ORIGINAL RESEARCH PAPER

Paediatrics

"A STUDY OF ANTHROPOMETRIC PROFILE IN CHILDREN WITH CONGENITAL HEART DISEASE"

KEY WORDS: Congenital Heart Disease, Malnutrition, Anthropometry.

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ABSTRACT

Background: Congenital heart disease (CHD) is commonly associated with protein energy malnutrition (PEM) and failure to thrive in children. Children with congenital heart diseases are commonly malnourished irrespective of CHD. The aim of the study is to assess the effect of CHD on growth and to identify the areas of growth affected with reference to different anthropometric measurements.

Materials and Method: A case control observational study was carried out in children aged 0-12 years old with CHD in the Department of Pediatrics, Kota. All patients underwent an anthropometric evaluation (weight, height/length, head circumference, mid-arm circumference) and growth charts (NCHS and WHO) were used accordingly.

Results: We had total of 40 patients, 30 (75%) had acyanotic congenital malformation, while 10 (25%) had cyanotic cardiac malformation. Majority, 17(77%) out of 22 cases above 5 years with CHD were underweight. Left to right shunt children with acyanotic malformation were tended to have acute malnutrition and stunting was more severe in children with cyanotic defects, with 100% of them affected.

Conclusion: A significantly higher number of children (82%) were underweight and 86% were stunted among children with congenital heart disease. In conclusion it can be stated that children with congenital heart disease have highly measurable significant growth retardation (P<0.05) by student t test.

INTRODUCTION

Congenital Heart Defects (chd) Are Anatomical Defects That Arise From Abnormal Development Of The Heart And Major Blood Vessels Present Since Birth Or Manifesting Any Time After Birth Or May Not Manifest At All. The Overall Incidence Of Congenital Malformation In Live Birth Is 0.8% [1]. Chd Comprise About 30% Of All Congenital Malformation In The New Born [2].

Severe Protein Energy Malnutrion May Occur In Children With Congenital Heart Defects Due To An Imbalance Between Energy Intake And Consumption. Cardiac Failure And Pulmonary Hypertension Are The Most Important Factors For The Development Of The Severe Malnutrition. Children With Cyanotic Heart Disease With Pulmonary Hypertension Are The More Seriously Affected Requiring Proper And Prompt Nutritional Therapy [3]. Cyanotic Patients Are Affected In Growth, Depending Upon The Severity Of Tissue Hypoxemia And Degree Of Physiological Adaptation. Weight And Height Are Affected Equally In Cyanotic Patients. Acyanotic Lesions Especially In Combination With Septal Defect, Left To Right Shunt Will Affect Predominantly Weight Only. In Short, Acyanotic Lesions Were Related To Acute Malnutrition Whereas Cyanotic Lesions Were Related To Chronic Malnutrition [4].

Infants And Children With Chd Exhibit A Growth Failure. In Some Cases Growth Failure Can Be Relatively Mild, Whereas In Other Cases, The Failure To Thrive Can Result In Permanent Physical Or Developmental Impairment [5].so It Is Important To Develop A Nutritional Strategy And Taking Into Account Of All The Factors At Play, Both Physical And Psychological. Therefore, There Must Be A Proper Coordination Between Parents And Pediatrician To Develop A Plan That Will Be Appropriate On A Patient To Patient Basis.[6].

The Aims Of This Study Were To Determine The Anthropometric Measurements And Prevalence Of Malnutrition In Children With Chd By Using Anthropometric Measurement. Those Measurements Are Useful In Early Detection Of Chd And Assessing The Prognosis Of The Basic Cardiac Defects And Their Complication.

MATERIALS AND METHODS

Analytical Study Was Carried Out In Children Aged 0-12 Years Old With Chd Who Had Consultation At Pediatric Department, Kota. Patients Falling Under The Inclusion Criteria For Age, And Who Had No Definitive Or Palliative Treatment Given, Were Taken Up For The Study.

Inclusioncriteria:

1. 0-12 Years With Congenital Heart Diseases (cyanotic & Acyanotic) Clinically Detected And Confirmed By Investigations And
2. Patients Who Have Not Undergone Any Surgical Intervention

Exclusion Criteria:

1. Major Congenital Malformation Other Than Chd.
2. Chronic Infections (tuberculosis , Hiv Etc.)
3. Other Obvious Causes Of Malnutrition
4. Other Chronic Disorders (Asthama, Chronic Liver Failure, Chronic Kidney Failure, Etc.)
5. Endocrinal And Neurological Causes Of Growth Retardation
6. Other Known Genetic Disorders Or Inborn Error Of Metabolism.

Diagnostic Criteria Of Congenital Heart Disease:

1. History And Clinical Examination,
2. X Ray Chest
3. Electro-cardiogram
4. 2d Echo

Following Anthropometric Parameters Were Studied:

1. Weight
2. Height Or Length
3. Head Circumference
4. Mid-arm Circumference

Anthropometric Measurements Were Performed Using Same Equipment Throughout The Study. Assessment Of Growth In These Children By Anthropometric Measurements Was Done And Compared With 50th Centile For Age And Sex, Nchs And Who Charts [7].

RESULTS

Total 40 Patients With Congenital Cardiac Malformation Were Registered For This Study. 24(60%) Were Male And 16(40%) Were Females.

Age Wise Distribution Of Children With Acyanotic And Cyanotic Cardiac Malformation In The Subject Group Were Divided Into Age Groups Of <5years, 5-10 Years And >10-12 Years.

Majority Of The Children With Chds, 18(45%) Were < 5 Years, Followed By 17(42.5%) In Age Group Of 5-10 Years And 5(12.5%) Above The Age Of 10 Years. 30 (75%) Had Acyanotic Congenital Malformation, While 10 (25%) Had Cyanotic Cardiac Malformation.

2 D Echocardiographic Diagnosis Revealed That Ostium Secundum Atrial Septal Defect (asd) In 15(37.5%) Of The Children As The Commonest. The Second Most Common Cardiac Malformation Was Patent Ductus Arteriosus (pda) In 9 (22.5%). Thus Asd And Pda Together Comprised Over Half 24(60%) Of Cardiac Defects. The Third Commonest Cardiac Malformation In The Present Study Was Ventricular Septal Defect (vsd) In 6(15%) Cases. Tetralogy Of Fallot (tof) In 10(25%) Cases Ranked Fourth And All Were Male Children.

Assessment Of The Mean Observed Value For Weight In Children With Congenital Cardiac Malformation Was 12.43 Kg Significantly Less Than Expected Value For Age As In Table 1.

Table-1: Comparison of observed mean weight and standard deviation

Group	Mean weight	S.D	P-Value
Observed value (CHD)	12.43	7.24	< 0.05
Expected value (50^{th} $\%^{ile}$ NCHS)	21.0	11.4	

There was a significant mean difference between observed weight and expected weight (p< 0.05).

Table-2: Assessment of nutritional status for children less than 5 years of age (IAP classification)

CHD	Normal	PEM				Total
		Grade I	Grade II	Grade III	Grade IV	
Acyanotic	3	3	4	2	1	13
Cyanotic	0	2	1	1	1	5
Total	3	5	5	3	2	**18**

Table-3: Wellcome Trust Classification – Weight for age for children above 5 years of age

CHD	Normal >80%	Underweight 80-60%	Marasmic <60%	Total
Acyanotic	4	13	0	17
Cyanotic	0	5	0	5
Total	4	18	0	**22**

Table-4: Mean height and standard deviation (S.D)

Group	Mean height(cm)	S.D	P-value
Observed value (CHD)	97.63	25.7	p < 0.05
Expected value (50^{th} $\%^{ile}$ NCHS)	107.6	29.5	

There was significant mean difference between observed height and expected height (p < 0.05).

Table-5: Mean head circumference and standard deviation (S.D)

Group	Mean head circumference (cm)	S.D	P-value
Observed value (CHD)	43.9	3.2	p < 0.05
Expected value 50^{th} $\%^{ile}$ WHO	46.2	3.4	

Table-6: The comparison of observed mean MAC, S.D, t-value, P-value to the expected 50th centile WHO standards

Group	Mean MAC (cm)	S.D	P-value
Observed value CHD	10.9	1.1	p < 0.05
Expected value (50^{th} $\%^{ile}$ WHO)	15.00	1.0	

There was a significant mean difference between observed MAC and expected MAC (p < 0.05).

DISCUSSION

The present study revealed that a majority, 30(75%) children had acyanotic malformation and 10(25%) cyanotic malformation.

A similar predominance of acyanotic malformation was also reported in other studies in Mumbai 82%[12], Mexico 74.2%[13] Croatia 87.2%[14]. In contrast study by Varan B, Tokel K, and Yilmaz G from Turkey reported predominance of cyanotic malformation 65.2% [3].

Diagnosis of type of leading cardiac defect in the present study was ASD 15(37.5%), followed by PDA 9 (22.5%), VSD 6 (15%) and TOF 10 (25%). While study from Mumbai reported VSD in 29% as the leading defect followed by ASD 24% and TOF 17.6%[12].

A study from Delhi reported VSD (34%) as the commonest diagnosis followed by PDA (18.6%)[10]. A study by Villasis Keever MA, et al in Mexico reported PDA (23.1%) as the leading cause, followed by VSD (22%) [13]. Children with congenital cardiac malformation showed male predominance in present study 24(60%). Study in Mumbai showed similar results with male predominance of 65.3%.[12]. Study by Villasis Keever MA, et al in Mexico[13] reported more female patients (54.5%) with, M:F ratio being 1:1.1.

Age was found to be an inverse factor, the older one had less chance for malnutrition and was reported by Villasis Keever MA, et al in Mexico[13]. 100% children with cyanotic malformations were stunted, compared to those with acyanotic malformation. The study also showed significant growth retardation for children with cyanotic malformations, more for height, nearly 60% compared to 45% for weight.

In contrast the study by Varan B, Tokel K, and Yilmaz G from Turkey, reported that cyanotic children were more malnourished for weight for age and height for age[3]. A study by Tambic-Bukovac L, Malcic I in Croatia [14], showed statistically significant growth retardation in 222 children with cardiac disease as compared to 50 in the control group, by values of body weight and height (p<0.001). Weight retardation was more marked than retardation in body height (p<0.001). Growth retardation was more significant in the cyanotic children than in those with acyanotic heart disease (p<0.001).

Among the children with left to right intracardiac shunt, growth retardation was found to increase proportionally with size of the shunt and was most significant in patients with large left to right shunt(QP/QS>1.80) (p>0.01) [14].

Dietary assessment in present study revealed that poor feeding practices involving late introduction of weaning foods, with poor quality of weaning foods, early discontinuation of breast feeding and introduction of diluted milk feeds was observed with deficit calorie intake when compared to recommended dietary allowance (RDA) for age. Poor feeding practices are observed in the low socioeconomic population. In this study only 20(40%) had income above Rupees 1000 per person.

Thus growth is affected in children with congenital heart disease, being highly statistically significant when compared

to expected values, in terms of weight height, mid-arm circumference and skin fold thickness for age and sex, 50th centile, NCHS and WHO standards ($p<0.001$). Around 90% of children were malnourished, indicating that children with CHD significantly suffered from growth failure. Failure to gain weight was seen in those with acyanotic malformation while stunting was seen with cyanotic CHD. Mid-arm circumference and skinfold thickness were also reduced significantly ($p<0.001$) in present study. Head circumference between children with acyanotic and cyanotic defect showed no difference.

Severity of the cardiac lesions and malnutrition put children with CHD at risk for increased morbidity and mortality.

Hence, strategies for intervening in the monitoring of growth, a more intensive nutritional rehabilitation, and early corrective surgery should be done to optimise the outcome. Some limitations in our study should be considered. Firstly, this study was conducted in hospitalized patients and hence the results in this study are not a true representative of the general population. Secondly, possible risk factors such as number of family members, mid-parental height, were not analysed in this study. Thirdly, our exclusion criteria may have caused selection bias, leading to underestimation of the true prevalence of malnutrition as some excluded cases may have had more severe malnutrition.

CONCLUSION

Congenital heart disease in children constitutes an organic cause for malnutrition. The child needs high calorie intake for increased cardiac workload, sympathetic over activity, recurrent respiratory infections, and hypoxia, in addition, congestive cardiac failure causes difficulty in feeding. Hence growth failure is expected in symptomatic children with congenital heart disease, which was noted among nearly 82% of the cases with regard to weight, height, mid-arm circumference and skin fold thickness, compared to 50th centile of NCHS and WHO standards being highly statistically significant($P<0.05$) by student t- test.

The two main types of anatomical heart defects are acyanotic and cyanotic heart disease show a distinct pattern of growth failure. Children with acyanotic malformations such as ASD, VSD etc. shows characteristic symptoms of poor feeding, tiredness, dyspnoea, tended to gain less weight and to be leaner than those with cyanotic defects such as TOF, who have decreased oxygen carrying capacity which affects the growing ends of the epiphyseal plates of long bones affecting growth and hence severely stunted in height. Mid arm circumference (MUAC) is affected significantly in present study. In India, 43% under-fives are underweight and 48% stunted [15] in comparison a significantly higher 82% underweight and 86% stunted among children with congenital heart disease [16]. The difference of 40% contributed by cardiac defect as cause for growth failure is significant. In conclusion it can be stated that children with congenital heart disease have highly statistically significant growth retardation ($P<0.05$) by student t- test.

Children with CHD are at risk for increased morbidity and mortality. Strategies for growth monitoring, nutritional rehabilitation, and early surgery should be done in these children.

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