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Assessment of neurodevelopmental abnormalities in children with severe acute malnutrition between the age of 6 months to 30 months

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Abstract

Objectives: To assess the developmental abnormalities in Severe Acute Malnutrition using Developmental Assessment Scale for Indian Infants (DASII).
Design: Hospital based Prospective Analytical Study.
Setting: Department of Pediatrics, Kamla Raja Hospital, Gajra Raja Medical College, Gwalior.
Participants: Children with severe acute malnutrition as per criteria of WHO between the age of 6 months and 30 months admitted in the hospital between March 2015 to January 2017.
Method: Patients were first managed as per WHO guidelines of SAM. At the end of stabilization phase detailed neurological examination was done to look for neurological deficits by Development Assessment Scale for Indian Infants (DASII).
Results: A total of 70 cases were enrolled. Mean Development Quotient for cases was 79.7(23.5) against a population mean of 112.28(10.7) ($p<0.001$). Motor Development Quotient was found to be 79.56(23.03) ($p<0.001$) and Mental Development Quotient was 79.90(26.075) ($p<0.001$). MUAC was found to have positive correlation with Motor DQ (p value 0.006) with patients having MUAC<11.5cm having motor DQ [74.7(24.1)] as compared to those having MUAC >11.5cm [91.5(16.4)]. On analyzing patients having stunting, it was found that a significant proportion of them had low Motor DQ (chi^2 4.1, p value 0.023), low Mental DQ (chi^2 2.9, p value 0.038), and low Mean DQ (chi^2 3.1, p value 0.036) when compared to patients not having stunting.
Conclusions: SAM patients have both low Mental DQ and Motor DQ. Low MUAC is associated with Low Motor DQ. Stunting is associated with low Motor and Mental DQ.
Keywords: Severe Acute Malnutrition, Neurodevelopmental Assessment, DASII.

1. Introduction

Severe Acute Malnutrition (SAM) is a major contributor of morbidity in children of our country. It has been estimated that in India, 65% i.e. nearly 80 million children under five years of age suffer from varying degrees of malnutrition. According to national family health survey III in India 6.4% of children below 5 years are suffering from Severe Acute Malnutrition [1]. It has also been seen that malnutrition also has some impact on development of child. An increasing number of studies are showing that stunting at a young age leads to deficit in cognitive impairment and impaired neuromotor development.

A lot of emphasis has been given to the growth of children suffering from SAM but equal efforts have not been made in estimating the developmental delay and

provide measures for correction in this regard. Keeping in view the holistic improvement of child, there is a need to find out the exact incidence of deranged neurodevelopment in such children so that early corrective steps could be taken to counteract it.

As there is paucity of published literature regarding the magnitude of impact of this problem in Indian children, such a study identifying developmental delay in malnourished children is necessary as most of the malnutrition-related neurological disorders can be prevented and therefore they are of public health concern.

2. Methods

70 patients who were admitted in Pediatrics Department Of Kamla Raja Hospital between the age of 6 months and 30 months and diagnosed as Severe Acute Malnutrition as per WHO guidelines were admitted in the study. Those patients who were suffering from any neurological disease or having impairment of vision or hearing were excluded from the study.

Consent was taken from parents of all the patients. All relevant data was collected in a preformed and pretested Performa. Patients were first managed as per WHO guidelines of SAM. At the end of stabilization phase detailed neurological examination was done to look for neurological deficits by Development assessment using DASII.

Both mental development index and psychomotor development index are calculated by DASII. The age placement of the item at the total score rank of the scale is noted as the child developmental age. This converts the child total scores to his motor age (MoA) and mental age (MeA). The motor and mental ages are used to calculate his motor and mental development quotients respectively by comparing them with his chronological age and multiplying it by 100.

(DMoQ = MoA/CA x 100 and DMeQ = MeA/CA x 100).

The composite DQ is derived as an average of DMoQ and DMeQ.

Tone abnormalities were assessed by Amiel Tison passive angles[2].

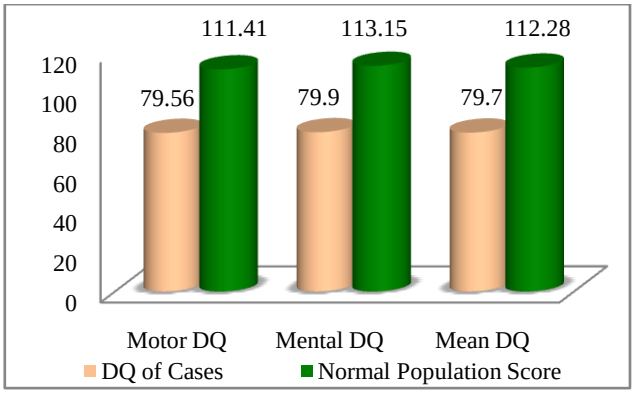
2.1 Data management and statistical analysis

Data were entered in a pretested proforma. Analysis was done using SPSS software version 23.0. Tests of difference between the means were applied. A *P* value of <0.05 was considered to be statistically significant.

The protocol was reviewed and approved by the local independent ethical committee.

3. Results

A total of 70 cases of Severe Acute Malnutrition were enrolled. Mean Development Quotient for cases was found to be 79.7±23.5 against a population mean of 112.28 ± 10.7(p<0.001). Motor Development Quotient was found to be 79.56±23.03 (p<0.001) and Mental Development Quotient was 79.90±26.075 (p<0.001) (Figure 1).



Various anthropometric parameters were individually correlated with DQ. MUAC was found to have positive correlation with Motor DQ (p value 0.006) with patients having MUAC <11.5cm having motor DQ (74.7±24.1) as compared to those having MUAC >11.5 cm (90.88±16.4). The values for Mean DQ were 74.8±24.8 in patients having MUAC<11.5 cm as compared to 88.81±17.5 in patients having MUAC>11.5cm (p value 0.033). But there was no significance difference in Mental DQ between 2 groups. It was 76.9±26.9 in patients with MUAC<11.5cm as compared to patients having MUAC>11.5cm (p value 0.148) (Table 1). On analyzing patients having stunting, it was found that a significant proportion of them had low Motor DQ (chi^2 4.1, p value 0.023), low Mental DQ (chi^2 2.9, p value 0.038), and low Mean DQ (chi^2 3.1, p value 0.036) when compared to patients not having stunting. (Table 2)

Table 1: MUAC and Motor, Mental and Mean DQ

MUAC		DQ -Motor score	DQ -Mental -Score	DQ- Mean-score
>11.5	Mean	90.88	86.85	88.81
	± SD	16.4	22.0	17.5
<11.5	Mean	74.7	76.9	75.8
	± SD	24.1	26.9	24.8
	P value	0.006*	0.148	0.033*

Table 2: Height for age and Motor, Mental and Mean DQ

Height for age	Total patients	DQ Motor-Normal	DQ Motor-low	DQ Mental-Normal	DQ Mental-low	DQ-Mean-Normal	DQ-Mean-low
>-3SD	35	11	18	11	18	11	19
<-3SD	35	5	36	9	32	6	34
Total	70	16	54	20	50	17	53

Chi^2=4.1 p=0.023*, significant difference in motor DQ in babies **<-3SD and >-3SD Ht for age**
Chi^2=2.9 p=0.038*, significant difference in mental DQ in babies **<-3SD and >-3SD Ht for age**
Chi^2=3.1 p=0.036*, significant difference in mean DQ in babies **<-3SD and >-3SD Ht for age**

Age of the patient, birth weight and gestation age was not found to have significant correlation with DQ (p=0.68, p=0.25, p=0.14 respectively).

4. Discussion

Developmental Assessment Scales for Indian Infants (DASII) is an Indian adaptation of the Bayley Scales of Infant Development (BSID) originally devised by Nancy Bayley. The DASII Scale in its present form is a revision of the Baroda norms with a major modification, where indigenous test materials are used for standardization and published in 1996[3]. The contents of the DASII are the same as used in the original study. The general approach in administration is retained. It also allows calculation of mental age and motor age of infants between one month and 30 months of age and also gives a developmental quotient (DQ). The DASII scale is divided into motor scale and mental scale. The motor scale consists of 67 items and mental scale consists of 163 items.

The age placement of the item at the total score rank of the scale is noted as the child's developmental age. This converts the child's total scores to his motor age (MoA) and mental age (MeA). The respective ages are used to calculate his / her motor and mental development quotients respectively by comparing them with his chronological age (CA) and multiplying it by 100.
(DMoQ = MoA/CA x 100 and DMeQ = MeA/CA x 100).

The composite DQ is derived as an average of DMoQ and DMeQ.

In this study Motor DQ, Mental DQ and Mean DQ of cases were found to be significantly lower. This is in accordance with study done by Chase and Martin [4] who compared 19 children at a mean age of 3.5 years of age who had suffered from malnutrition in the first year of life with controls of similar sex, race, social background and birth weight. The mean DQ of the controls was 99.4 and that of the test children was 82.1. Similar findings were observed in Barbados [5] when 101 children having suffered malnutrition in the first year, were examined at the age of 4-11 years, and compared with 101 controls, it was found that the former, especially the boys, tended to be clumsy, faring badly on timed motor tests (repetitive movements of one or more fingers, hand patting, pronation, supination, flexion and extension of the hands, toe tapping and heel-toe tapping). They also had features of the attention deficit disorder-poor concentration and other learning difficulties. In this study comparison of MUAC and Development Quotient was done and it was found that Motor DQ and Mean DQ was significantly low in children having MUAC<11.5cm when compared to children with MUAC>11.5cm. But no significant difference was found in Mental DQ between the two groups. No previous study has been done in this regard.

On comparison of Development Quotient in stunted versus Non stunted children statistical difference in proportion was found between the 2 groups. This is in concordance with study done by Celedon and Andraca who reported that Patients with stunting had low Development assessment scores as compared to non stunted [6]. Similar results were found by Bhoomika *et al* who found that malnourished children performed poor on tests of attention, working memory, learning and memory and visuospatial ability [7].

5. Conclusions

What is already known?

- Patients with Severe Acute Malnutrition have developmental delay.

What this study adds?

- DASII is an equally effective tool in children with SAM to know the extent of developmental delay.
- Low MUAC is associated with low Motor DQ.

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