Research Article

More Severe the Malnutrition, Faster the Catch up Growth: Experience From Nutrition Rehabilitation Centre in Management of Complicated Sam in Children Aged 6 Months to 5 Years

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Abstract:
Background: Child malnutrition is one of the indicators of health status that the World Health Organization (WHO) recommends for measuring equity in health. Uttar Pradesh being second worst performing states in terms of childhood mortality, with under 5 mortality rate (U5MRC) of Uttar Pradesh 91 per 1000 births, therefore Nutritional Rehabilitation Centres (NRCs) were started in the state to control severe malnutrition.

Methods: It was prospective longitudinal study including 156 children admitted in Nutrition Rehabilitation Centers (NRCs) in a tertiary care center in Kanpur, Uttar Pradesh between April 2013 to March 2014.

Results: 156 children with severe acute malnutrition (SAM) were admitted in the NRC during the study period. There were 86 males and 70 females. Mean mid upper arm circumference (MUAC) at the time of admission in 6-59 months age patients was 10.52 (±1.34) cms in boys and 10.39 (±1.17) cms in girls. Average weight gain of patients with weight for height -3 to -4 SD at the time of admission was 10.77 (±4.32) gms/kg/day, and for the group below -4SD group it was 13.38 (±6.14) gms /kg/day. This difference was found to be significant (p< 0.004). There was a significant correlation between average weight gain and MUAC with Pearson correlation value -0.208 (p<0.042).

Conclusion: Greater the severity of malnutrition in children, faster the catch up growth, which implies that every malnourished child can be weaned to healthy life if proper nutritional rehabilitation is provided. Malnutrition clinic in every pediatric set up can go a long way to reduce the childhood morbidity and mortality consequent to SAM

Keywords: Catch Up Growth; Children, Malnutrition

Introduction:
Childhood under nutrition is an important public health and development challenge in developing nations. Undernourished children have significantly higher risk of mortality and morbidity. Besides increasing the risk of death and disease, under nutrition also leads to growth retardation and impaired psychosocial and cognitive development [1]. Children with severe acute malnutrition (SAM) have nine times higher risk of dying than well-nourished children. Of the 7.6 million deaths worldwide annually, nutrition-related factors contribute to approximately 35% deaths and 4.4% of deaths have been shown to be specifically attributable to severe wasting among children who are under 5 years of age [1,2]. In India in the year 2010, prevalence of SAM is 6.4% in children below 5 years [1]. UNICEF estimates of the 2008 highlighted Uttar Pradesh as the second worst performing states in terms of childhood mortality. U5MR of Uttar Pradesh being 91 per 1000 births, second only to Madhya Pradesh having U5MR of 92 per 1000 births [3]. Hundred focus districts situated in 8 states have high prevalence of malnutrition [4]; Madhya Pradesh,
Uttar Pradesh, Orissa, Assam, Rajasthan, Bihar, Chhattisgarh and Jharkhand. While these eight states together contribute to 47 per cent of the population and 57 per cent of the live births in the country, they have a burden of almost 70 per cent of under-five and infant deaths. Millennium Development Goal 1 (Target 2) aims to halve, between 1990 and 2015, the proportion of people who suffer from hunger as measured by the prevalence of under-weight among under-5 years children [5]. Therefore UNICEF has planned phase wise implementation of nutrition rehabilitation centers (NRCs) in these states to control severe malnutrition and decrease the prevalence of severe malnourished children to less than 1% among children aged 0-5 years.

We share experience and treatment outcome of our nutrition rehabilitation center located in a tertiary care setting in Kanpur, Uttar Pradesh, India

Methods:
It was a prospective longitudinal study conducted in the Department of Pediatrics of GSVM Medical College in Kanpur from April 2013 to March 2014. Children aged 6-59 months with SAM were admitted in the NRC, in the Department of Pediatrics if fulfilling the following criteria: (a) bilateral pitting edema and/or (b) weight-for-height < –3 SD and/or (c) mid-upper-arm circumference <115 mm. Infants below 6 months of age were admitted in NRC if fulfilling the following criteria: (a) recent weight loss or failure to gain weight; (b) ineffective feeding (attachment, positioning and suckling) directly observed for 15-20 min, ideally in a supervised separated area; (c) any pitting oedema [6]. Children with any medical or social issue needing more detailed assessment or intensive support (e.g. disability, depression of the caregiver, or other adverse social circumstances) were excluded from the study.

All patients who were admitted in the NRC were treated according to the recommendations given by World health Organization (WHO) [6]. Infants with severe acute malnutrition who were admitted for inpatient care were given parenteral antibiotics to treat possible sepsis and appropriate treatment for other medical complications such as tuberculosis, HIV, surgical conditions or disability. Children 6-59 months were given F-75 diet in stabilization phase if they failed appetite test and/or had medical complications. After stabilization, when the appetite started improving and edema started decreasing, they were shifted to the transition phase in which F-100 was started without increasing the volume of feeds. Gradually, the volume of feeds was increased and the patients were shifted to rehabilitation phase with F-100 diet, therapeutic food and some home-based foods like porridge (without salt), banana, and biscuits. Exclusive breast feeding was prioritized for infants below 6 months age, if breast feeding was not possible, supplementary suckling approach, expressed breast milk feeding, F-75 or diluted F100 was given. The patients were transferred to outpatient care when they fulfilled criteria [6] as per WHO guidelines.

Children were transferred to outpatient care when their medical complications, including oedema was resolving, and they had a good appetite, and were clinically well and alert. The decision to transfer was determined by their clinical condition and was not on the basis of specific anthropometric outcomes such as a specific mid-upper arm circumference or weight-for-height/length [6]. Infants who were less than 6 months of age and had been admitted to inpatient care were transferred to outpatient care when: (a). All clinical conditions or medical complications, including oedema, had resolved, and (b), the infant had good appetite, was clinically well and alert, and (c) weight gain on either exclusive breastfeeding or replacement feeding was more than 5 g/kg/day for at least 3 successive days. Children were shifted to home based culturally acceptable foods like porridge, and therapeutic food in the outpatient care, for infants below 6 months age, if breast feeding was not possible, supplementary suckling approach, expressed breast milk feeding, F-75 or diluted F100 was continued in the outpatient care. Patients were called for outpatient visits every 15 days until cured. During each outpatient visit children were assessed for weight for height, edema and MUAC. Children were declared cured when they fulfilled the following criteria. (a) weight-for-height/length ≥ –2 Z-score and they have had no oedema for at least 2 weeks, or (b) mid-upper-arm circumference is ≥125 mm and they have had no oedema for at least 2 weeks [6]. Infants who were less than 6 months of age were discharged from all care when they had started breastfeeding effectively or were feeding well with replacement feeds, and had (a) adequate weight gain, and (b) weight-for-length ≥–2 Z-score. The outcome and output indicators of NRC were determined after 4 outpatient visits [7]. The study was approved by the Institutional Ethical Committee of GSVM Medical College, Kanpur. Informed written consent was taken from the parents/attendants of the children included in the study. Data was collected on a pre-designed...
and pretested questionnaire. Data entry and data analysis were done preserving children’s anonymity by using children’s unique identification number only. The data were compiled in Microsoft excel spreadsheet and analyzed using SPSS version 22. Categorical data was analysed using percentages. Pearson’s correlation coefficient was used to analyse the association between two quantitative variables. Student’s t test was used to study the comparison between means. Two-tailed p value less than 0.05 was considered significant.

Results:
Sociodemographic profile of study subjects: A total of 156 children with SAM were admitted in the NRC during the study period. There were 86 males and 70 females. 38% children were below 6 months age, rest 62% were in the age group 6-59 months. 41% of the study population belonged to general category, 47 (30.2%) belonged to other backward classes (OBC) and 47 (30.2%) belonged to schedule caste and schedule tribe category. Families of 70 (44.9%) of study subjects fell in above poverty line socioeconomic status and 86 (55.1%) were below poverty line. The mean standard deviation (SD) age of boys was 17 (±5.1) months and girls 14.8 (±4.7) months. Mean (SD) MUAC at the time of admission in 6-59 months age patients was 10.52 (±1.34) cms in boys and 10.39 (±1.17) cms in girls.

Effect on selected anthropometric Indicators of the admitted children during stay at the NRC: Average weight gain during hospital stay was 12.54 (±6.28) gms /kg/day in boys and 12.75 (±5.41) gms/kg/day in girls. Length of stay of males was 16.53 (±7.59) days and of females it was 15.58 (±4.88) days (Table 1).

<table>
<thead>
<tr>
<th>Outcome</th>
<th>MALE (N=86)</th>
<th>FEMALE (N=70)</th>
<th>p VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg wt gain in gms/kg/day</td>
<td>12.54</td>
<td>12.75</td>
<td>0.825</td>
</tr>
<tr>
<td>Length of stay in days</td>
<td>16.53</td>
<td>15.58</td>
<td>0.372</td>
</tr>
</tbody>
</table>

Table 1: Outcome in males and females based on Avg wt. gain and length of stay

Average weight gain of patients with weight for height -3 to -4SD at the time of admission was 10.77 (±4.32) gms per kg/day, and for the group below -4SD group it was 13.38 (±6.14) gms/ kg/day, This difference in average weight gain between the two groups was found to be significant (p< 0.004). Length of stay was 16.69 (±6.24) days in the first group and 15.74 (±6.31) days in the second group. No statistically significant difference was observed between the two groups with respect to duration of stay at the centers (P=0.416). These findings signify that children who were more severely affected with malnutrition had a faster catch up growth (Table 2).

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Wt for height -3to-4 SD(N=42)</th>
<th>Wt for height below -4 SD(N=114)</th>
<th>p VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg wt gain in gms/kg/day</td>
<td>10.77</td>
<td>13.38</td>
<td>0.004</td>
</tr>
<tr>
<td>Length of stay in days</td>
<td>16.69</td>
<td>15.74</td>
<td>0.416</td>
</tr>
</tbody>
</table>

Table 2: Outcome based on Avg wt gain and length of stay

There was a significant correlation between average weight gain and MUAC with Pearson correlation value -0.208 (p=0.042), showing that the average wt gain was inversely related to MUAC at the time of admission in children 6-59 months of age, which also signifies that lower was the MUAC at the time of admission, more was the average weight gain per day at the time of discharge.

Final outcome of study subjects: A total of 149 (95.5%) patients were transferred to the outpatient care, 4 (2.5%) children were transferred to hospital care following development of medical complications and 3 (1.9%) children defaulted. None of them died. Out of 149 patients 132 (88.5%) patients came for the first outpatient visit. Children were divided into groups according to their weight for height during the visit. Nine (6.8%) children were in the group median to -1 SD, 35 (26.5%) were in -1 to -2 SD, 36 (27.3%) were in -2 to -3 SD, 52 (39.4%) were below -3 SD. One hundred twenty nine patients (86.5%) came for 2nd outpatient visit, no. of children in category median to -1 SD increased from 9 (6.8%) to 26 (20.2%), children in -1 to -2 SD group increased to
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45 (34.9%), 25 (19.4%) in -2 to -3 SD, and 33 (25.6%) below -3 SD. One hundred twenty three (82.5%) patients attended third outpatient visit, 58 (47.2%) were in group -1 to -2 SD, 33 (26.8%) were in -1 to -2 SD, 14 (11.4%) were in -2 to -3 SD, and 18 (14.6%) were below -3 SD. One hundred eighteen (79.1%) patients came for fourth outpatient visit, 70 (59.3%) were in -1 to -2 SD group, 35 (29.7) were in -1 to -2 SD group, 3 (2.5%) were in -2 to -3 SD group, 10 (8.5%) were below -3 SD (Table 3).

<table>
<thead>
<tr>
<th>Std Deviation</th>
<th>At the time of admission N =156</th>
<th>1st outpatient visit N = 132</th>
<th>2nd outpatient visit N = 129</th>
<th>3rd outpatient visit N-123</th>
<th>4th outpatient visit N = 118</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Percent</td>
<td>No. Percent</td>
<td>No. Percent</td>
<td>No. Percent</td>
<td>No. Percent</td>
</tr>
<tr>
<td>Btw median and -1 SD</td>
<td>0 0 9 6.8</td>
<td>26 20.2</td>
<td>58 47.2</td>
<td>70 59.3</td>
<td></td>
</tr>
<tr>
<td>-1 to -2 SD</td>
<td>0 0 35 26.5</td>
<td>45 34.9</td>
<td>33 26.8</td>
<td>35 29.7</td>
<td></td>
</tr>
<tr>
<td>-2 to -3 SD</td>
<td>1 0.6 36 27.3</td>
<td>25 19.4</td>
<td>14 11.4</td>
<td>3 2.5</td>
<td></td>
</tr>
<tr>
<td>-3 to -4 SD</td>
<td>40 25.6 31 23.5</td>
<td>22 17.1</td>
<td>15 12.2</td>
<td>8 6.8</td>
<td></td>
</tr>
<tr>
<td>Below -4 SD</td>
<td>115 73.7 21 15.9</td>
<td>11 8.5</td>
<td>3 2.4</td>
<td>2 1.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>156 100 132 88.5</td>
<td>129 86.5</td>
<td>123 82.5</td>
<td>118 79.1</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Distribution Of study subjects according to grade of malnutrition during follow up visits

The Nutrition Rehabilitation Centre (NRC) observed a cure rate of 69.2 % and secondary failure rate of 6.4 % at the end of four outpatient visits, 2.5% cases were medical transfers and 31 (20.8%) patients did not come for all the outpatient visits. Out of these 31 patients, 12 patients did not come for any outpatient visit and 9 patients were cured before the completion of 4 visits.

Discussion:
NRCs provide life-saving care for children with SAM. The present study highlights the integral role of standardized care provided at Nutrition Rehabilitation Centre (NRC) to combat malnutrition which is a major bane and a challenge to the developing world. None of the patient admitted in our center died 100% survival outcome achieved compares favorably well with national and international standards of care (<10% child deaths) [8,9]. This is important as the primary objective of NRCs is to reduce mortality rates among children with SAM.

The study findings show that a major proportion of the admitted children belonged to the marginalized population groups. The findings are in accordance with that of NFHS-III, which states that children belonging to the SC, ST, and OBC have high rate of malnutrition [10]. According to the latest estimates 37 per cent of the population in India lives below the poverty line [11]. In our study we observed families of 55% patients belonged to below poverty line socioeconomic status and 45% belonged to above poverty line socioeconomic status.

The average weight gain in the NRC is above the minimum 8 g/kg body weight/day recommended [12]. Average weight gain during hospital stay was 12.54 (+6.28) gms/kg/day in boys and 12.75 (+5.41) gms/kg/day in girls. Results observed by Savadago et al. in a study at Burkina Faso reported an average weight gain of 10.18 ± 7.05 g/kg/day; [13] similar findings were reported by Taneja et al who evaluated the effect of nutritional interventional measures undertaken at their NRCs for severe malnourished children. They observed an average weight gain of 9.25 ± 5.89 g/kg/day, for the inpatient group [14].

In our study length of stay of males was 16.53 (+7.59) days and of females it was 15.58 (+4.88) days, which is comparable to the median duration of stay of 14 days reported by Taneja et al. [14]. It is found to be much less than earlier programmes for children with severe Protein Energy Malnutrition (range from 6 weeks to 8 months) [15-17]. Singh et al. reviewed the two year data (Jan 2010 to Dec 2011) of 12 NRCs in Uttar Pradesh reported a very high default rate of 45.3% [18]. In our study default rate was 1.9% which is comparable to 4.4% reported by Maurya et al and 7% reported by Taneja et al [14]. The short duration of stay not only decreases costs but also minimizes default rate of the patients. Effectively, the duration of stay needs to be balanced between the chances of cross exposure to infection and the readiness of the mothers to effectively manage their children at home.
were discharged from the facility based programmes i.e. the inpatient care which is well above minimum national / international standards (75%) [19,20].

Singh et al. observed that only 25% of the children, turned up for all three follow up visits after discharge, 175 (29%) came back for two follow up visits, 219 (36%) did not come back for any follow up visit [18]. Although our study also reveals increasing dropout rates with each successive outpatient visits, our attendance in the first outpatient visit was 88.5% in the first visit, 86.5% in the second visit, 82.5% in the third, and 79.1% in the fourth visit. Undoubtedly, this shows the effectiveness of measures taken to improve the compliance rates of outpatient visits over the years, but since there is always a scope for further improvement, efforts should be directed towards making the community aware of the functioning of the centers.

Our study demonstrated that average weight gain of patients with weight for height -3 to -4 SD at the time of admission was 10.77 (±4.32) gms/kg/day, and for the group below -4 SD group it was 13.38 (±6.14) gms/ kg/day, This difference in average weight gain between the two groups was found to be significant (p< 0.004). The improvement in body weight corresponds, in part, to an increase in fat mass as indicated by significant increase in MUAC. Two very significant findings observed in our study were (a) significantly higher average weight gain of the patients whose weight for height at the time of admission was below -4 SD in comparison to the patients whose weight for height lied between -3 to -4 SD. (b) Inverse correlation between the average weight gain and MUAC at the time of admission. Both the findings are indicative of the immense potential of severely malnourished children for faster catch up growth when provided with optimum care. It further strengthens the concept of NRCs and their role in decreasing the mortality and morbidity of children who are more severely affected with malnutrition. Barouaca et al. [21] observed significantly better catch-up growth in marasmic children than in children with kwashiorkor. They attributed a less significant recovery in kwashiorkor group to loss of edema causing a decrease in weight. A systematic review of several studies revealed higher mean weight gain in SAM compared with moderately malnourished children [22]. None of the previous studies have compared the catch up growth based on initial weight for height Z score.

Therefore, the present study reiterates that fact that malnutrition needs to be addressed promptly. The more severe the malnutrition the faster the catch up growth following rehabilitation which emphasizes the need for establishment of nutritional rehabilitation centers with every pediatric clinic so that the morbidity and mortality attributable to malnutrition can be averted. Further studies need to be done on this subject to demonstrate the mechanism of catch up growth in children with severe acute malnutrition.

References:
3. The Situation of Children in India-A Profile. UNICEF 2011


