Research

Prevalence of malnutrition in children with congenital heart disease awaiting cardiac interventions at a tertiary care setting in Sri Lanka

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Abstract

Introduction: Estimated number of children born with congenital heart disease (CHD) in Sri Lanka is 3255 per year. Although the pre-operative nutritional status is one of the major determinants of the magnitude of the metabolic response and recovery time following surgery[1), studies are limited on this aspect in Sri Lanka. This study aims to determine the prevalence of malnutrition among children with congenital heart disease awaiting cardiac interventions in a tertiary care cardiology unit.
Method: All CHD children admitted to the cardiology unit at Lady Ridgeway hospital for cardiac interventions during August 2017 were included. Weight and length/height were measured and WHO standards were used for the assessment of nutritional status.
Results: A total of 102 children were enrolled; 43 infants, 26 children aged 1-5 years and 33 children >5 years. Prevalence of severe (SAM) and moderate (MAM) acute malnutrition was 26.4% and 22.5% respectively. The prevalence of stunting in children below 5 years was 45.1% of which 21.5% were severely stunted. In children above 5 years, 36.3% were stunted and 9.0% were severely stunted. Prevalence of low birth weight among them was 29.4%. There was a significantly high percentage of SAM among children above 5 years of age (P<0.001).
Conclusions: Half of the children with CHD admitted for cardiac interventions in this study sample were malnourished. It is recommended to screen all children with CHD awaiting surgey in order to identify malnutrition and provide appropriate medical nutrition therapy before the cardiac interventions.
Key Words: congenital heart disease, malnutrition, SAM, stunting

Introduction

Approximately eight out of 1,000 infants are born with a congenital heart disease (CHD) globaly [(2)]. Children with CHD are at an increased risk of malnutrition during the critical developmental period due to the multifactorial nature of its aetiology [(3,4)]. Growth failure due to CHD may begin before birth and approximately 6% of children may present with intrauterine growth retardation[(5)]. Chronic malnutrition and wasting is found in two thirds and one third of these children respectively [(2,5)]. Malnutrition may have acute health implications as well as a negative impact on the child's development. Majority of this vulnerable group of children will require surgery within the first few years of life. Pre- operative nutritional status is one of the major determinants of the magnitude of the metabolic response, recovery time following surgery, morbidity and the overall outcome [(1)]. Early identification of children with feeding difficulties and early nutrition intervention results in improved nutritional status, surgical outcome and long term developmental outcome [(6,7)].

Estimated number of children born with congenital heart disease in Sri Lanka is about 3255 per year. Although the assessment and optimization of nutritional status of these vulnerable children is of great importance, according to our knowledge, there are no studies done in Sri Lanka in children with CHD on malnutrition.

Hence the aim of our study was to determine the prevalence of malnutrition among children with CHD awaiting cardiac interventions in a tertiary care cardiology unit.

Methodology

This was a cross sectional study and study population was all children aged 0-12 years with CHD admitted to the cardiology unit at the Lady Ridgeway Hospital for children (LRH) in Sri Lanka. CHD was identified when it was dignosed by the Cardiologist and holding a diagnosis card. The type of the cardiac lesions; (acyanotic or cyanotic) were also recorded.

Sample size was calculated considering the 95% confidence interval, 40% prevalence of wasting [(1,2)], 10% desired precision and 10% non-response rate. The total sample size was 102. All the children below 12 years with CHD who were admitted to the cardiology unit in August 2017 were included till the required sample size was achieved; after obtaining verbal consent from the parent. All the children were stable enough to be included in the study.

Two of the investigators were trained in order to standardize the data collection method, obtained the weight, length and height in all selected children. Length and height were measured in children under 2 years and above 2 years respectively. Uniscale for children below 2 years and calibrated Seca scale for children above 2 years was used for weight measurements. The height was measured by stadiometer and an infantometer was used to measure the length. Weights and length/ heights were taken to the nearest 0.1 kg and 0.1 cm respectively. Cut-off value for stunting and wasting was standard deviation (SD) score (z-score) below −2SD of the reference value, according to World Health Organisation (WHO) guidelines[8]. In children below 5 years, weight-for-height/length below -2SD, -3SD and between -3SD and -2SD were taken as wasting, severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) respectively. In children above 5 years, the sex specific BMI <-2SD, <-3SD and between -3SD and -2SD was considered as wasting, SAM and MAM. Height-for-age below -2SD was taken as stunted and below -3SD was taken as severely stunted.

Data Analysis

Age was calculated from the date of birth extracted from the child's health records which were available for all the children. Low birth weight was defined as children born with a birth weight below 2.5 kg. Statistical significance was considered when $P<0.05$.

Results

A total of 102 children were studied. Table 1 shows the age and sex distribution of the study sample. The male and female representation in the study is almost equal. Infants constitute 42.2% of the study sample.

Age in years	Male No. (%)	Female No. (%)	Total No. (%)
< 1	22 (51.1)	21 (48.8)	43 (42.2)
1-5	13 (50.0)	13 (50.0)	26 (25.5)
>5	16 (48.5)	17 (51.5)	33 (32.3)
Total	**50 (49.0)**	**52 (51.0)**	**102 (100.0)**

Table 1: Age and sex distribution of the study sample

Table 2 shows the prevalence of wasting and stunting in the study sample, in relation to age, sex, birth weight and type of cardiac lesion. Almost half (48.8%) of children below one year showed evidence of SAM and one third (30.7%) of children aged 1-5 years showed MAM. Stunting (88.4%) and sever stunting (50.0%) was highest among children between 1-5 years.

Male or female gender has not shown any significant association with SAM, MAM, wasting, severe stunting or stunting.

The children with <2.5kg of birth weight (LBW) had significantly higher prevalence of severe stunting (40%Vs13.8%) and stunting (66.6%Vs36.1%) compared to children born with a birth weight above 2.5kg. SAM and MAM were higher in LBW children compared to children born with >2.5kg birth weight, which is not statistically significant.

Higher prevalence of stunting was observed among children with acyanotic heart diseases (54%) than children with cyanotic heart diseases (31.7%). But the difference is statistically not significant and may be due to wide confidence intervals. Likewise the type of congenital heart disease was not significantly associated with prevalence of SAM, MAM and wasting.
Overall prevalence of SAM, MAM, wasting, severe stunting and stunting were 26.4%, 22.5%, 48.9%, 21.5% and 45.1% respectively.

Table 2: Prevalence (%) and confidence interval (CI) of wasting and stunting of study sample in relation to age, sex, birth weight and cardiac lesion

Characteristics	Weight-for-height/length or BMI-for-age-sex			Height-for-age		Total No.
	<-3SD (SAM)	<-2SD to -3SD (MAM)	<-2SD (wasting)	<-3SD (severe stunting)	<-2SD (Stunting)	(%)
Age in years						
<1	48.8 (39.1-58.5)	16.3 (9.1-23.5)	65.1 (55.9-74.4)	13.9 (7.2-20.6)	25.5 (17.0-34.0)	43 (42.2)
1-5	15.4 (8.4-22.4)	30.8 (21.8-39.8)	46.2 (36.5-55.9)	50.0 (40.3-59.7)	88.4 (82.2-94.6)	26 (25.5)
>5	6.1 (1.5-10.7)	24.2 (15.9-32.5)	30.3 (21.4-39.2)	9.0 (3.5-14.6)	36.3 (27.0-45.6)	33 (32.3)
P value			*0.001*		*0.001*	
Sex						
Male	26.0 (17.5-34.5)	16.0 (8.9-23.1)	42.0 (32.4-51.6)	20.0 (12.2-27.8)	46.0 (36.3-55.7)	50 (49.0)
Female	26.9 (18.3-35.5)	28.8 (20.0-37.6)	55.7 (46.0-65.3)	23.0 (14.8-31.2)	44.2 (34.6-53.8)	52 (51.0)
P value			*0.2*		*0.8*	
Birth weight (kg)						
<2.5	40.0 (30.5-49.5)	16.7 (9.5-23.9)	56.7 (47.1-66.3)	40.0 (30.5-49.5)	66.6 (57.5-75.8)	30 (29.4)
≥ 2.5	20.8 (12.9-28.7)	25.0 (16.6-33.4)	45.8 (36.1-35.5)	13.8 (7.1-20.5)	36.1 (26.8-45.4)	72 (70.6)
P value			*0.1*		*0.005*	
Type of cardiac lesion						
Cyanotic	31.7 (22.7-40.7)	22.0 (14.0-30.0)	53.7 (44.0-63.4)	17.1 (9.8-24.4)	31.7 (22.7-40.7)	41 (40.2)
Acyanotic	23.0 (14.8-31.2)	22.9 (14.8-31.1)	45.9 (36.2-55.6)	24.5 (16.2-32.9)	54.0 (44.3-63.7)	61 (59.8)
P value			*0.3*		*0.3*	
Total	**26.4 (17.9-35.0)**	**22.5 (14.4-30.6)**	**48.9 (39.2-58.6)**	**21.5 (13.5-29.5)**	**45.1 (35.4-54.8)**	**102 (100.0)**

Discussion

Malnutrition is a recognized complication in children with clinically significant congenital cardiac defects. Factors implicated are cyanosis, hypoxemia, congestive heart failure and pulmonary hypertension [2].

In our study the prevalence of wasting was 48.9%, indicating that half of the study sample was acutely malnourished. Among the study population, 26.4% were severely malnourished while 22.5% were moderately malnourished. When compared with the national level data, DHS (2016) reported national prevalence of wasting, SAM and MAM was 15.1%, 3.0% and 12.1% respectively [9] . This shows that our study population has three times higher level of wasting and eight times higher level of SAM compared to the national prevalence. Similar findings were reported in a study conducted among children with CHD in India [10]. Though Sri Lankan health statistics in the child health domain remain above the rest of the region, results of our study does not outstand in growth parameters. Insufficient energy intake and high energy expenditure of children with CHD directly affect the growth. Excessive fatigue with oral feeds, excessive vomiting or iatrogenic fluid restriction and diuresis due to heart failure are the main reasons behind the low energy intake of children with CHD [11]. It was reported that the daily energy expenditure of children with CHD is increased up to 40% or more of normal for the age [11]. The increased cardio respiratory work associated with movement, food digestion and metabolizing nutrients are the main components of the daily energy requirement that are overburdened. In some of these children malabsorption coexists due to gastrointestinal tract malformations or gut edema due to heart failure [11].

In this study the highest percentage of severe acute malnutrition was seen in infants, which is 48.8%. First thousand days concept identifies a powerful window of opportunity extending from conception to the child's second birthday when nutrition has a long- term impact on the future health and development of both children and society [12]. Therefore, early corrective surgery with comprehensive nutritional management will be the requirement of these vulnerable infants.

We found that the prevalence of stunting, which reflects chronic malnutrition, was 45.1%, of which 21.5% were severely stunted.

Among children between 1-5 years of age, 50% and 88.4% were severely stunted and stunted respectively. The national prevalence of stunting and severe stunting in Sri Lanka in 2016 was 17.3% and 4.1% respectively [9], which is far lower than the stunting prevalence reported in our study. Childhood stunting links with short adult stature, reduced lean body mass, less schooling, diminished intellectual function and reduced learning. CHD is a hyper metabolic state where the increased energy expenditure is not usually fulfilled by the limited intake due to associated multiple factors. Therefore, it is of paramount importance to intervene early with regards to surgery and nutrition to guarantee their growth potential [13].

In this study stunting was seen in 36.3% of children above 5 years and acute malnutrition was seen in 30.3%. This highlights that CHD seems to have affected the growth potential even after surviving initial years. However, most of these children had more stable heart lesions which only needed interval interventions.

In this study 29.4% of the study population had low birth weight, suggesting probable intra uterine growth retardation due to the CHD. It is almost double the national prevalence of low birth weight in Sri Lanka, which is 15.7% [9] . A retrospective study done in Australia shows that there is an increased risk of mortality and morbidity in low birth weight and premature infants compared to the population of term infants with appropriate weight matched cardiac diagnosis [4]. Therefore the birth weight is an important factor that should be taken into consideration in prioritizing early intervention in limited resource settings, such as in Sri Lanka.

This study shows a marked prevalence of wasting among children with cyanotic as well as acyanotic heart disease. However, there was no significant difference between the percentages of undernutrition in both groups (p= 0.3). May be due to low sample sizes. Okoromah et al reported in a case control study that there was a higher degree of undernutrition among children with acyanotic heart diseases [14,15]. Cyanosis leading to hypoxemia seems to have a major impact on the growth of children with heart disease.

Despite improved facilities for cardiac services there is still a lot more to be done in order to assure the best outcome in patients with congenital heart disease. They are unique as they are still growing, and if not addressed will have severe impact on the productivity of the patient even after corrective surgery.

The foremost objective for any country is to identify the present situation of the problem.

In conclusion, the results of this study could have significant inferences for medical professionals caring for children with heart disease. Presence of congenital heart disease complicated by heart failure and malnutrition which sets in due to several factors has irreversible impact on the productivity of these individuals. Hence, the practice of early referral for corrective intervention followed by aggressive nutritional therapy to achieve a catch-up growth should be the target treatment for children with CHD.

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