAMA were excluded, and the effect of sepsis, electrolyte, and acidosis mortality were not studied. Large sample size study would be needed to find out association of emergency or priority signs with mortality at 24 hours of hospitalisation.

CONCLUSION

Early recognition of clinical signs of shock, severe respiratory distress and dehydration would identify SAM children who are at risk of early death on arrival to facility.

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