ORIGINAL RESEARCH PAPER

Volume-8 | Issue-7 | July - 2019 | PRINT ISSN No. 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

GROWTH AND DEVELOPMENT OF PRESCHOOL (3-6 YEARS) CHILDREN WITH CONGENITAL HEART DISEASE

Paediatrics

Dr. Mohita Suri Department of Paediatrics, Dr. DY Patil Medical College, Hospital and Research Centre, Dr. DY Patil Vidyapeeth , Pune, Maharashtra, India

Dr. Geeta Karambelkar* Department of Paediatrics, Dr. DY Patil Medical College, Hospital and Research Centre, Dr. DY Patil Vidyapeeth , Pune, Maharashtra, India *Corresponding Author

Dr. Sharad Agarkhedkar Department of Paediatrics, Dr. DY Patil Medical College, Hospital and Research Centre, Dr. DY Patil Vidyapeeth , Pune, Maharashtra, India

ABSTRACT

Children with congenital heart disease commonly have delay in growth and development. This paper is based on hospital based cross-sectional study to assess and compare the growth and development with congenital heart disease (n=20) and compare with normal children(n=20). Growth was assessed as per the WHO standard growth trajectories by measuring the height, weight, midarm circumference and head circumference. The neurodevelopment assessed by Denver Development Screening Test II. Preschool children with CHD were significantly underweight (p= 0.047) and stunted (p= 0.01). The weight for height was also affected and statistically significant(p=0.026) in children with CHD. On assessment of development the gross motor domain (p=0.03) and language domain(p=0.03) were delayed and it was statistically significant. The study of the growth and development differences between children with CHD and normal children may help in aiding early interventional strategies to improve the overall outcome and help to educate the caregivers.

KEYWORDS

growth, development, preschool, congenital heart disease

INTRODUCTION:

Congenital heart diseases cover a wide variety of anatomical and functional cardiac malformations. The prevalence is 4 to 5 per 1000 live births (1). They comprise an important cause of childhood mortality due to congenital malformations.

The diagnosis of CHD is established by 1st week of life in 40-50% of cases and by 1st month in 50-60% of cases. They are divided into two major groups cyanotic and acyanotic.

Children with congenital heart disease (CHD) are at an increased risk for wasting and stunting. Acyanotic congenital heart lesions tend to jeopardize weight gain rather than height, whereas cyanotic lesions tend to affect both height and weight. Not only growth but developmental delay also occurred in congenital heart diseases.(2)

Chronic congestive heart failure and chronic hypoxaemia impair cellular metabolism and cell growth. There is increased calorie demand to sustain myocardial, respiratory and neurological function. The mechanisms influencing both growth and development in CHD are multifactorial. Risk factors include heart failure, cyanosis, hyperviscosity of blood, dyspnea, fatigue, multiple heart defects, delayed corrective surgery, anaemia, low birth weight and pulmonary hypertension.(2) These factors can cause physical and motor constraints that indirectly affect the emotional and cognitive development of a child.(6)

A child's development is the result of the interaction of various factors including biological, psychological and social. (5)The acquisition of new skills is related to the age and experienced interactions with other individuals in their social environment. Children demonstrate an association between delayed intellectual development and cognitive impairment .

Frequent hospitalisation due to complications of CHD and chest infections, lead to persistent impairment of somatic growth and increase death rate.(3-5) Poor growth was associated with delayed mental development, thus establishing a relationship between impaired growth and reduced intellectual achievement.

In addition to the physical well being the socioeconomic status, education of parents, stimulation of quality medical care, family size, social interactions, housing conditions, also influence the development and growth. The outcome of patients is influenced by these factors.

The understanding of the complex nature of malnutrition and developmental delay in children with CHD is essential to design strategies that will improve outcomes in these children. This study was therefore planned to evaluate the development and growth in children with congenital heart disease against a control group belonging to same age.

MATERIALS AND METHODS:

This was a hospital based cross sectional study conducted at Dr. DY Patil Medical College and Research Centre, Pimpri, Pune. It was initiated after obtaining approval from the institutional ethics committee from July 2016 to September 2018. The patients were enrolled from the paediatric OPD and IPD after obtaining a written informed consent from the parents/caregivers. The sample size worked out to be 20 by using the Win PIPI software package. Patients full filling the following inclusion and exclusion criteria were used:

INCLUSION CRITERIA:

1). Preschool children (in age group of 3-6yrs, irrespective of sex and race) with CHD (cyanotic and acyanotic) confirmed on 2D-ECHO- CASE GROUP. Those who are hemodynamically stable and symptoms controlled on medication.
2). Normal healthy preschool children without any disease/disorder-CONTROL GROUP.
3). Parent/caretakers of patient voluntarily willing to participate in the study.

EXCLUSION CRITERIA:

1). Seriously ill child who needs immediate life support.
2). Having other obvious congenital or chromosomal defects.
3). Suffering from chronic illness.
4). Not willing to participate in study.

Data analysis was done using the SPSS (Statistical Package for the Social Science) Version 17 for window. The Chi-square test was used to find significant difference of age sex, mid arm circumference, Personal social, fine motor adaptive, language, gross motor, DDST, weight for age, height for age, weight for height in study and control group. The Chi-square test/ Fisher exact test was used to find significant difference between cyanotic and acyanotic in study group. A probability value of 0.05 was accepted as the level of statistical significance.

A detailed history and clinical examination was recorded according to the proforma and thorough clinical examination was done. The growth of the preschool children was assessed by measuring :

Weight- on the electronic scale in kilograms with a minimum error of 10gm.

Height - in centimetres along the stadiometer.

Head circumference: measured along the occipital protuberance and supra orbital ridges with glabella in front. It was measured to the nearest 0.5mm.

Mid arm circumference: midway between the two bony prominences acromian and olecranon processes with the arms hanging straight by side of the body.

Growth was interpreted with help of WHO growth chart[7].

Development was assessed with Denver development screening test II (DDST II): Published in 1992, it is currently one of the instruments used in the evaluation of development children aged zero to six years. The test consists of 125 items, divided into four fields of function : personal-social, fine-motor-adaptive, language and gross motor. Test was administered with child along with the parent/caregiver was made to sit comfortably in a quiet room that had minimum distractions. The age was calculated in years and months and plotted on the test form. Maximum of three trails were given to the child to perform the test to label as failure. Test took approximately 40-50minutes.

RESULTS :

It was observed that majority of the children in the study group and control group were in the age group of 3-4yrs. It was seen that in study group 9 children were male while in control group 11 children were male. Both were not statistically significant.

Table 1 : Weight for age wise distribution of cases

Weight of age	Study	Percentage	Control	Percentage	Total
Normal	10	50	16	80	26
Underweight	10	50	4	20	14
Total	20		20		40

Chi-square = 3.96, P = 0.047

The table 1 depicts weight for age was normal in 10 children of study group and 16 children of control group, while 10 children were underweight in study group and 4 in control group. The difference observed was statistically significant.

Table 2: Height for age wise distribution of cases

Height of age	Study group		Control		Total
Normal	6	30	14	70	20
Stunting	14	70	6	30	20
Total	20	20	40		

Chi-square = 6.40, P = 0.011

The table 2 depicts stunting was observed in 14 children of study group and 6 children of control group with statistically significant difference.

Table 3: Weight for height wise distribution of cases

Weight of height	Study		Control		Total
Normal	10	50	17	85	27
Moderate acute malnutrition	5	25	3	15	8
Severe acute malnutrition	5	25	0	0	5
Total	20		20		40

Chi-square = 7.31, P = 0.026

The table 3 depicts weight for height was compared in both study and control group and it was seen that 5 children of study group were of Moderate acute malnutrition and 5 were of severe acute malnutrition. In control group only three were of moderate acute malnutrition and no child was suffered from severe acute malnutrition. The difference observed was statistically significant.

Table 4: Comparison of mid arm circumference

Parameter	Study (n=20)		Control (n=20)		Z Value	P Value
	Mean	SD	Mean	SD		
MAC (cm)	12.26	1.02	12.87	0.81	2.04	0.049
Range	11.2 – 14.2		11.5 – 14.5			

The mean MAC in study group was 12.26±1.02cm and that of control group was 12.87±0.81cm and the difference was statistically significant as P<0.05.

On observation of the head circumference the difference was not statistically significant.

Table 5: Language domain of DDSTII wise distribution ofcases

	Study	Control	Total
Caution	3	1	4
Delay	5	0	5
Fail	1	0	1
Pass	11	19	30
Total	20	20	40

Chi-square = 9.13, P = 0.03

Language development was delayed in 5 children of study group and caution in 3 children, fail in 1 child and pass in 11 children. In control group language was caution in one children and pass in 15 children. And the difference observed was statistically significant.

Table 6: Gross motor domain of DDSTII wise distribution of cases

Gross motor	Study	Control	Total
Caution	2	1	3
Delay	6	0	6
Fail	0	3	3
Pass	12	16	28
Total	20	20	40

Chi-square = 10.67, P = 0.031

In the study group the Gross motor development was pass in 12 children while was delay in 6 children and caution in 2 children. In control group gross motor development was pass in 16 children, fail in 3 children and caution in 1 child which was statistically significant.

Table 7: Personal social domain of DDSTII wise distribution of cases

Personal social	Study	Control	Total
Caution	1	1	2
Delay	1	0	1
Fail	1	1	2
Pass	17	18	35
Total	20	20	40

Chi-square = 1.03, P = 0.79

Personal social development was pass in 17 children in the study group and in 18 children in control group.

Table 8: Fine motor adaptive domain of DDSTII wise distribution of cases

Fine motor adaptive	Study	Control	Total
Caution	0	3	3
Delay	3	0	3
Fail	1	0	1
Pass	16	17	33
Total	20	20	40

Chi-square = 7.03, P = 0.071

In study group fine motor adaptive development was delayed in 3 children and failed in one child. In control group caution was observed in three children. The difference observed was not statistically significant.

Table 9: DDST II wise distribution of cases

DDST II	Study	Control	Total
Normal	11	16	25
Suspect	8	3	11
Untestable	1	1	2
Total	20	20	40

Chi-square = 2.67, P = 0.44

The Denver Developmental Screening Test(DDST)II distribution was normal in 9 children of study group while 10 children of control group. And the difference observed was not statistically significant.

Table 10: Comparison of DDSTII between cyanotic and acyanotic in study group

Parameter		Cyanotic (n=7)	Acyanotic (n=13)	Chi-square	P Value
DDST2	Normal	1	10	9.41	0.01
	Suspect	6	2		
	Untestable	0	1		

Table 11: Comparison of weight for age, height for age, weight for height MAC between cyanotic and acyanotic in study group

Parameter		Cyanotic (n=7)	Acyanotic (n=13)	Chi-square	P Value
Weight for age (kg)	Normal	4	6	FET	1
	Underweight	3	7		
Height for age (cm)	Normal	1	5	FET	0.35
	Stunting	6	8		
Weight for height	Normal	4	6	4.18	0.12
	Moderate acute malnutrition	3	2		
	Severe acute malnutrition	0	5		
MAC (cm)	>13.5	1	2	5.35	0.15
	12.5-13.4	2	4		
	11.5-12.4	4	2		
	<11.5	0	5		

DDST II interpretation of children with cyanotic congenital heart disease 6 were suspects and only 1 was normal one child was normal. In acyanotic CHD children only 2 were suspects.

Number of children underweight, stunted and having severe acute malnutrition were more in children with acyanotic CHD as compared to cyanotic CHD children. But, no statistically significant difference was observed.

DISCUSSION:

In children with CHD it is observed that their growth is primarily affected along with delay in development. Affection of growth and subsequent compromise of the development is a vicious cycle.

The cases of the study group included 13 children with a-cyanotic and 7 had cyanotic congenital heart disease. Majority of the cases in the study group were between 3 to 4yrs who presented to the OPD or who were admitted in the wards. Okoromah CA et al[4] reported that maximum number of children (64.3%) with congenital heart disease were between age group of 0-59 months age group. In the study by Mondal S et al[9] , majority of the children with CHD (46%) were pre-schoolers (3-6years), followed by 38% in age group of 5-10 years and 16% above the age of 10 years.

On assessment of growth by WHO growth chart, 50% of the children were underweight in study group and 4 children in control group. The difference observed was significant statistically (p=0.04). Height for age < -2SD, that is, stunting was observed in 14 children (70%) of study group and 6 children (30%) of control group with difference between the two groups statistically significant (p=0.01).

Chen et Al[10]had conducted a hospital based study in 2004 to assess and compare the growth and development of preschool children with CHD to those of normal age and sex matched preschool children. The height for age of 52.6% and the weight for age of 73% of children with CHD were below the 50th percentile. Their observations were statistically significant and the results were consistent with the present study.

In the present study it was observed that 5 children (25%) of study group had moderate acute malnutrition and 5 had of severe acute malnutrition (25%) as per the WHO growth charts. In control group only 3 had moderate acute malnutrition (15%) . Also, 5 children with CHD had MAC <11.5cm and falls under the category of severe acute malnutrition. The difference in weight for height between study and control group was statistically significant (p=0.026). Okoromah et al[4] in their case control study observed that children with CHD were underweight and 90.4% had severe acute malnutrition. Growth parameters of wasting and stunting were significantly higher in the children with CHD as compared with the control group. Similar results were also observed in the study by Batte A et al[9] that out of 194 children (0 to 5years) with CHD there were 31.5% wasted and 45.4% were stunted and the finding was statistically significant. In a study by Varan et al[6] between 1996-1997 to assess the nutritional status of children with CHD, 65%of the children had wasting and 41% were stunted and 63% were underweight.

In this study the number of children underweight, stunted and with established severe acute malnutrition was more in children with acyanotic CHD as compared to cyanotic CHD children. The children with cyanotic CHD were more stunted. As reported by Linde et al[7]and Salzer et al[8] in their respective studies that acyanotic infants and children gained less weight and wasting was more prominent in cyanotic heart disease. AHM Nasiruzzaman et al[11], in their hospital based study at Bangladesh reported that 38% children from acyanotic and 16% from cyanotic heart disease were severely stunted. 10% children from acyanotic and 4% from cyanotic heart disease were severely wasted. It was similar finding to the present study.

The development of a child is a broad, complex and continuous process. In the present study Denver developmental scale testII was used to assess neurodevelopment and aid in segregating children requiring support early.

The items depicting gross motor development were observed to be delayed in 6 children in study group while 2 had a caution. In control group gross motor development was pass in 16 children, 3 children failed to perform the test, 1 had caution. The difference between gross motor development observed in two groups was statistically significant (p=0.031). The gross motor development is affected due to repeated hospital admissions, physical constraints of exercise intolerance and easy fatigability. Language development domain was also significantly affected in study group. The test items of the language domain as per age demonstrated delay in 5 children, caution in 3, 1 failed and remaining 11 children had a pass interpretation. In control group 19children had achieved normal language development milestones and only one had caution. The difference observed between two groups was statistically significant (p=0.03).

The items depicting personal social development domain were observed to be pass in 17 children, 1 fail and 2 caution in the children with CHD in study group. 18 children were pass in control group with 1 fail and 1 caution. In study group fine motor adaptive development items were delay in 3 children and fail in 1 child. The fine motor development items were observed to be pass in 16 children of study group and 17 children in control group. The difference observed was not statistically significant. But the study group lagged behind in development.

The DDST II interpretation in the present study demonstrated out of 20 CHD children 8 were suspect, one untestable and rest were normal. Majority of the children in the control group were developmentally normal and 3 children were suspects and one was untestable. The difference observed was not statistically significant (p=0.44). The children with cyanotic CHD (n=7) as assessed by DDST II evaluation there were 6 suspects with delay in gross motor and language development and only one was developmentally normal. However 8 children were normal and two were suspect amongst children with acyanotic CHD, and the difference observed was statistically significant (p=0.01). AHM Nasiruzzaman et al[11] assessed the development in preschool children having CHD DDSTII, they observed that 60% of children had abnormal gross motor development which is consistent with our study result. In 2004 Chen, Li & Wang et al[10] in their case control study had children with CHD having delay in language domain of Denver II as compared to normal children (Fisher's exact test; P-0.003). This result was consistent with our study.

CONCLUSION:

1. Amongst the 20 children in the study group 7 had cyanotic heart disease and 12 had cyanotic heart disease.
2. Majority of the children were between 3 to 4 years of age.
3. More number of children in the study group as compared to the control group were underweight, stunted and had moderate and severe acute malnutrition. The overall growth was affected in children with congenital heart disease as compared to normal child.
4. Gross motor and language milestones were delayed in more number of children with CHD as compared to normal children.
5. Fine motor and personal social domains were not observed to be affected in the study group as compared to normal children.

6. The growth of acyanotic congenital heart disease children was more affected as compared to cyanotic CHD children.
7. The development of cyanotic congenital heart disease children was more affected when compared to acyanotic heart disease.

REFERENCES

1. Hoffman JI, Kaplan S. The incidence of congenital heart disease. J. Am. Coll. Cardiol. 2002; 39 (12):890-900.
2. Weintraub RG and Menahem S. Growth and congenital heart disease. J Paediatr Child Health. 1993;29:95-98.
3. O'Brien P and Smith PA. Chronic hypoxemia in children with cyanotic heart disease. Critical Care Nursing Clinics of North America. 1994; 6:215226
4. Okoromah CA, Ekure EN, Lesi FE, Okunowo WO, Tijani BO, Okeiyi JC. Prevalence, profile and predictors of malnutrition in children with congenital heart defects: a case-control observational study. Arch Dis Child. 2011;96(4):354–60.
5. Varan B, Tokel K, Yilmaz G. Malnutrition and growth failure in cyanotic and acyanotic congenital heart disease with and without pulmonary hypertension. Arch Dis Child. 1999;81(1):49–52.
6. WHO child growth standards and identification of severe acute malnutrition in infants and young children. A joint statement by WHO and UNICEF, 2009.
7. Linde LM, Dunn OJ, Schireson R, et al. Growth in children with congenital heart disease. J Pediatr 1967 ; 70 : 413 – 19
8. Salzer HR, Haschke F, Wimmer M, et al. Growth and nutritional intake of infants with congenital heart disease. Pediatr Cardiol 1989 ; 10 : 17 – 23 .
9. Batte A, Lwabi P, Lubega S, Kiguli S, Otwombe K, Chimoyi L, et al. Wasting, underweight and stunting among children with congenital heart disease presenting at Mulago hospital, Uganda. BMC Pediatr. 2017;10:1-7
10. Chen CW, Li CY, Wang JK. Growth and development of children with congenital heart disease.J AdvNurs. 2004 Aug;47(3):260-9
11. Hassan BA, Albanna EA, Morsy SM, Siam AG, Shafiel MA, Elsaadany HF, et al. Nutritional status in children with un operated congenital heart disease: an Egyptian center experience. Frontiers in Pediatr. 2015;53(3):1-5.]
12. AHM Nasiruzzamarrt, MZ Hussain, MA Baki, MA Tayeba, MN Mollah, Growth and Developmental Status of Children with Congenital Heart Disease; Banglodesh Medical Journal 20ll:40(2): PP 54-57.)