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ASSESSMENT OF MALNUTRITION IN CONGENITAL HEART DISEASE

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ABSTRACT

Background/Aims: Congenital heart disease is an anomaly of heart arising due to defect in structure or function of heart. Early studies indicate that the congenital heart patient often suffer from malnutrition and this is due to tissue hypoxia and imbalance between energy intake and consumption. So, the aim of the present study is to assess the anthropometric profile and the prevalence of malnutrition among children admitted for surgical or catheter based interventionin pediatric general ward .

Materials and Methods: Body weight, height, triceps skinfold thickness, and mid-arm circumference were measured on admission and percentages of weight-for-age, weight-for-height, mid-arm circumference, and triceps skinfold thickness were calculated. The nutritional status was evaluated using the Waterlow, Gomez, Anthropometric assessments. The study was extended in assessing the biochemical parameters such as serum protein and serum albumin

Results: 51 children with congenital heart disease were included in the study. The average age of the patients 3.98± 2.85, the observed mean height and weight of patients were less than the standard data on comparing the National Centre for Health Statistics growth charts. The

assessment of mid arm circumference and triceps skin fold thickness showed a decrease when compared with the statistics growth charts. According to water low and Gomez anthropometric assessments the children under study showed mild to moderate malnutrition and this was prominent in younger age groups (0-2 years). The study also showed that there is significant lowering of serum protein and albumin levels

Conclusion: The study highlighted the prevalence of malnutrition in congenital heart patients, it showed mild to moderate degree of malnutrition while assessing the hospitalized children, the nutritional evaluation and an early intervention to nutritional support will bring a positive impact

Keyword: CHD, Malnutrition, Anthropometric, protein

INTRODUCTION

Congenital heart disease or congenital heart defect (CHD) is a heart abnormality that can affect the heart valves, arteries and blood vessels. The cardiac anomalies arise at the time of birth due to the defect in the structure or function of the heart and great vessels is called as CHD. The lesions of the heart either obstruct blood flow in the heart and vessels or may alter the pathway of blood circulating through the heart. The incidence of hemodynamically significant congenital anomalies is about 8 per 1000 live birth **[1, 2]** CHD comprise about 30% of all congenital malformation in the new born **[3]**. The congenital heart disease can be classified as cyanotic and acyanotic heart ailment

CHD may present at any age group ranging from neonates to adolescence and clinical symptoms may vary being asymptomatic to fatal complications. A popular view states that children with congenital heart disease are often small and undernourished **[4]**. Several reported study points malnutrion occur in children with congenital heart defects and this malnutrition is often associated with the lack of balance between energy intake and consumption **[5]**. The contributing factors for malnutrition in heart ailments are congestive cardiac failure and pulmonary hypertension **[5, 6]**. Literature states that patients suffering from cyanotic heart disorders are often retarded in growth and the retarded growth is assumed to be based on the gravity of tissue hypoxemia and degree of physiological adaptation. The anthropometrical observations of previous studies on cyanotic patients showed weight and height are affected equally and require aggressive nutritional therapy whereas acyanotic lesions especially in combination with septal defect, left to right shunt affected only weight. To conclude, patient suffering

from acyanotic cardiac malfunctions were related to acute malnutrition whereas cyanotic malfunctions were related to chronic malnutrition **[5]**.

Children and neonates with CHD display an array of delay in weight gain and growth. In some cases the weight gain and growth are mildly affected, whereas in other cases, the failure to gain weight and growth can endin developmental impairment **[7]**. Considering the various issues in regarding the growth and malnutrition for a children suffering from CHD, it is at most important to develop a nutritional strategy and takes care of all of the factors which are essential, both physical and psychological. Therefore, there must be an effort between parents, physicians, nurses and other health care professionals to develop a plan that will be appropriate on an individual basis **[8]**.

The aims of present study were to determine the anthropometric profiles and prevalence of under nutrition in children with CHD by using anthropometric measurement. The early identification of malnutrition in congenital heart disease enables us to employ corrective surgical intervention along with nutritional strategies and helps us to improve the growth status of children with congenital heart disease.

MATERIALS AND METHODS

STUDY DESIGN

The study is a prospective observational study conducted at a tertiary hospital at Chennai. Study was conducted for a period of one year and fifty-one patients were selected for the study and had obtained the approval from Institutional Ethical Committee of Madras Medical Mission (ECR/140/Ins/TN/2013/RR-16). The study complied with the conditions as suggested by the Ethics Review Committee.

IEC Patients were selected on the basis of clinical and laboratory examinations including electrocardiography and echo-cardiography who were admitted for surgical or catheter based corrective intervention in the pediatric general ward. The patients were assigned into two groups according to their diagnosis such as cyanotic and acyanotic heart disease. In this study wide range of age group (1month to 10 years)were included patient were homogenously classified into 3 age category 0 month – 2 years, 2 year to 6 years and 6 years to 10 years. Patients with a history of prematurity, intrauterine growth retardation, known genetic malformation, Dysmorphic features and neurologic disability were excluded from the study.

Assessment of Anthropometric parameters

Anthropometry is one of the best methods to assess the nutritional status of individuals or groups in a population by non- invasive method. Growth and body composition are the two different types of anthropometric measurements and has been widely used in the assessment of nutritional status of both young children and adults. Anthropometric measurements are performed in the day before operation using the same equipment throughout the study the five anthropometric parameters are used. The evaluation of child's growth was conducted by assessing weight, length/height and weight: height ratio using the National Centre for Health Statistics growth charts **[9]**.

Height was measured in centimeters. Height was measured in children with stadio meter who were able to stand and otherwise length can be measured by Infantometer.

Weight - Weight was taken for all the congenital heart disease children. The children who were able to stand, standing weight was taken. Those who were not able to stand weight can be taken by beam scale, which can be used as accurate measurement of weight.

Mid arm circumference was measured at the point mid-way between the acromion process of the scapula and the olecranon process of the ulna in dependent left arm with elbow flexed to 90 percent. This was recorded in centimeters using a flexible non-stretch tape.

Subscapular skin fold thickness was measured just below the angle of the scapula also on the left side. The same pair Harpenden skin fold calipers were used throughout the study and measurement was recorded.

To assess the children with congenital heart disease has malnutrition the investigator has used the following parameters Gomez classification, waterflow classification

Gomez classification [10]

Weight for age (%) = (Weight of the child /Weight of the normal child of same age) x 100 and compared with NCHS standards

Waterflow classification [11] is calculated to identify stunting. It is calculated by **(actual height/height for age) x 100** and compared with NCHS standards.

Assessment of Biochemical parameters

Determination of specific biochemical parameters such as protein and albumin **[12]**, is helpful in determining the nutritional status

Statistics All values were expressed as mean ± SEM. The data's were statistically analyzed (spss15) using the Chi-square test and comparison of the mean values of the measurements of the independent two groups was made using the Mann–Whitney U test. A

value of $p<0.05$ was accepted as statistically significant**.**

RESULTS

51 children with congenital heart disease were included in the study. The average age of the patients3.98± 2.85.There were 25 males children and 26 females. Among the 51 children with congenital heart disease 37 children were acyanotic and 14 children were cyanotic heart disease. The patients were homogenously segregated based on the age groups (0 month – 2 years, 2year to 6 years and 6 years to 10 years). For the age group - I, 15 were acyanotic and 4 were cyanotic, for group II 13 were acyanotic and 6 were cyanotic and group III 9 were acyanotic and 4 were cyanotic **(Table 1 & 2)**.

The anthropometric data from the 51 children with Congenital Heart Disease were compared with the standard chart of National Centre for Health Statistics (India). The Expected mean height of the children of group I , group II, group III were found to be 71.54cm, 104.64cm and 130.32cm respectively and the observed mean height of group I (acyanotic 67.62± 2.4 cm cyanotic 69.25± 7.98cm), group II (acyanotic 99.9±2.08 cm, cyanotic 98.50± 2.65cm) group III (acyanotic121±2.04 cm, cyanotic 122.0±2.00cm) respectively **(Table 3)**.

The Expected mean weight of the children of group I , group II, group III were found to be 8.61kg ,17.3 kg and 26.2kg respectively and the observed mean weight of group I (acyanotic 7.09± 0.58kg), (cyanotic 6.8± 1.71kg), group II (acyanotic 12.05±0.65 kg), (cyanotic 13.33± 0.65kg) group III (acyanotic 20±0.88 kg) (cyanotic 22.0±0.700kg) respectively **(Table 4)**.

The Expected mid arm circumference of the children of group I, group II, group III were found to be 12.5cm respectively and the observed mid arm circumference of group I (acyanotic 5.58± 0.40 cm, cyanotic 5.15± 0.91cm), group II (acyanotic 7.33±0.32 cm, cyanotic 6.91± 0.44cm) group III (acyanotic 9.3±0.66 cm, cyanotic 8.82.0±0.70cm) respectively **(Table 5)**.

The Expected skin fold thickness of the children of group I, group II, group III should to be > 10mm respectively and the observed mid arm circumference of group I (acyanotic 5.44± 0.29 mm, cyanotic 5.63± 0.80mm), group II (acyanotic 7.41±0.30 mm, cyanotic 6.65± 0.24mm) group III (acyanotic 8.45±0.50 mm, cyanotic 8.55.0±0.89mm) respectively **(Table 6)**.

Table 7 shows the nutritional status of study patients according to Gomez Classification. Acyanotic patients 37 (100%) and cyanotic patients 14 (100%) irrespective of age groups

suffer from mild malnutrition and are placed in grade I of scale of weight for age

Table 8 shows Stunting percentage Height for Age Water Flow Classification of PEM. Acyanotic patients of group I (29.4%)suffer from moderate malnutrition while the group II and group III suffer from mild malnutrition and cyanotic patients 14 (100%) irrespective of age groups suffer from mild malnutrition and are placed in grade I of scale of weight for age

The serum total protein level of normal individual range 6.0 – 8.3gm/dl and mean serum total protein for the acyanotic and cyanotic was less than the normal level and similar observations was seen the albumin level**(Table 9 & 10)**.

Table 1: Distribution of sex with cyanotic and Acyanotic

.Congenital Heart Disease	Male	Female	Total
Acyanotic	16 (31%)	21(41%)	37 (72.5%)
Cyanotic	9(17.6%)	5(9%)	14(27.4%)

Table 2: Distribution of Age based on cyanotic and Acyanotic

Group	Acyanotic	Cyanotic	Total
I (0-2years)	15 (29.4%)	4(7.8%)	19
II (2-6 years)	13(25.4%)	6(12.7%)	19
III (6-10years)	9(17.6%)	49(7.8%)	13

Table 3: Comparison of observed mean height, standard mean errorwith expected mean height

Group	Acyanotic		Cyanotic	
	Observed height	Expected mean height	Observed height	Expected mean height
I (0-2years)	67.62± 2.4	71.54	69.25± 7.98	71.54
II (2-6 years)	99.9±2.08	104.64	98.50± 2.65	104.64
III (6-10years)	121±2.04	130.32	122.0±2.00	130.32

Table 4: Comparison of observed mean weight, standard mean error with expected mean weight

Group	Acyanotic		Cyanotic	
	Observed Weight in Kg	Expected Mean Weight in Kg	Observed Height in Kg	Expected Mean Weight in Kg
I (0-2years)	7.09± 0.58	8.61	6.8.± 1.71	8.61
II (2-6 years)	12.05±0.65	17.3	13.33± 0.65	17.3
III (6-10years)	20.03±0.88	26.2	22.0±0.70.	26.2

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Table 5: Comparison of observed mean MAC, standard mean error with expected mean MAC

Group	Acyanotic		Cyanotic	
	Observed Mid arm Circumference in cm	Expected Mid arm Circumference in cm	Mid arm Circumference Observed in cm	Expected Mid arm Circumference in cm
I (0-2years)	5.58± 0.40	12.5	5.15± 0.91	12.5
II (2-6 years)	7.33±0.32		6.91±0.44	
III(6-10years)	9.3± 0.66		8.82±0.70	

Table 6: Comparison of observed mean skin fold thickness, Standard mean error for with expected skin fold thickness

Group	Acyanotic		Cyanotic	
	Observed skin fold thickness (mm)	Expected skin fold thickness (mm)	Observed skin fold thickness (mm)	Expectedskin fold thickness (mm)
I (0-2years)	5.44± 0.29 mm	> 10mm	5.63± 0.80	> 10mm
II (2-6 years)	7.41±0.30	> 10mm	6.65±0.24	> 10mm
III(6- 10years)	8.45± 0.50	> 10mm	8.55±0.89	> 10mm

Table 7: Weight for Age Gomez Classification

Group	Acyanotic					Cyanotic				
	Wt for percentage Observed	Scale of weight for age Grade				Wt for percentage Observed	Scale of weight for age Grade			
		N	I	II	III		N	I	II	III
I (0-2years)	77.70± 2.50	90	75-90	60-75	<60	76.07± 2.89	90	75-90	60-75	<60
II (2-6 years)	80.37±2.50	90	75-90	60-75	<60	81.61± 2.89	90	75-90	60-75	<60
III (6-10years)	81.51± 1.37	90	75-90	60-75	<60	85.12±1.23	90	75-90	60-75	<60

Table 8: Stunting percentage Height for Age Water Flow Classification of PEM

Group	Acyanotic					Cyanotic				
	Stunting percentage observed	Scale of the Shunting				Stunting percentage observed	Scale of the Shunting			
		Normal	Mild	Moderate	Severe		Normal	Mild	Moderate	Severe
I (0-2years)	88.70±0.93	>95	87.5-95	80- 87.4	<80	92.9± 0.60	>95	87.5-95	80- 87.4	<80
II (2-6 years)	93.40±0.78	>95	87.5-95	80- 87.4	<80	93.40± 1.10	>95	87.5-95	80- 87.4	<80
III (6-10years)	94.40± 0.45	>95	87.5-95	80- 87.4	<80	94.60±1.37	>95	87.5-95	80- 87.4	<80

Table 9: Assessment of Total Protein Content

Group	Acyanotic	Cyanotic	
	Total protein Observed in g/dl	Total protein Observed g/dl	Normal
I (0-2years)	5.4± 0.13	5.3+ 0.95	6.0 – 8.3 gm/dl
II (2-6 years)	5.1± 0.11	5.6±0.21	
III (6-10years)	5.4±0.26	5.5±0.18	

Table 10: Assessment of Albumin Content

Group	Acyanotic	Cyanotic	
	Total albumin Observed in g/dl	Total albuminn Observed g/dl	Normal
I (0-2years)	3.08± 0.09	3.0+ 0.14	3.42 – 5.4 gm/dl
II (2-6 years)	3.08± 0.08	3.15±0.07	
III (6-10years)	3.24±0.10	3.3±0.09	

DISCUSSION

The aim of the study was to evaluate the malnutrition associated with congenital Heart Disease admitted in pediatric ward of a tertiary hospital in Chennai. In this study about 51 patients were selected they were segregated intoacynotic and cyanotic of different age groups. Six variables were measured in each patient to determine the state of malnutrition. Anthropometric (4) and biochemical (2). Anthropometric data from 51 children was compared with standard reference chart of National Centre for Health Statistics (India). Most of the studies related to nutrition and congenital heart disease depend on height and weight of the subject under study. In the current study we have demonstrated mild grade of under nutrition in congenital heart patients on assessing the height of the subjects whereas, the study showed a moderate level of under nutrition on comparing the weight of congenital heart patients against the standard data showed. Apart from measuring the height and weight, the study was also extended in assessing the mid arm circumference and skin fold thickness measurement to study the malnutrition status. Mid arm circumference is recognized to indicate the status of muscle development. It is useful in identifying malnutrition and also in determining the mortality risk in children it also correlates weight and clinical sciences **[13]**. In the current study we have demonstrated a severe malnutrition while assessing the mid arm circumference and this was prominent among the age group between 0-2 years .The skinfold thickness measurement is used to estimate the body fat reserves **[13]**. In the current study the skin fold thickness assessment showed severe level of malnutrition in both groups and was severe in younger age groups. To assess the nutritional status Gomez classification (weight for age) showed all the subjects can be categorized in grade I of the scale of malnutrition irrespective of nature of cardiac defect and Water flow classification (for stunting) was performed and observed both cyanotic and acyanotic were mildly stunted.

First indication of malnutrition is the lowering of serum total protein and serum albumin[14] The study also demonstrates a low protein level and albumin level in the serum concentration an important indicator in malnutrition Several studies demonstrated that severity of malnutrition and type of cardiac defect such as cyanosis are related but in the current study we were not able to establish a relation between malnutrition and cardiac defect. The present study was in

unison with the earlier study done by salzer *et al* **[14]** and Mitchell *et al* **[15]**.

CONCLUSION

The observational study shows there is a relation between congenital heart disease and malnutrition and this was demonstrated by assessing the anthropometric and biochemical studies. A longitudinal study is necessary to understand the changes in growth and development in children further more increasing the size population and residence area of study population would provide greater understanding of growth and developmental difference between children with CHD and normal children

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