



A CROSS-SECTIONAL STUDY TO ASSESS THE CARDIAC STATUS IN CHILDREN LESS THAN 6 MONTHS WITH SEVERE MALNUTRITION

Paediatrics

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ABSTRACT

Severe acute malnutrition (SAM) is one of the leading problems in children under the age of 5 years in developing and under-developed countries. Undernutrition and cardiac disease among children under the age of 5 years are interconnected in a vicious cycle. Children with SAM have significant change in body composition altering the anatomical and functional parameters of various systems, including the cardiovascular system. This results in myocardial dysfunction. Though several studies have shown altered cardiac status in children between 6 months to 5 years of age with severe acute malnutrition, very little is known about the same in children less than 6 months. To address this issue, a descriptive cross-sectional study was performed on children less than 6 months with severe malnutrition. The Left ventricular mass (LVM) was observed to be lower in the subjects than age matched reference values and left ventricular dysfunction was seen in 40% of the subjects. Early identification of these cardiac dysfunctions can lead to a reduction in mortality and morbidity. Thus, clinicians must have a heightened suspicion of cardiac dysfunction in children with severe malnutrition and institute fluid, electrolyte and micronutrient therapy accordingly to improve the overall well-being of these children.

KEYWORDS

Severe Malnutrition, Echocardiography, Left Ventricular Mass, Left Ventricular Mass Index

INTRODUCTION

Severe acute malnutrition (SAM) is one of the major healthcare problems plaguing children under the age of 5 years in developing and underdeveloped countries [1]. It accounts for about half of the mortality and morbidity in children under 5 years of age. World Health Organization (WHO) defines SAM as presence of weight-for-height < -3 Standard Deviation (SD), mid-upper-arm circumference < 11.5 cm, bilateral pedal edema and visible severe wasting [1,2]. However, for children less than 6 months, severe malnutrition is defined as weight for age < -3 SD, weight for length < -3 SD if length is more than 45 cm bilateral pedal edema and visible severe wasting [3]. Undernutrition and cardiac disease among children under the age of 5 years are interconnected in a vicious cycle. Though, left ventricular dysfunction is commonly studied in children with SAM between 6 months and 5 years of age, little is known regarding cardiac status in children less than 6 months with severe malnutrition. This study is aimed at studying cardiac status in children with severe malnutrition and also observing associated risk factors for development of severe malnutrition.

K Mishra et al. conducted a study on risk factors for development of SAM and concluded that lack of exclusive breast feeding in first 6 months, bottle feeding and deprivation of were significant risk factors for SAM [4]. They also studied the effect of maternal nutrition on child's nutritional status. Brent et al. conducted a prospective case control study on the cardiac physiology in SAM children [5]. They included 88 children with severe acute malnutrition. The authors concluded that children with SAM had reduced absolute left ventricular mass relative to controls. D Jain et al. conducted a prospective observational study on 76 children with SAM and concluded that children with SAM had a lower left ventricular mass as compared to controls [6]. Hence the objectives of this study are –

1. To describe the cardiac status in children with severe malnutrition less than 6 months of age.
2. To identify the risk factors in development of severe malnutrition in children less than 6 months of age.

In this paper, a cross-sectional descriptive study has been presented to address the issues mentioned above.

METHODOLOGY

A cross-sectional descriptive study was conducted on total of 40 children admitted to nutritional rehabilitation centre and pediatric intensive care unit (PICU) of a tertiary care hospital in Bangalore. The children were less than 6 months of age. All the children fulfilled the criteria for Severe malnutrition i.e., weight for age < -3 SD, weight for length < -3 SD if length is more than 45 cm bilateral pedal edema and visible severe wasting. Nutritional status assessment was done and

data regarding other risk factors for development of malnutrition such as faulty feeding techniques, poor socioeconomic status, immuno compromised states and maternal dietary details were collected. Children with severe anaemia, pre-existing cardiac disease and syndromic infants with genetic causes were excluded from the study. All children underwent echocardiography once they were stabilized. The overall methodology is shown in the Figure 1.

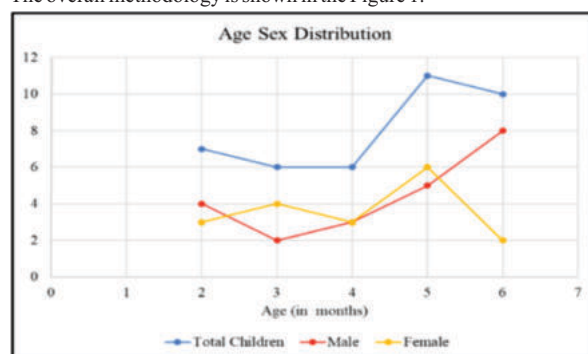


Figure 1: Age Sex Distribution of Subjects

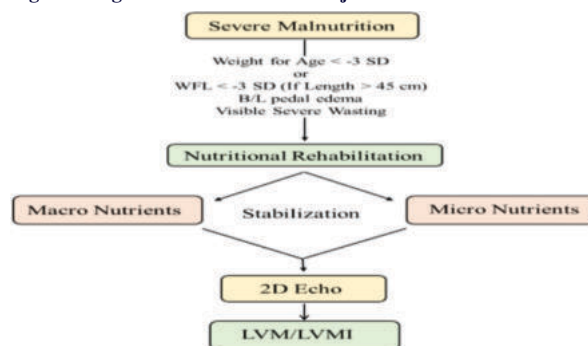


Figure 2: Overall methodology of the current study

RESULTS

Of the 40 children, 22 were male and 18 were female, with 21(52%) children being between the ages of 5 and 6 months. The age-sex distribution of the subjects is shown in Figure 2. After stabilization and nutritional rehabilitation, all the children underwent 2D echocardiography. Left ventricular mass (LVM) was calculated using obtained parameters and it was indexed to body surface area to obtain

Left ventricular mass index (LVMI). The mean LVM was 6.29 and mean LVMI was 27.73, both of which were lower than the age and sex specific reference values [7]. It was also seen that LVM was positively correlated with both weight (Pearson's correlation coefficient, $r = 0.343$) and length ($r = 0.472$). No correlation was seen between LVM and age. It was also observed that 40% of the subjects had LV dysfunction. Figure 3 and Figure 4 show the correlation of LVM with weight and length respectively.

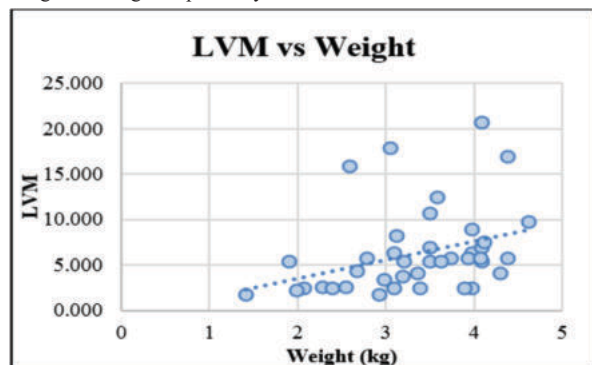


Figure 3: Correlation between LVM and Weight

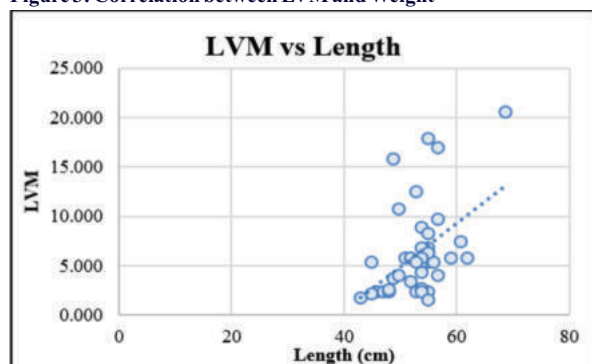


Figure 4: Correlation between LVM and Weight

Risk factors of faulty feeding was seen in 65% of cases with severe malnutrition. Poor socioeconomic state leading to occurrence of acute diarrhoeal disease and respiratory infections was seen in 66% of the subjects. Acute diarrhoeal disease was seen in 57% and respiratory infections were seen in 52% of the subjects. Poor maternal diet of polished rice and pulses leading to malnutrition was seen in 43% of subjects. 45% of subjects had low birth weight as a risk factor for severe malnutrition. Figure 4 shows the various risk factors.

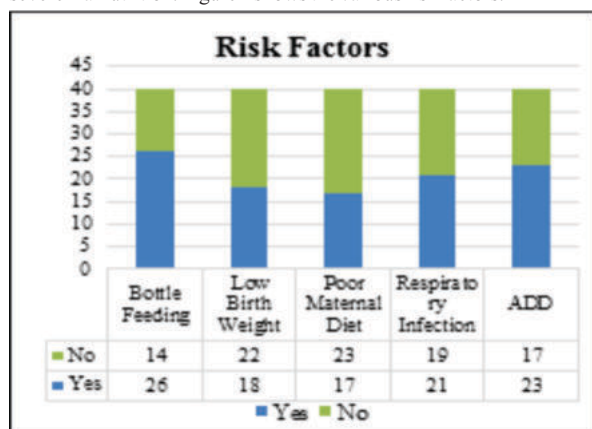


Figure 5: Various risk factors for severe malnutrition in children below 6 months

DISCUSSION

Cardiac dysfunction is known to occur in children with SAM. Cardiac dysfunction is multifactorial and can affect the management and quality of life of these children. Performing echocardiography would help in identification of underlying cardiomyopathy in SAM children. Echocardiography acts as an effective tool to identify left ventricular

dysfunction in these children. Early identification and timely intervention can reverse the cardiac dysfunction leading to reduction in mortality and morbidity of children with severe malnutrition. Echocardiography also acts as a guide to initiate and monitor fluid therapy in these children.

Cardiomyopathy in SAM children is generally caused by micronutrient deficiencies and dyselektrolytemia. Hypokalemia and hyponatremia can cause abnormalities in electrical activity in these children [8]. Adequate supplementation of the deficient micronutrients would reverse the cardiac dysfunction caused by deficiencies [9]. During recovery, the atrophic myocardium is subjected to high load as a result of hypervolemia associated with the mobilization of edema fluid and severe anemia [10]. This hypermetabolic state is accompanied by an increase in heart rate, blood pressure and cardiac output.

The risk factors for both mothers and children for development of severe malnutrition have also been studied extensively, with the most profound outcome of undernutrition being premature death [11]. Malnutrition increases the risk of morbidity in the form of physical and cognitive damage. This cycle of undernutrition is passed on from one generation to another, when undernourished women give birth to low-birth-weight babies. Thus, they enter into the vicious cycle of undernutrition progressing from one generation to another [12]. Hence proper assessment of risk factors needs to be performed in the early stages of undernutrition.

CONCLUSION

The study showed that the mean LVM & LVMI were less than the values described by age- matched studies with LV dysfunction in 40% of the sample size. Further, it was seen that LVM & other echo parameters show correlation with anthropometric parameters of children less than 6 months with severe malnutrition. Cardiac assessment should be performed in all children with SAM as soon as they are stabilized. This helps in providing better treatment to the children by identifying the underlying cardiac pathology.

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