ORIGINAL ARTICLE

Treatment Outcome and Predictors of Severe Acute Malnutrition using the WHO Guideline at a Referral Hospital in Southern Ethiopia

Wegen Shiferaw(MD)[1], Birkneh Tilahun(MD)[2]*, Kolsteren Patrick(PhD) , Tefera Belachew (MD)

ABSTRACT

Background*: Management of severe acute malnutrition (SAM) is a challenge in the developing world because it is a common problem which consumes the majority of the scarce resources. Despite the marked progress in improving mortality of SAM through implementation of the WHO protocol in well resourced settings, the reported mortality from institution based management ofSAM in the developing world remained high. This article reports on the outcome predictors of management of SAM at a developing country setting; Methods, From September 2006 to August 2009, a total of 151 cases who fulfilled the inclusion criteria were included for final analysis at the paediatric ward of Hawassa University Referral Hospital (HURH). Data were abstracted from the clinical records on structured data retrieval forms. The data were analyzed using SPSS for windows version 16.0. Bivariate and multivariable logistic regression wasused to identify predictor variables; Results: Of the reviewed 151cases, 84(55.6%) had oedematous malnutrition. In response to the treatment provided, 105(70%), 23(15.2%) and 23(15.2%) of the cases had improved/ been discharged, defaulted and died respectively. The non-oedematous cases of SAM were more likely to default from the course of treatment (COR: 2.8[95%CI: 1.0-7.68], P <0.05). Most deaths of children with SAM occurred in the early course of treatment:8(35%) of the deaths occurred in the first 48hours while 11(48%) occurred within the first week of admission (P<0.05).On multivariable logistic regression, fluid or blood transfusion (AOR: 8.73 [95%CI: 2, 06-37, 02]) and age of the child (AOR: 1.05 [95%CI: 1, 00-1.09]) were the independent predictors of death while on treatment. Presence of HIV infection and severe anaemia doubled the mortality rate; Conclusion, The treatment success of SAM against the WHO protocol at HURH is below the standard. Various predictors of death of children while of treatment based on the WHO protocol have been identified. Addressing these risk factors for death is vital to decreasing the child mortality due to malnutrition.*

Key Words*: Severe acute malnutrition, Mortality, Ethiopia*

INTRODUCTION

Severe acute malnutrition is defined as weight for height (WFH) below -3 Z score (Zs) of the median WHO growth standards, visible severe wasting, or the presence of bilateral pitting oedema. In children aged 6–59 months, an arm circumference less than 110 millimetres is also indicative of severe acute malnutrition [1, 2].

Although various efforts were made in the last few decades to decrease under 5 mortality rate in the developing countries, little progress was seen to improve the situation and achieve the millennium development goal-4 (MDG4) [3]. Malnutrition still contributes to half of the deaths of under 5 children worldwide and is one of the major socioeconomic, political, and environmental and health problems [4-8]. Any child with malnutrition is at an increased risk of developing complications which may lead to severe illness and death [1].

[1] Department of Pediatrics and Child Health, Hawassa Unievrsity
correspondence: Birkneh Tilahun birknehtilahun@gmail.com

Among all malnutrition related deaths, 42% occurred in the WHO African region [9]. The risk of death is up to 20 times higher than a healthy child for children with severe acute malnutrition, making severe acute malnutrition a major killer of children less than five years of age [10-12].

In Southern Nation Nationality Peoples Region (SNNPR) of Ethiopia, community and family survey data estimates indicate that 45% of children are stunted, 42% are underweight, and 12% are wasted [13]. The appropriate treatment of SAM significantly contributes to the success of both clinical medicine and public health in reducing many child deaths [14]. In a country with limited resourcesand multi-factorial causes of malnutrition, considering treatment of malnutrition as the only solution for the problem is not reasonable.In a situation with high prevalence of SAM, an integrated approach salvages the life of hundred thousands of children [15]. This study reports on the predictors of outcome of severely malnourished under five children managed as in-patients with the WHO protocol for the treatment of severe acute malnutrition.

METHODS AND SUBJECTS

Setting: This study was done at Paediatrics department of HURH. The hospital gives service to patients from the Hawassa city administration, cases coming from different zones of Southern region of Ethiopia and adjacent zones of Oromiya region. It has a total of 250 beds; out of which 50 are in the paediatric ward. The paediatric ward has a corner for treatment of SAM patients with the phased approach of the WHO protocol.

Study Subjects and Management of SAM: Included were all under five children who were admitted to HURHPaediatric ward during the study period with a diagnosis of SAM. The admission was decided at the Paediatrics outpatient department (OPD) by assigned physicians after standardization of the anthropometric parameters using WHO curves. Screening of all children for malnutrition was the routine procedure at the OPD and those who fulfil the criteria for admission were admitted to the general paediatric ward.Children who were nottreated according to the WHO protocol were excluded from the study. The diagnostic criteria for SAM at the outpatient department included: weight-for-height (WFH) less than 70% the standard on the WHO curve, mid upper arm circumference (MUAC) less than 110 mm for children of length/height at least 65 cm or, and the presence of bilateral pitting leg oedema [16]. After admission to the paediatric ward, the national guideline for the management of SAM (an adaptation of the WHO guideline) for hospital treatment of severe malnutrition was used. The management of SAM is organized in 3 phases: phase I, transition phase and phase II [16]. Formula75/ Formula 100, Vitamin A, Folic Acid and Antibiotics were routinely administered according to the protocol for all children.

Data collection process

All data from the records of the patients were abstracted using a structured data retrieval format. Acomprehensive follow up chart (also called the UNICEF/WHO multi-chart) which is prepared and distributed by UNICEF for the follow up of admitted cases was the main source of the abstracted data. Other hospital records including patient charts and follow-up sheets were used for patients whose multi-chart is incomplete. The multi-chart includes a wide range of patient characteristics. On the first part, it states: the patient's name, sex, age in months, spaces for the daily weight, height and weekly head circumference. It also records if there are any additional diagnosis, the amount of milk taken, presence or absence of vomiting, diarrhoea, fever, cough, transfusion and others. It is usually filled by attending doctors and nurses.

Statistical Analysis

The data were entered, cleaned and analyzed using SPSS for windows version 16 software (SPSS Inc. version 16.1., Chicago, Illinois). Descriptive statisticswere presented as mean (standard deviation), median (range) and numbers (percentage). On bivariate analysis, factors associated with treatment outcome of SAM were identified at P-values of <0.05. 95% confidence intervals were also calculated. Multivariable logistic model was used to identify the independent factors associated with mortality of children on treatment for SAM. Chi square and Fisher's exact tests were also used to compare certain variables. Fisher's exact test was especially used when the number of children under comparison was small.

Ethical considerations

The study was approved by the institutional review board (IRB) of the college of medicine and health sciences of Hawassa University. The data retrieval forms were made anonymous.

RESULTS

A total of 151 children who fulfilled the inclusion criteria were studied. There were more males than females with a male to female ratio of 1.25:1. The mean age of the group was 26.5 (± 16.8SD) months.Children below the age of 24 months constituted 58.3% of all cases and infants constituted nearly one third of the cases.

Oedematous SAM was the commonest form of malnutritionaccounting for 55.6 %(n=84) of all cases.Infants were 2.3 times at increased risk of developing wasting than oedematous malnutrition (P =0.019). The proportion of oedematous cases increased from the second year of life to reach the peak during the 4th year of life (COR: 2.93 [95%CI: 1.00-9.74]), P=0.04.

Nearly 93% of the cases had co-morbidities at admission. The common co-morbidities identified were diarrhoeal disease, 53 %(n=80); tuberculosis, 35.8% (n=54); pneumonia, 31.8% (n=48); paediatrics AIDS, 9.9% (n=15/82); anaemia 54% (n=78/143), malaria; 13(8%) and pyuria, 40% (25/61).

Among the 84 cases of oedematousSAM, 14(16.7%), 8(9.5%) and 62(73.8%) of cases died, defaulted and improvedrespectively. Whereas, among the 67 cases with marasmus, 13.4%, 22.4% and 64.2% died, defaulted and improved, respectively. Cases with marasmus were more likely to default from the course of treatment (COR: 2.8[95% CI: 1.0-7.68]), P =0.029.No significant difference (P>0.05) was observed inthe case fatality rate of oedematous versus non-oedematous cases of malnutrition.

Co-morbidities affected the outcome of patients with SAM; children with severe anaemia (HCT<21%) were more likely to die (COR: 4.85[95% CI: 1.14-20.0], P-value <0.05) children who received intravenous fluid/blood transfusion had a significantly higher risk of death (COR: 9.31[95% CI: 3.0-29.0], P-value<0.0001).

Forty three percent (n=65) of the cases with SAM had very severe anthropometric deficit with the WHO Zs standard at admission (WFH <-4Zs.More than half, 54.5% (n=36/67) of non oedematous cases of SAM and 34% (n=29/84) of oedematous cases ofSAM had very severe anthropometric deficit at admission (WFH < -4Zs). The marasmic (non-oedematous) cases were more likely to have very severe anthropometric deficit (COR: 2.8[95%CI: 1.12-4.65], P-value=0.014).

Case fatality rate did not significantly differ by thelevel of severity of malnutrition at admission; though, severe anthropometric deficit doubled the risk of dying from marasmus (COR: 2[95%CI: 0.33-11.8], P-value>0.05) (Table 1).

Further analysis of predictors of mortality using multivariable logistic regression revealed that the risk of dying from SAM was independently associated with fluid and/or blood transfusion (AOR: 8.7[95%CI: 1.31-19.5]). Even though age category had showed no significant association in the bivariate analysis, it was identified as a predictor withan increment in mortality as age in months increases (AOR: 1.05[95%CI: 1.01-1.09]). An increased odds of mortality was observed for cases with severe anaemia (AOR: 4.14[95%CI: 0.56-30.5]) and HIV sero-positivity (AOR: 3.69[95% CI: 0.7-19.5]) but no significant association was found (P> 0.05) (Table 2).

Figure 1: Outcome of SAM treatment in Hawassa University Referral Hospital versus the Sphere project from September 2006 to August 2009

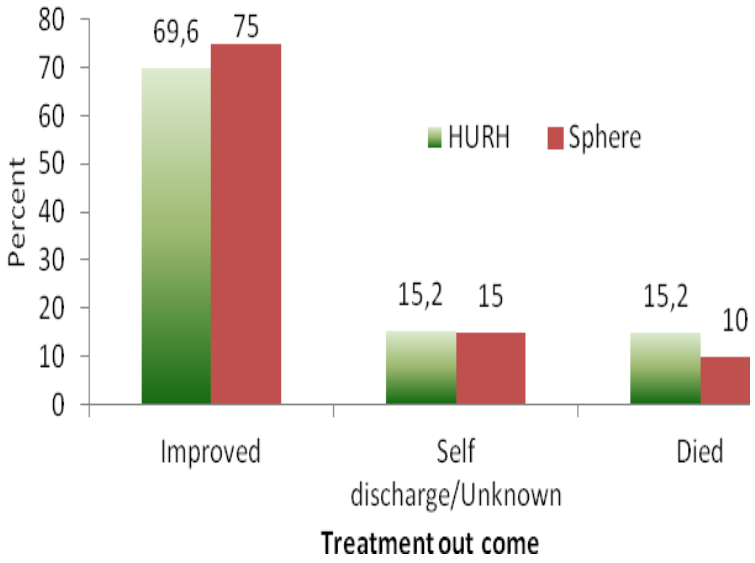

Table 1: Common co-morbidities and other factors as predictors of outcome of SAM September 2006 to August 2009

Contributing factors		Died	Improved	COR	P-value
Pneumonia	Yes	7	31/128	1.04[0.35-3.1]	0.93
	No	16	74	1	
Diarrhoea	Yes	14	54/128	1.47[0.54-4.1]	0.28
	No	9	51	1	
Fluid /blood transfusion*	Yes	12	11/128	9.31[3.0-29.0]	<0.0001
	No	11	94	1	
Tuberculosis	Yes	9	39/128	1.09[0.39-3]	0.85
	No	14	66	1	
HIV sero-status	Reactive	5	10/74	2.45[0.57-10]	0.15
	Non-Reactive	10	49	1	
Anaemia*	Hct < 21%	5	7/121	4.85[1.14-20]	0.01
	Hct 21-30	7	49	0.68[0.2-1.9]	0.36
	Hct > 30%	7	46	1	
Pyuria (≥10WBC/HPF)	Yes	3	19/54	0.85[0.14-4.8]	1†
	No	5	27	1	
Breast feeding history	Yes	16	97/118	1	
	No	2	3	4[0.43-33]	0.16†
Exclusive Breast feeding	6month	8	42/101	1	
	Not for 6 month	7	44	0.84[0.24-2.8]	0.74
Immunization of measles	Yes	8	51/100	1	
	No	10	31	2.06[0.66-6.5]	0.17
WFH-WHO Zs Deficit	> - 4Zs	12	63/127	1	
	< - 4Zs	10	42	1,25[0.45-3.5]	0,63

*: Significant values ($p<0.05$), †: Fisher exact test

±: Defaulter cases were excluded from the analysis

Table 2: Parameter estimates from multivariable logistic regression models predicting the probability of death in HURH September 2006 to August 2009

Predictors of mortality	B	P-Value	Adjusted OR†	95,0% CI
Age	0.05	0.033	1.05	[1.00-1.09] **
Sex				
Male			1.00*	
Female	-0.53	0.452	0.59	[0.15-2.35]
Place of Residence				
Urban			1.00*	
Rural	-0.1	0.88	1.12	[0.30-4.02]
Oedema at admission				
No		0.971	1.00*	
Yes	0.03	0,308	1.03	[0.26-4.01]
Anemia				
Hct,†† <21%	1.42	0,163	4.14	[0.56-30.51]
Hct 21-30%	-0.23	0.729	0.79	[0.21-2.98]
Hct >31%			1.00*	
Fluid blood Transfusion				
No		0.003	1.00*	
Yes	2.17	0.174	8.73	[2.06-37.02] **
WFH Zs				
>-3ZS		0.127	1.00*	
-3Zs to-4Zs	-1.43	0.807	0.24	[0.04-1.50]
<-4Zs	-0.19	0.245	0.83	[0.18-3.81]
HFA Zs				
>-2Zs		0.124	1.00*	
-2to-3Zs	1.31	0.721	3,69	[0,70-19,49]
<-3Zs	0.3	0.047	1,35	[0,26-6,86]
HIV sero status				
No			1.00*	
Yes	1.52	0.090	4,57	[0,78-26,55]
Unknown	-0.923	0.204	0,4	[0,96-1,65]

*: Referent categories, †: Odds Ratio, , ††: Hematocrit **:Significant at P<0.05

DISCUSSION

After the introduction of WHO protocol for the management of SAM remarkable improvement was observed on the outcome of cases managed in institution based (17- 19) community based(CTC) and emergency settings (13, 20-22).

In the current study, the overall case fatality rate was 15.2% with a recovery rate of 69.6%; these figures are not acceptable when compared with national and international standards (10, 16,23). The minimum standards set by the Sphere project are recovery rate of >75%, death rate of <10% and defaulter rate of <15 % (16, 23).

Young age at admission is an independent predictor of mortality in the current study. Many cases suffer from malnutrition related deaths during the early year life. The first two years of age is a critical period which is usually a negative reward of sub optimal breast feeding, inappropriate complementary feeding practices with a low-protein diet and severe or frequent infections (5, 7). Similar findings were reported from a study done in the northern part of the country (24).

In the current study, fluid and/or blood transfusion increased mortality.This is possibly because these children are seriously ill and need progressive stabilization. Fluid and/or blood transfusion areusually required in the presence of severe illnesseslike dehydration and anaemia. Golden and Bachou Halso showed adjustment for severity of disease did not change case fatality in those who had fluids and/or blood transfusion (25, 26). Ciliberto *et al* identified that both severity and poor case management are more important in low resource setting countries and severity is the main determinant of high case-fatality rates in central hospitals (27).

Oedematous malnutrition was the most common type of SAM in the current study. Similar findings were reported by several studies (17, 28). This increased could be because of the public recognition of oedematous malnutrition as a more serious problem than the marasmic malnutrition (29). This affects the health seeking behaviour of parents. The finding of anthropometric deficit increasing the odds of mortality was similarly reported by other researchers (17,24).

In the current study, most of the cases were having one or more co-morbidities atadmission. Similar findings were reported by other Ethiopian studies (24, 30). Carlos *et al* also showed diarrhoea was the most common complication (31).

In this study, significant number of deaths occurred in the first few days of hospitalisation. Similarly, in Kenyan study, one third of deaths were occur within 48 hourof hospitalisation and the WHO danger signs were in a close relationship with mortality (12). This finding was similarly reported by an Ethiopian study (17).

The current study can be taken as an important indicator or of the quality of service delivery for patients with severe acute malnutrition in the study area and other places with similar settings. The main limitations of the study emanate from its retrospective nature posing problems of incompleteness and limited quality assurance methods.

In conclusion, the treatment success of SAM against the WHO protocol at HURH is below the standard. Fluid transfusion and young age were independent predictors of death of children while of treatment based on the WHO protocol. Addressing these predictors for death is vital to decreasing the child mortality due to malnutrition. Generally, the findings underscore the need for better adherence to protocol.

REFERENCES

1. WHO, UNICEF, WFP, United Nation Standing Committee on Nutrition. Community-Based Management of Malnutrition, 2007. Accessed from: http://www.who.int/nutrition/topics/Statement_community_based_man_sev_acute_mal_eng.pdf(Date accessed: December. 20, 2009)
2. Ciliberto MA, Sandige H , Ndekha MDJ, et al. Comparison of home-based therapy with ready-to-use therapeutic food with standard therapy in the treatment of malnourished Malawian children: a controlled, clinical effectiveness trial1–4. Am J ClinNutr 2005; 81:864 - 70
3. UNICEF. Progress for Children. A Report Card on Nutrition, no. 4. UNICEF, New York, 2006. Available from; www.unicef.org/progressforchildren/2006n4/12-15. (Date accessed; December 6, 2009)
4. Caulfield LE, de Onis M, Blössner M, and Black RE. Under nutrition as an underlying cause of child deaths associated with diarrhoea, pneumonia, malaria, and measles. Am J Clin.Nutr. 2002; 80:193–198
5. Rice AL, Sacco L, Hyder A, Black RE. Malnutrition as an underlying cause of childhood deaths associated with infectious diseases in developing countries, Bull World Health Organ. 2000; 78:1207–1221.
6. Pelletier DL, Frongillo EA. Changes in child survival are strongly associated with changes in malnutrition in developing countries, J Nutr. 2003; 133:107–119.
7. Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? Lancet 2003; 361:2226-34.
8. Müller Olaf, KrawinkelMichael. Malnutrition and health in developing countries. CMAJ.2005; 173: 279-86.
9. MSF, WHO, what are the consequences of malnutrition? 2008. Accessed from: http://china.org.cn/international/malnutrition/2008-12/03/content_16891515.htm (Date accessed: July 20, 2009)
10. Ashworth A, Sultana K, Alan J, Claire S. Guidelines for the inpatient treatment of severely malnourished children. New Delhi: World Health Organization Regional Office for South-East Asia. WHO 2003. Accessed from; http://www.searo.who.int/LinkFiles/FCH_malnourished_children.pdf (Date accessed: December. 20, 2009)
11. Dubik M. Mortality of Children Worldwide, AAP Grand Rounds 2005; 14:22-23.
12. Maitland K, Berkley JA, Shebbe M, Peshu N, English M, Newton CR. Children with Severe Malnutrition: Can Those at Highest Risk of Death Be Identified with the WHO Protocol? PLoS Med 2006; 3:e500.
13. Yimer G. Malnutrition among children in Southern Ethiopia: levels and risk factors. Ethiop. J. Health Dev. 2007; 14(3):283-292.
14. Collins S, Dent N, Binns P, Bahwere P, Sadler K, Hallam A.Management of severe acute malnutrition in children. Lancet 2006; 368: 1992–2000.
15. IASC, UNICEF. Global Nutrition Cluster. New York, 2008. Accessed from: http://www.humanitarianreform.org/humanitarianreform/Default.aspx?tabid=74 (Date accessed; July 21, 2009)
16. Federal Ministry of Health of Ethiopia and UNICEF. Guidelines for the Management of Severe Acute Malnutrition.2nd edition, FMOH, 2007:122.Accessed from; http://motherchildnutrition.org/resources/pdf/mcn-ethiopia-sam-guidelines.pdf (Date accessed: July 20, 2009.)
17. Berti A, Bregania ER, Manentia F, Pizzi. C. Outcome of severely malnourished children treated according to UNICEF 2004 guidelines: a one-year experience in a zone hospital in rural Ethiopia. Transactions of the Royal Society of Tropical Medicine and Hygiene 2008; 102: 939-944.
18. Collins S, Sadler K,Dent N, et al. Key issues in the success of community-based management of severe malnutrition. Food Nutr Bull 2006; 27:S49-82.

19. Morrice JS, Molyneux EM. Reduced mortality from severe protein-energy malnutrition following introduction of WHO protocol in children in Malawi. Arch Dis Child. 2003; 88 suppl 1: A28.
20. Chaiken MS, Deconinck H, Degefie T. The promise of a community-based approach to managing severe malnutrition: A case study from Ethiopia.Food Nutr Bull 2006; 27:95-104.
21. Belachew T, Nekatibeb H. Assessment of outpatient therapeutic programme for severe acute malnutrition in three regions of Ethiopia. East Afr Med J 2007; 84:577-88.
22. Ashworth A, Chopra M, McCoy D, et al. WHO guidelines for management of severe malnutrition in rural South African hospitals: effect on case fatality and the influence of operational factors. Lancet 2004; 363:1110-5.
23. SPHERE project team, The SPHERE humanitarian charter and minimum standards in disaster response: Minimum Standards in Food Security, Nutrition and Food Aid. The SPHERE Project. Geneva 2003:134-153.
24. Amsalu S, Asnakew G. The outcome of severe malnutrition in northwest Ethiopia: retrospective analysis of admissions. Ethiop Med J 2006; 44:151-7.
25. Bachou H, Tumwine JK, Mwadime RK, Tylleskar T. Risk factors in hospital deaths in severely malnourished children in Kampala, Uganda.BMC Paediatr 2006; **6**:7.
26. Golden MHN. The development of concepts of malnutrition. J Nutr 2002; 132: 2117S-2122S.
27. Ciliberto H, Ciliberto M, Briend A, Ashorn P, Bier D, Manary M. Antioxidant Supplementation for the prevention of kwashiorkor in Malawian children: randomised, double blind, placebo controlled trial. BMJ 2005; 330: 1109.
28. Brewster DR. Critical appraisal of the management of severe malnutrition: 2.Dietary management. J Paediatr Child Health 2006; 42: 575-82.
29. Waterlow JC, Scrimshaw NS. The Concept of Kwashiorkor from a Public Health Point of View. Bull World Health Organ 1957; 16:458-64.
30. Shimeles D, Lulseged S. Clinical profile and pattern of infection in Ethiopian Children with severe protein energy malnutrition. East Afr Med J.1994; 71:264-7.
31. Bernal C, Velasquez C, Alcaraz G, Botero J. Treatment of severe malnutrition in children: experience in implementing the World Health Organization guidelines in Turbo, Colombia. J Pediatr Gastroenterology Nutr. 2008; 46:322-8.