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Original Research Article

Study on the effect of severe acute malnutrition on various echocardiographic parameters of the heart

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ABSTRACT

Background: Malnutrition is a major cause for morbidity and mortality in children below 5 years of age in developing countries. According to National family health survey-5 (NFHS-5), stunting has reduced from 38.4% to 35.5%. Wasting has reduced from 21.0% to 19.3% and underweight prevalence has reduced from 35.8% to 32.1%. Acute malnutrition can lead to biochemical changes based on metabolic, hormonal and glucoregulatory mechanisms and can affect various organ systems. This study aims to determine the effect of malnutrition on various cardiac parameters by M mode echocardiography.
Methods: A cross sectional observational study was conducted in 50 severe acute malnutrition children selected by convenient sampling between 6 months and 5 years of age of Government Cuddalore medical college for a period of 2 years and M mode echocardiography was done to assess various parameters of cardiac wall dimensions and cardiac mass and compared with age/body surface area specific values.
Results: Among SAM children, 74% had decreased end diastolic diameter, 80% had decreased end systolic diameter and 88% had decreased posterior wall dimension. Ejection fraction and fractional shortening was in normal range for all children. 64% had decreased left ventricular mass and 56% had decreased left ventricular mass index.
Conclusions: Dimensions of the heart and cardiac mass was reduced in majority of malnourished children. Systolic function of the heart was relatively preserved as demonstrated by normal ejection fraction and fractional shortening. Thus, echocardiography can serve as a valuable tool in detecting changes in cardiac structure and function in malnourished children.

Keywords: Severe acute malnutrition, Cardiac dimensions, Left ventricular mass, Left ventricular mass index, Echocardiography

INTRODUCTION

Malnutrition is a major concern for public health especially in developing countries. Malnutrition can manifest as decreased weight for age, decreased height for age, decreased weight for height.[1-3] Severe acute malnutrition is both a medical and social disorder defined by WHO as; weight for height <70% of expected/<-3 Z score and/or, mid upper arm circumference <11.5 cm, visible severe wasting and/or, presence of nutritional edema. It can occur as a result of several factors such as socio economic, cultural, environmental factors or may be secondary to underlying disease process.[2,3] Severe acute malnutrition can manifest as marasmus (non-edematous) or kwashiorkor (edematous) forms with several effects on various organ systems.[4] The objective of the study is to determine the effect of malnutrition on various echocardiographic parameters and cardiovascular function.

METHODS

A cross sectional observational study was carried out for a period of 2 years from December 2020 to December 2022 at Government Cuddalore medical college, Chidambaram in SAM children attending outpatient department or admitted as in patients between the age group of 6 months to 5 years by performing M mode echocardiography after getting informed consent from parent/guardian. The participants were selected by convenient sampling technique and with SAM prevalence of about 7.7% based on NFHS-5 survey and an expected response rate of 60%, the study would require 50 participants for estimating the expected proportion with 10% absolute precision and 95% confidence interval.[5-13] The data was analysed by SPSS software.

Inclusion criteria

Children between 6 months and 5 years of age with clinical features of SAM admitted as inpatients/attending outpatient department were included.

Exclusion criteria

Exclusion criteria for current study were; children with congenital/acquired heart disease, preterm or IUGR babies, congenital anomalies, children with systemic illnesses or chronic disease.

The following parameters were determined by M mode echocardiography: end diastolic diameter, end systolic diameter, posterior wall dimension, ejection fraction, fractional shortening, left ventricular mass, left ventricular mass index and compared with age/body surface area specific standard values.

RESULTS

Total 50 SAM children were included in the study and M mode echocardiography was performed to determine various parameters.

Table 1: Various echocardio graphic parameters in SAM children.

Parameters	Mean±SD	Normal	Decreased
EDD (cm)	1.53±0.60	13	37
ESD (cm)	1.68±0.3	10	40
PWD (cm)	0.31±0.04	6	44
EF (%)	65.4±4.9	50	-
FS (%)	33.7±3.8	50	-
LVM (g)	19.8±6.5	18	32
LVMI (g/m2)	41.6±10.4	22	28

EDD-end diastolic diameter; ESD-end systolic diameter; PWD-posterior wall dimension; EF- ejection fraction; FS- fractional shortening: LVM-left ventricular mass: LVMI-left ventricular mass index.

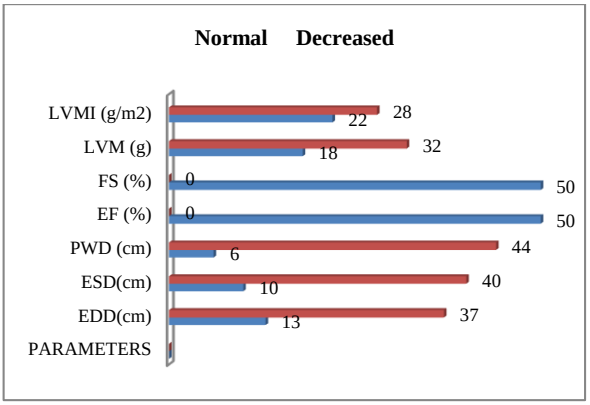

Figure 1: Comparison of various cardiac parameters in SAM children gender distribution of participants.

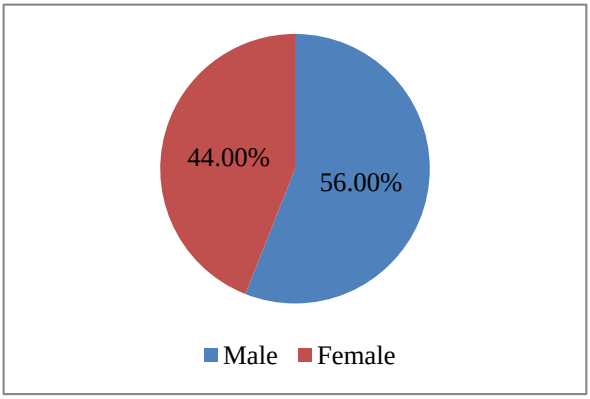

Figure 2: Gender based distribution of patients.

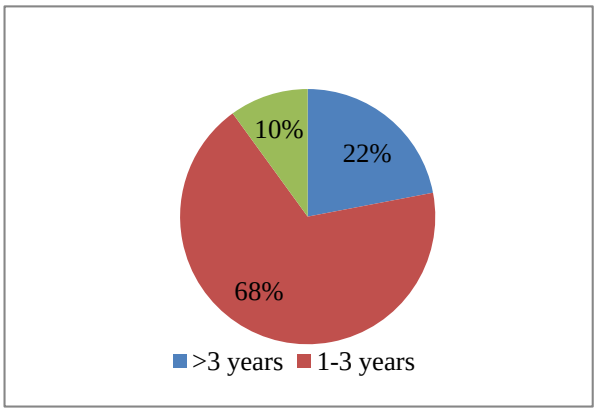

Figure 3: Age based distribution of patients.

This study included 56% males and 44% females. Among the participants 68% belonged between the Age group of 1 to 3 years, 22% were above 3 years and 10% were below 1 year. Among the participants, 74% had decreased end diastolic diameter, 80% had decreased end systolic diameter and 88% had decreased posterior wall dimension when matched with controls of similar body surface area. All of them had ejection fraction and fractional shortening in the normal range. 64% had decreased left ventricular mass and 56% had decreased left ventricular mass index when compared with age specific values.

DISCUSSION

Severe acute malnutrition affects cardiovascular structure and function as demonstrated by various studies. In our study, 80% of participants had decreased end systolic diameter, 74% had decreased end diastolic diameter and 88% had decreased posterior wall dimension. Faddan et al did echocardiographic evaluation in children with first degree, second-degree, third-degree marasmus, kwashiorkor and marasmic kwashiorkor.[5] The left ventricle posterior wall diameter, interventricular septal diameter and left ventricle mass are significantly decreased in malnourished children compared with controls as seen in our study. A similar study was conducted by Asuthosh Kumar et al who showed a decrease in dimensions of heart such as left ventricular end diastolic diameter and left ventricular end systolic diameter and inter septal diameter as seen in our study.[6] Ocal et al also recorded a decrease in posterior wall diameter compared to controls in malnourished children.[7] Bergman et al also did a study on kwashiorkor children where he found a decrease in end systolic diameter, end diastolic diameter and posterior wall thickness.[8] Ejection fraction and fractional shortening was measured and was found to be within normal limits in all participants of the study. A similar finding was recorded by Jain et al who found the mean of both ejection fraction and fractional shortening to be within normal range for both malnourished and normal individuals.[9] Kumar et al also found that ejection fraction and fractional shortening among the participants of their study was normal as similar to our study.[6] Chelo et al found that 35% of participants had ejection fraction and fractional shortening less than the 3rd centile in contrast to our study.[10] Left ventricular mass was found to be decreased in 64% of patients. Similar findings were recorded Bergman et al who found the cardiac muscle mass to be significantly reduced in severely malnourished children compared to age matched controls.[8] Ocal et al also observed similar findings where the left ventricular mass was found to be decreased in severely malnourished children.[7-10] Kothari et al also found that there is a decreased myocardial mass in malnourished children.[11] Phornphatkul et al found a decrease in cardiac mass among malnourished children which recovered during nutritional supplementation.[12] Left ventricular mass index was also found to be decreased in about 64% of participants. Similar findings were recorded by Jain et al who found both left ventricular mass and left ventricular mass index to be decreased in malnourished children when compared with controls.[9] The limitations of this study are that there were no matched controls. The effect of nutritional supplementation on the echocardiographic parameters was also not evaluated in this study. Further studies are required to determine the reversibility of these parameters after rehabilitation.

CONCLUSION

This study concludes that severe acute malnutrition affects cardiac wall dimensions and cardiac mass is reduced while the systolic functions are relatively preserved. Echocardiography can be used as a tool to detect early changes in cardiac structure and function to make early intervention feasible.

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REFERENCES

1. National family health survey, nutrition and anaemia. Available at: https://www.rchiips.org/nfhs/. Accessed on 20 November 2022.
2. Facility based care of severe acute malnutrition. Available at: https://www.nhm.gov.in › child-health - materials. Accessed on 20 November 2022.
3. Dipasquale V, Cucinotta U, Romano C. Acute malnutrition in children: pathophysiology, clinical effects and treatment. Nutrients. 2020;12(8):2413.
4. Tennant IA, Barnett AT, Thompson DS, Kips J, Boyne MS, Chung EE, et al. Impaired cardiovascular structure and function in adult survivors of severe acute malnutrition. Hypertension. 2014;64(3):664-71.
5. Faddan NH, Sayh KI, Shams H, Badrawy H. Myocardial dysfunction in malnourished children. Ann Pediatr Cardiol. 2010;3(2):113-8.
6. Sharma AK, Gaur A, Agrawal NS. What affect heart in SAM: structure or Function. Int J Contemp Pediatr. 2017;4:1614-9.
7. Ocal B, Unal S, Zorlu P, Tezic HT, Oguz D. Echocardiographic evaluation of cardiac functions and left ventricular mass in children with malnutrition. J Paediatr Child Health. 2001;37:14-7.
8. Bergman JW, Human DG, De Moor MM, Schulz JM. Effect of kwashiorkor on the cardiovascular system. Arch Dis Child. 1988;63:1359-62.
9. Jain D, Rao SK, Kumar D, Kumar A, Sihag BK. Cardiac changes in children hospitalized with severe acute malnutrition: A prospective study at tertiary care center of northern India. Indian Heart J. 2019;71(6): 492-5.
10. Chelo D, Nguefack F, Ngate A. Study of the cardiac function of children aged from 6 to 59 months suffering from severe acute malnutrition in Yaounde Cameroon. J Pediatr Neonat. 2020;2(1):1-6.
11. Kothari SS, Patel TM, Shetalwad AN, Patel TK. Left ventricular mass and function in children with severe protein energy malnutrition. Int J Cardiol. 1992;35:19-25.
12. Phornphatkul C, Pongprot Y, Suskind R, George V, Fuchs G. Cardiac function in malnourished children. Clin Pediatr. 1994;33:147-54.

13. Ulahannan SK, Wilson A, Chhetri D, Soman B, Prashanth NS. Alarming level of severe acute malnutrition in Indian districts. BMJ Glob Health. 2022;7(4):e007798.

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