ORIGINAL ARTICLE

Developmental Status in Children with Severe Acute Malnutrition

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ABSTRACT

Objective: To access the developmental status in children with severe acute malnutrition (SAM).

Study Design: Hospital based observational cross sectional study.

Place and Duration of Study: Department of Pediatrics, The children's hospital and the institute of child health Multan from 1st January 2019 to 15 July 2019.

Material and Methods: A total of 72 patients aged 6-36 months, diagnosed as severely acute malnourished according to World Health Organization criteria, were included in study. Permission was taken from the IRB ethical committee of the hospital. Prior to study a Performa was designed by trained staff and after the permission of parents complete data were collected from patients. All the children were assessed by using Portage Early Education Plan by a trained and expert clinical nurse to evaluate for the specific areas of development affected by malnutrition. Portage Early Education Plan has five development key areas applied up to 5 years. These are self-help, motor skills, cognition, social skills and language. Complete data was analyzed by using SPSS version.21.0. Mean comparison test was applied and Chi square test was applied and *P* value less than 0.05 were considered as statistically significant (MUAC).

Results: Out of 72 patients, 38(52.78%) were male and 34(47.22%) were female. Male to female ratio was 1.11:1. Mean comparison of mid upper arm circumference (MUAC) was correlated with developmental quotient (DQ). Mid upper arm circumference was found to be significant correlation with Motor developmental quotient (DQ) (*p*-value 0.005), cognition developmental quotient (DQ) (*p*-value 0.048) and mean developmental quotient (DQ) (*p*-value 0.03). It was found that significant association with low Motor developmental quotient (DQ) (Chi^2= 4.2, *P*-value= 0.032), low Cognition developmental quotient (DQ) (Chi^2= 3.0, *P*-value= 0.042) and low Mean developmental quotient (DQ) (Chi^2= 3.1, *P*-value= 0.038).

Conclusion: Children with severe acute malnutrition have extreme developmental delay in all five domains i.e. Self-help, motor skills, cognition, social skills and language. This highlights the importance of developmental therapy with management of malnutrition as recommended by WHO manifest of severe acute malnutrition after development therapy. To improve potential outcome of children with severe acute malnutrition, developmental assessment and therapy should be part of severe acute malnutrition program to timely identify and manage neuro disabilities in severe acute malnutrition.

Key Words: *Mean Score Developmental Quotient DQ, Mental Developmental Quotient DQ, Motor Developmental Quotient DQ, Neuro-Developmental Delay, Portage Early Education Program, Severe Acute Malnutrition.*

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Introduction

The first 1000 days of life (conception to 2 years of age) are particularly crucial for both nutrition and child development. Deficiency of macronutrients as well as micronutrients during this phase has direct long term impact on child development and identifies as major risk factor for developmental delay and deficit in cognitive, motor, social skills and impact on school performance and psychomotor development.[1] According to National nutritional survey (NNS) 2018, 17.7% children in Pakistan are wasted, 40.2% children are stunted and 28.9 % under 5 children are undernourished [2.]

A large number of data suggest that stunting at a young age leads to deficit in cognitive impairment and impaired neuromata development.[3, 4] According to Lancet it is now estimated that 66% children in sub-Saharan-African at risk for not reaching their development potential.[5] A large research gap exists in under developed countries where there is a high prevalence of SAM but no data is available regarding the severity of development and behavioral disorders in children treated at nutrition rehabilitation centers. Also there might be a significant or no significant difference in developmental attainment between children with kwashiorkor and marasmus.[6] SAM children may need comprehensively interventions to enhance neurodevelopmental skills.[7] appropriate physical assessment or cognitive tools along with nutritional assessment followed by exercise rehabilitation reveals positive results in SAM.[8] The rationale for carrying out this study in Pakistan is that our country is facing a huge burden of severe acute malnutrition in under 5 year's old children. There is not much local data available therefore this study was planned to assess the development status of children with Severe Acute Malnutrition in order to bridge the gap and emphasis the need of developmental therapy for SAM in addition to nutrition therapy.

Material and Methods

A hospital based observational cross sectional study was designed. This study was conducted in Department of Pediatrics, The children's hospital and The Institute of child Health Multan From 1st January 2019 to 15 July 2019. A total number of 72 patients aged 6-36 months who were diagnosed as severely acute malnourished according to WHO criteria were included in current study. Simple random sampling technique was used to include maximum children. Prior to study permission was taken from the ethical committee of the hospital. Severe acute malnutrition is defined by a very low weight for height (below -3z scores of the median WHO growth standards), MUAC 11.5 cm or less, or by the presence of nutritional edema.[2] The Children with primary malnutrition were enrolled for this study and all patients with malnutrition secondary to chronic disease were excluded. The parents who did not give the consent, and/or complete data and children with secondary malnutrition were excluded from current study. Once the children with SAM were admitted at NRC of CH & ICH, Multan. They were assessed for infections and illness i.e. diarrhea, liver dysfunction, electrolyte imbalance and pneumonia and have failed an appetite test (defined as an inability to eat therapeutic food).[9] During the stabilization phase, when all the children were stabilized, the complications were dealt with and therapeutic feeding was started and the children entered rehabilitation phase child's developmental was assessed. Prior to study, a Performa was designed by medical officer and after the permission of parents complete data were collected from patients. All relevant data were recorded on performa by the trained nursing staff of hospital. In CH&ICH Developmental pediatrics OPD Portage is applied by psychologist to patients with delayed development, mental age assessed and sessions are started to overcome deficits by psychiatrists. Portage Early Education Plan is internationally applied early childhood interventions service for pre-school children for special needs. A trained and expert clinical psychiatrist with more than 5 years of experience working with Portage Early Education Plan, administered and assessed the child in a quiet room with peaceful surroundings in the Nutrition Rehabilitation Centre. During the assessment mother/care giver of the child was constantly present to comfort the child. Portage Early Education Plan has five development key areas applied up to 6 years. These are self-help, motor skills, cognition, social skills and language. Each area had a specific checklist according to age. Total numbers of checklist items up to 3 years are motor: 63, Cognition: 40, Self-help: 52, Socialization: 43 and Gross motor: 144.In addition, there is a section of infant stimulation activities, which has total 45 checklist item. Child was assessed according to checklist items. When there were 10 consecutive negative items, the nurse at that point of checklist stops. Positive items were obtained by subtracting failure items from total. Developmental age was assessed by first subtracting failures from total to calculate positive items (Total – failure = positive items). Than the positive items were divided by total items and then multiplied by 12 to find out developmental age (Development age=positive item/total item × 12). Developmental age is used to access his/her developmental quotient

respectively by: DQ=DA/Chronological age × 100).

All the children were further assessed in all the clusters of both domains to evaluate for the specific areas of development affected by malnutrition. Data collected was nonparametric. Complete data was analyzed by using SPSS version.21.0. Mean comparison test was applied and chi square test was applied and *P* value less than 0.05 were considered as statistically significant.

Operational Definitions

Severe Acute Malnutrition

Severe acute malnutrition is defined by a very low weight for height (below -3z scores of the median WHO growth standards), by visible severe wasting, MUAC<11.5, or by the presence of bilateral edema[1]

Results

Out of 72 male to female ratio was 1.11:1. Mostly patients 48(66.67%) belong to rural areas and 52(72.22%) patients belong to very low socio-economic status and 44(61.11%) mothers were illiterate. Mean age was 18.23 months and mean weight was 6.74kg. (Table-I).

Table I: Socio-Demographic Characteristics in Children with Developmental Delay

Characteristics	Frequency	Percentage
Gender		
Male	38	52.78 %
Female	34	42.22%
Type of family		
Joint	50	69.44%
Nuclear	22	30.56%
Socio-economic status		
Normal	16	22.22%
Poor	52	72.22%
Good	4	5.56%
Area		
Urban	24	33.33%
Rural	48	66.67%
Mothers Education		
Primary	22	30.56%
Middle	0	0
Matric	6	8.33%
Illiterate	44	61.11%

Table II: Weight for Age Distribution in Children with SAM

Weight for age	Frequency	Percentage
<-3SD	35	48.61%
< -4 SD	37	51.39%

Mean comparison of MUAC was correlated with developmental quotient (DQ). MUAC was found to be significant correlation with Motor QD (*p*-value 0.005), cognition DQ (*p*-value 0.048) and mean DQ (*p*-value 0.03) (Table III).

Table III: Mean Comparison of MUAC and Motor, Mental and Mean DQ

MUAC		DQ- Gross motor	DQ-Cognition	DQ-Mean score
<11.5	Mean±SD	73.5±22.6	75.7±21.4	74.6±22.5n
	P-value	0.005	0.048	0.003

Significant association was found between moderately stunted patients and low Motor DQ (Chi^2= 4.2, *P*-vlaue= 0.032), low Cognition DQ (Chi^2= 3.0, *P*-vlaue= 0.042) and low Mean DQ (Chi^2= 3.1,*P*-vlaue= 0.038) (Table: IV).

Table IV: Height for Age and Motor, Cognition and Mean DQ

Height for Age	Total patients	DQ Motor-Normal	DQ Motor-low	DQ Cognition normal	DQ Cognition low	DQ-Mean normal	DQ-Mean low
<-2SD	35	12	18	12	17	12	18
<-3SD	37	5	37	9	34	7	35
Total	72	17	55	21	51	19	53
		Chi^2= 4.2, *P*-vlaue= 0.032		Chi^2= 3.0, *P*-vlaue= 0.042		Chi^2= 3.1,*P*-vlaue= 0.038	

Discussion

Portage Early Education Program (PEEP) began in Great Britain and is now practiced worldwide for developmentally delayed children. The portage checklist is an ideal instrument for carrying out assessment and setting teaching objectives. It has five main sections each one having total number of items (motor: 140, Cognition: 108, Self-help: 108, Socialization: 83 and language: 218).[8]

The current hospital based observational cross sectional study included children with severe acute malnutrition. These children were assessed using Portage Early Education Program (PEEP) and all of them had low mental and motor DQ. Furthermore, our results show a significant difference in motor and mental DQ of SAM children with stunting and non-stunting. The socio-economic status was also found to be significantly related with under nutrition. Our study is distinctive as it uses PEEP to assess developmental status of children with SAM.

First three years of life are generally counted as a very crucial for children's development. Most recent studies focus on effects of undernutrition in young

children's development aged less than 36 months. Our study also included under 5 years children with severe acute malnutrition and Majority of children with 3SD SAM also had low Motor DQ, low cognition DQ and low mean DQ. Another study by Dwivedi D et.al, also observed similar low motor and mental DQ in Indian children with SAM. These studies show that severe acute malnutrition at early stages of child development is strongly linked with child performance on school level and it negatively effects fine motor skills, personal-social, language, gross motor skills and social-emotional competences of SAM children as compared to non-SAM.[10,11] There was a significant difference in motor and mental DQ of SAM children with stunting and non-stunting in our study. The comparison of stunted and non-stunted children with developmental quotient was analyzed between two groups which shows that patient with stunting has low development assessment scores as compared to non-stunted children. Similarly conducted studies were also show same results.[12] However there were low emphasis on behavioral alterations and outcomes of children with SAM and stunting e.g. higher negative impact, lesser physical activity, play and exploration and interactions with other children.[13]

In the present study mostly male children 52.78% were affected by severe acute malnutrition similar results were also found in another research showing higher male to female ration of SAM children, the reasons for this higher male to female ratio is still unknown as more importance is given to male child in our culture and they are better taken care of[14,15] Children with SAM show significant delay in development, but motor DQ is affected more than mental DQ, these findings were reinforced by different studies conducted in India on similar topics.[11,16] The comparison of MUAC and Development Quotient was done and it was reported that Motor DQ, Mental DQ and Mean DQ was significantly low in children having MUAC 11.5cm. Higher MUAC and anthropometric z -scores, including height-for-age, were related to higher development. The findings show a direct relation of MUAC and Motor DQ, Mental DQ and Mean DQ but another study show that mental DQ was insignificant and unrelated to MUAC, indicating MUAC as irrelevant to mental DQ.[17,18] The socio-economic status is significantly related with under nutrition in our study as 72.22% children's had very low socio-economic status and it slightly higher as compared to study conducted by Ullah et al.[19]

The overall low level of development in children with SAM in this study is distressing. This study was conducted on a small sample size with limited resources. To produce more significant results more studies should also be conducted using Portage Early Education Program (PEEP) in different provinces of Pakistan to assess which dimensions of child development is impaired during the acute stage of SAM in children under 5 years of age. Similar studies with different development assessment tools e.g Bayley Scales of Infant Development should be conducted to figure out the most suitable tool for our native culture.

Conclusion

Children with Severe acute malnutrition have extreme developmental delay in all five domains i.e. self-help, motor skills, cognition, social skills and language. This highlights the importance of developmental therapy with management of malnutrition as recommended by WHO manifest of severe acute malnutrition after development therapy. To improve potential outcome of children with severe acute malnutrition, developmental assessment and therapy should be part of severe acute malnutrition program to timely identify and manage neuro disabilities in severe acute malnutrition.

Limitations of the Study

The limitations of this study includes small sample size and limited time duration. The developmental assessment was done in the rehabilitation stage only, there was no information about the developmental status of child before or after admission. Children should be followed up after nutritional rehabilitation and developmental therapy to assess outcome. Culturally adapted assessment tools for development be designed and used for assessment as the international portals are not suitable for our local children.

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