Short Communication

Efficacy of modified WHO feeding protocol for management of severe malnutrition in children: a pilot study from a teaching hospital in New Delhi, India

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Aim: To assess the efficacy of modified World Health Organization (WHO) feeding protocol for severe malnutrition. Setting: Prospective observational study conducted in the nutritional rehabilitation center of a tertiary care teaching hospital of New Delhi, India over four months period from August to November 2007. Methods: 25 children with severe malnutrition (age 6 months to 5 years) were recruited. All children were treated according to Indian Academy of Pediatrics modified WHO guidelines. Daily weight gain and improvement in the clinical status was assessed. Children were followed up at day 15, day 30 and day 45 after discharge or when a new problem emerged. Results: Weight-for-age *z* score (WAZ) at admission was -4.82±0.96, weight-for-height *z* score (WHZ) was –5.0 ±0.7, height-for-age z-score (HAZ) was –2.55 ± 1.65. All children had diarrhea on admission, two had pneumonia in addition, and one each had otitis, sepsis and hepatitis in addition to diarrhea. The mean duration of admission was 8.32 ± 2.87 days. At discharge the mean WAZ was -4.15 ± 0.92 and mean WHZ, -3.91± 0.61 (*p* value highly significant). Follow up at day 15, 30 and 45 showed significant improvement in WAZ and WHZ. Conclusions: Following modified WHO guidelines is feasible, efficacious and cost effective in resource-limited settings. Early discharge of patients is possible with no complications or mortality.

Key Words: Severe malnutrition, WHO guidelines, IAP malnutrition guidelines, Child Mortality, Diarrhea

INTRODUCTION

Severe malnutrition (SMN) continues to be an important cause of under five mortality [1] To bring down malnutrition related deaths, the World Health Organization (WHO) has published two reference manuals for the management of children with SMN [2, 3]. Implementation of these guidelines has been shown to be feasible and efficacious [4-9]. Pooled data from nine studies has shown that WHO guidelines for facility-based management of children with SMN can reduce mortality by 55% [summary risk ratio of 0·45 (95% CI 0·32–0·62; random effects)] compared with conventional treatment [10].

Implementation of these guidelines however is fraught with multiple problems namely: lack of reading materials in different languages, limited availability of trained staff, and non availability of ReSoMal/ vitamin mix/ mineral mix. Further F-75 and F-100 feeder formulae are difficult to prepare in the field settings and no modifications are available as per local cultural practices. Thus these guidelines have not been widely used even in tertiary care centers in India due to various limiting factors mentioned above during implementation.

To circumvent these problems, recently the Indian Academy of Pediatrics (IAP) has published a modified WHO protocol keeping in mind the local feeding practices and culturally acceptable foods [11].

This study aimed to assess the efficacy and feasibility of implementing these modified guidelines in a tertiary level hospital in New Delhi, India. The study also explored the possibility of early discharge.

METHODS

This was a prospective observational study conducted in the nutritional rehabilitation center of a tertiary care teaching hospital in New Delhi, India over four months period from August 2007 to November 2007. Twenty-five children between 6-60 months with severe malnutrition presenting to the hospital were recruited into the trial. The diagnosis of severe malnutrition was based on the WHO IMCI criteria for malnutrition: Weight-for-height z scores (WHZs) of ≤ -3 or ≤ 70% of the reference median; clinical criteria (presence of 'visible severe wasting' or 'bipedal edema'); mid upper arm circumference (MUAC) of <11 cm in children between 6-60 months of age [2, 3]. Children with a non-nutritional cause of failure to thrive were excluded. Informed consent was obtained from the

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parents of all children. Institutional ethical committee approval was taken prior to the start of the study.

A detailed history and physical examination findings were recorded. Trained pediatric residents, using standard methodology, performed the nutritional anthropometric assessments. All children were hospitalized during the course of the trial.

As per protocol after the phase of initial stabilization nutritional rehabilitation was started using F-75 and later F-100 diets. Puffed rice was used as a source of cereal as it is easily powdered, widely available, cheap (30 Indian rupees (0.75 dollars) per 1000 grams), culturally acceptable in northern India, palatable, easily miscible with milk and easy to administer via nasogastric tube (where necessary). Use of puffed rice obviated elaborate cooking as it was partially cooked during the process of making. It was grounded locally in the wards. Powdered puffed rice was mixed with warmed milk and sugar and oil was added. Children were fed in the appropriated quantity as per IAP guidelines [11]. Initially the nursing staff prepared these and subsequently the mothers made it themselves under supervision.

Children were assessed daily for weight gain, improvement in the clinical status, problems associated with the feeding protocols, compliance with the treatment and improvement in appetite. Children were discharged from the health facility if the child had a good appetite, gained weight for at least 3 consecutive days, showed no evidence of any active infection, mother had learnt how to feed the child, all vitamin/mineral supplementation has been started and had no edema. Mothers were taught how to give complementary feeding at home with locally prepared food and how to shift to a family pot diet gradually. Age appropriate immunization was also given. Patients were followed up after discharge at day 15, day 30 and day 45 or when a new problem emerged.

Statistical analysis

Eight for age, weight for length, height for age percentiles and Z- scores were calculated using the WHO Standards with WHO anthropometrics calculator version 5.0. All statistical analysis was done with using SPSS version 11. Mann Whitney U test was used for comparing the statistical significance of continuous variables between two groups. The level of significance was set as 5% and all tests were two sided.

RESULTS

The study group included 25 children ranging from 6- 30 months (mean 12 $\pm$ 6 months) with 14 males and 11 females. The weight-for-age z-score (WAZ) at admission was -4.82 $\pm$0.96, Weight-for-height z scores (WHZ) was –5.0 $\pm$0.7 and height-for-age z scores (HAZ) was –2.55 $\pm$ 1.65.

All children had diarrhea at admission, two had pneumonia in addition, and one each had otitis, sepsis and hepatitis in addition to diarrhea. All children received broad-spectrum antibiotics in the combination of a third generation cephalosporins with an aminoglycoside. The mean duration of admission was 8.32 $\pm$ 2.87 days. At discharge the mean WAZ was -4.15 $\pm$ 0.92 and mean WHZ was -3.91$\pm$ 0.61. The *p* value as compared to admission was highly significant (*p* value WAZ 0.001, *p* value WHZ 0.001). Table 1 shows the details for the serial anthropometrical values from admission to discharge to days 15, 30 and 45 of follow up.

Twenty-one patients came for follow up at day 15 of discharge with a mean WAZ of -3.00 $\pm$ 1.07 and mean WHZ of -2.35 $\pm$ 0.74. The *p* value as compared to discharge was highly significant (*p* value WAZ 0.0001, *p* value WHZ 0.0001). Seven patients were followed at day 30 of discharge with a mean WAZ of -1.95 $\pm$ 0.87 and mean WHZ of -1.09 $\pm$ 0.45. The *p* value as compared to day 15 was highly significant (*p* value WAZ 0.001, *p* value WHZ 0.003). Four patients were followed at day 45 of discharge with a mean WAZ of -1.33 $\pm$ 0.97 and mean WHZ of +0.06 $\pm$ 0.06. The *p* value as compared to day 30 was not significant for WAZ but was significant for WHZ (*p* value WAZ 0.535, *p* value WHZ 0.023).

DISCUSSION

Lowering case fatality rates in severe acute malnutrition

Table 1. Trend of the weight for age z-scores and weight for height z-scores from admission to discharge to days 15, 30 and 45 days of follow up

GROUP		Admission	Discharge	Day 15	Day 30	Day 45
WAZ	N	25	25	21	7	4
	Mean	-4.82	-4.15	-3.00	-1.95	-1.33
	Std. Deviation	0.96	0.92	1.07	0.87	0.97
	p value		0.000	0.000	0.001	0.535
WHZ	N	25	25	21	7	4
	Mean	-5.0	-3.91	-2.35	-1.09	0.06
	Std. Deviation	0.7	0.61	0.74	0.45	0 .06
	p value		0.001	0.000	0.003	0.023

WAZ, weight-for-age z score; WHZ, weight-for-height z score.

to less than 10 % can only be achieved by strictly implementing WHO management protocols in specialized units with skilled manpower and adequate resources to formulate the F-75 and F-100 feeding formulas for rehabilitation [12.] For making these feeding formulas WHO recommends the use of whole dried milk, skimmed milk power or fresh cow milk and cereal flour (if cereal based is used) along with vitamin and mineral solutions. Further if milk is unavailable, the use of a precooked corn-soya or wheat-soya base is recommended [13]. Most facilities in India especially those in the periphery treating severe malnutrition are unable to procure these due to economic constraints.

With the aim of cost reduction and long term feasibility especially in the community in mind the IAP proposed a modified WHO protocol using locally available foods [11]. Use of puffed rice powder in this trial exemplifies this. Puffed rice powder was used, as it is cheap, readily available, and culturally acceptable to people of myriad religious backgrounds in India. Easy miscibility of puffed rice in warm milk and the semi-cooked nature of this product, therefore eliminating the need for prolonged cooking, are its added advantages. Further, as puffed rice is made from unhusked and unpolished rice, preservation of B-complex vitamins namely thiamine adds to its nutritive value.

In this trial the use of IAP modified protocol for severe malnutrition using puffed rice along with provision of vitamins and minerals supplementations was successful in lowering case fatality with substantial cost reductions and eliminating prolonged hospitalization stays. Motivation of mothers to carry out nutritional rehabilitation at home after discharge using powdered puffed rice perhaps prevented relapse of malnutrition. Although all malnourished children recruited in this trial had diarrhea, puffed rice incorporated feeding formulas were well tolerated. A brief manual set should be prepared in locally used languages showing how they can use this new method.

There is paucity of controlled clinical trials investigating the efficacy of WHO guidelines on the management of severe malnutrition. In a meta-analysis reviewing this subject only nine trials were included for analysis [14.] Even these were heterogeneous and not strictly comparable. Only one study from Senegal [15] was comparable to ours, conducted in a facility, which concluded that locally available ready to use foods can be used efficiently for the management of severe malnutrition.

The limitations of the study include its unicenteric nature and the setting of a tertiary care teaching hospital with trained pediatrics residents and nurses available round the clock. The results would be difficult to extrapolate in the community setting at the primary care level and secondary (referral) level. The other drawback was the absence of community visits due to manpower constraints and non- involvement of NGO and other paramedical staff. Hence few patients were lost to follow up. The feasibility of these guidelines needs to be tested in the community setting.

These findings are similar to two other programmes both in Bangladesh where children with severe acute malnutrition were successfully managed with mixtures of local foods combined with the provision of multivitamins and multi-minerals [16, 17]. The use of locally available cheap foods can rehabilitate severely malnourished even from poorest part of the poorest countries with severe economic constraints.

AUTHOR DISCLOSURES

We declare that we have no confl ict of interest. As corresponding author, K Rajeshwari states that she had full access to all data and fi nal responsibility to submit for publication.

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WHO 管理嚴重營養不良的兒童餵食方案修訂版的效力：一個印度新德里教學醫院的先驅研究

目的：評估世界衛生組織(WHO)嚴重營養不良餵食方案修訂版之效力。背景：在印度新德里的一個三級教學醫院的營養復原中心，從 2007 年 8 月至 11 月超過 4 個月的期間，所執行的前瞻性觀察研究。方法：25 名有嚴重營養不良的兒童(年齡為 6 個月到 5 歲)被納入研究。所有的兒童依據印度小兒科研究院(IAP)修訂的 WHO 指南治療，評估每日體重的增加及臨床狀況的改善。追蹤兒童出院後的第 15 天、30 天及 40 天或是有任何新問題出現時。結果：年齡體重 Z 分數(WAZ)在住院時為-4.82±0.96、身高體重 Z 分數(WHZ)為-5.0±0.7、年齡身高 Z 分數(HAZ)為-2.55±1.65。所有兒童在入院時都有腹瀉的現象，2 名另有肺炎，有 3 名還各有耳炎、敗血症及肝炎。平均住院時間為 8.32±2.87 天。在出院時平均 WAZ 為-4.15±0.92，WHZ 為-3.91±0.61 (p 值為高顯著性)。追蹤的第 15 天、30 天及 40 天，WAZ 及 WHZ 都有顯著改善。結論：在資源受限的區域，WHO 指南修訂版是可行的、有效的及有成本效益的，病患未發生併發症或死亡而可能提早出院。

關鍵字：嚴重營養不良、WHO 指南、IAP 營養不良指南、兒童死亡率、腹瀉