Orginal Article

Growth and Developmental Status of Children with Congenital Heart Disease

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Abstract

Cardiac malformations are responsible for malnutrition, which may range from mild under nutrition to severe failure to thrive (FTT). Developmental delay was also associated with congenital heart disease. The aim of the study was to evaluate the nutritional status and developmental status of children with congenital heart disease. This cross sectional study was done in the department of Paediatrics, BSMMU and Dhaka Shishu Hospital from March'08 to February'09. Children, age 1 month to 6 years with congenital heart disease confirmed by echo-cardiogram (both cyanotic and acyanotic heart disease) were included in this study. Total 50 children included in this study. Mean age of study patient was 3.04 (±2.01SD) years. Ventricular septal defects were found as leading number (36%). Tetralogy of Fallot was found in 26% cases. According to WHO standard 38% children from acyanotic and 16% from cyanotic heart disease were severely stunted. Ten percent children from acyanotic and 04% from cyanotic heart disease were severely wasted. Gross motor and fine motor delay was present in 60% and 54% of children. Forty four percent children had speech delay and social impairment was present in 32% children. Severe stunting was more common than wasting in this study. Gross motor and fine motor delay was found the main developmental problem.

Key words: Congenital Heart Disease, Malnutrition, Growth and Development

Introduction:

Congenital heart disease (CHD) is an important component of pediatric cardiovascular disease with an estimated prevalence of 4 to 5 per 1000 live births[1]. Cardiac malformations are responsible for malnutrition, which may range from mild under nutrition to severe failure to thrive[2]. Growth failure has been associated with cellular hypoxia[3], hypermetabolism[4], reduction in nutrient ingestion[5], and intestinal malabsorption of nutrients[6]. In addition, low serum IGF-I concentrations may result in growth delay in children with heart disease. Growth impairment of infants with acyanotic CHD is directly proportional to the severity of the hemodynamic disturbance. The most severely affected infants are those with congestive heart failure. Acyanotic lesions tend to jeopardize weight gain rather than height, whereas cyanotic lesions tend to affect both height and weight. Anorexia and early satiety may be exacerbated by the drugs, such as diuretics, that are administered for the treatment of congestive heart failure may also lead to development of malnutrition.[7] Not only the growth but also developmental delay occurred in congenital heart disease. Developmental milestones like sitting, crawling, standing and walking, may be delayed. Mild general cognitive impairment and impairment of functions associated with right-hemisphere disabilities occurred in children with congenital heart disease.[8] Growth and development both are certainly influenced by social background, clinical type of congenital heart disease and the degree of severity of the problem. This study was done to evaluate growth and development of children with congenital heart disease.

Methods:

This cross sectional study was conducted in the department of Paediatrics, BSMMU and Dhaka Shishu Hospital from March'08- February'09. Children, age 1 month to 6 years with congenital heart disease confirmed by echo-cardiogram (both cyanotic and acyanotic heart disease) were included in this study. Children with clinically diagnosed chromosomal abnormalities, seriously ill child with congenital heart disease who needs immediate life support and care were excluded.

For each patient a detailed history of age, birth

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acyanotic group and 10% of total cases from

weight and socio-economic status was taken. In this study wide range of age group (1 month to 6 years) were included. Patients were homogenously distributed in 3 age category- age 1 month to 1 year, 1 year to 3 years and 3 years to 6 years. Clinical examination was done in all the children and special attention was given to pallor, cyanosis, respiratory rate, heart rate, hepatomegaly, oedema and cardiac findings. Weight was taken in all children. Baby who was able to stand, standing weight was taken by paediatric scale (Misaka, Japan). Those who were not be able to stand weight were taken by baby weighing scale (Misaka, Japan). Height was measured in children with stadiometer who were able to stand and otherwise length was measured by infantometer. Occipitofrontal circumference (OFC) was measured by measuring tape. The growth curve formulated by Centre for Disease Control (CDC) was used to evaluate children's growth according to height and weight. The Denver Developmental Screening Test was done in all children which includes four main developmental events: gross and fine motor skills, adaptive ability, language skills, and personal-social aptitude. For this study, investigator himself performed all the developmental assessments with the help of a trained person who was able to do neuro developmental assessment. Gross motor, fine motor and speech was categorized as normal and delayed. Hearing, vision and social development was categorized as normal and impaired. All the data was recorded in data collection sheet. Analysis was done by employing Statistical Package for Social Science (version. 10) and EPI Info (version 3.5.1) of Microsoft Windows software package.

Results:

Fifty children with congenital heart diseases were included in this study. The mean age of study patient was 3.04 (±2.01 SD) years. Twenty six (52%) children were male and 48% (24) were female and male female ratio was 1.08: 1. Among 50 children with congenital heart disease 56% (28) children had acyanotic and 44% (22) children had cyanotic variety of CHD. In acyanotic heart disease ventricular septal defect was found as leading number (36%) and in cyanotic heart disease Tetralogy of Fallot was found in 26% cases.

Figure 1. Distribution of heart disease among the study patients

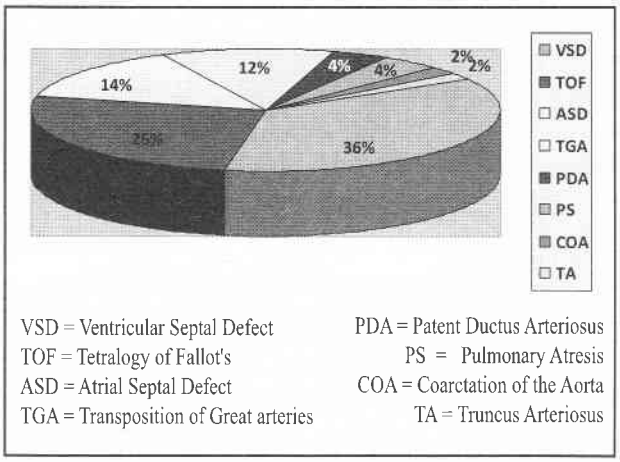

Table I: Nutritional status of cases according to Gomez classification (n= 50)

Type of heart disease	Malnutrition			Normal
	Mild (%)	Moderate (%)	Severe (%)	
Acyanotic Heart Disease (n=28)	3 (6)	18 (36)	7 (14)	0
Cyanotic Heart Disease (n=22)	6 (12)	11 (22)	5 (10)	0

Table I shows nutritional status of study patients according to Gomez classification. Fourteen percent of total cases from acyanotic group were suffering from severe malnutrition where as 10% of total cases from cyanotic group suffering from severe malnutrition. 36% of total cases from acyanotic group and 22% of total cases from cyanotic group were suffering from moderate malnutrition.

Table II: Nutritional status of cases according to Welcome classification (n = 50)

Nutritional status	Acyanotic (n = 28) (%)	Cyanotic (n = 22) (%)
Marasmus	05 (10)	05 (10)
Marasmic Kwashiorkor	02 (4)	0 (0)
Kwashiorkor	02 (4)	01 (2)
Undernutrition	19 (38)	16 (32)
Normal	0 (0)	0 (0)

Table II shows nutritional status according to Welcome classification, 38% of total cases from acyanotic group and 32% of total cases from cyanotic group were suffering from undernutrition. On the other hand 10% of total cases from

cyanotic group were suffering from marasmus.

Table III: Nutritional status of patient according to WHO classification

Height for age				
Study patient (n = 50)	Malnutrition			Normal (%)
	Mild (%)	Moderate (%)	Severe (%)	
Acyanotic Heart Disease (n=28)	2 (4)	6 (12)	19 (38)	1(2%)
Cyanotic Heart Disease (n=22)	5(10)	8 (16)	8 (16)	1(2%)
Weight for height				
Study patient (n = 50)	Malnutrition			Normal (%)
	Mild (%)	Moderate (%)	Severe (%)	
Acyanotic Heart Disease (n=28)	10 (20)	4 (8)	5 (10)	9(18)
Cyanotic Heart Disease (n=22	5(10)	2 (4)	2 (4)	13(26)

Table III shows nutritional status according to WHO classification for malnutrition, 38% of total cases from acyanotic group and 16% of total cases from cyanotic group were suffering from severe malnutrition. On the other hand only10% of total cases from acyanotic group and 4% of total cases from cyanotic group were suffering from severe malnutrition in weight for height category. Developmental assessment findings were shown in Table IV.

Table IV: Development assessment of study children (n=50)

Developmental domains		Acyanotic CHD (%) n = 28	Cyanotic CHD (%) n = 22
Gross motor	Impaired	15 (30)	15 (30)
	Normal	13 (26)	07 (14)
Fine motor	Impaired	13 (26)	14 (28)
	Normal	15 (30)	8 (16)
Hearing	Impaired	01 (02)	0 (0)
	Normal	27 (54)	22 (44)
Vision	Impaired	01 (02)	0 (0)
	Normal	27 (54)	22 (44)
Speech	Impaired	12 (24)	10 (20)
	Normal	16 (32)	12 (24)
Social	Impaired	09 (18)	07 (14)
	Normal	19 (38)	15 (30)

Sixty percent child had gross motor delay, 54% had fine motor delay and 44% (22) child had impaired speech.

Discussions:

In this study, among the acyanotic congenital heart disease, ventricular septal defect was found as leading cause (36%), followed by atrial septal defect (14%) and patent ductus arteriosus (04%). Regarding cyanotic congenital heart disease, Tetralogy of Fallot was found in 26% cases. In Wickramasinghe study they found the most common acyanotic heart disease was VSD (21.5%) and common cyanotic heart disease was Tetralogy of Fallot (19.8%)[9]. In this study according to Gomez classification fourteen percent of total cases from acyanotic group were suffering from severe malnutrition and 10% of total cases from cyanotic group suffering from severe malnutrition. According to Welcome classification, 38% of total cases from acyanotic group and 32% of total cases from cyanotic group were suffering from undernutrition. According to WHO standard 38% children from acyanotic and 16% from cyanotic heart disease were severely stunted. Ten percent children from acyanotic and 04% from cyanotic heart disease were severely wasted. Children with CHD experience delayed growth because of genetic influences, tissue hypoxia, reduced cardiac output, pulmonary hypertension, repeated respiratory tract infections and malnutrition[10]. A cross-sectional study was done by Chen et. al. to evaluate and compare the growth and development of preschool children with CHD to those of normal preschool children[11]. The study included the heights and weights of 42 preschool children with CHD and 116 normal preschool children comparing with standard growth curves. The heights of 52.6% and the weights of 73% of children with CHD were below the 50th percentile. Severe failure to thrive (height and weight below the third percentile) was observed in 13% of the children with CHD but in only 1% of the normal children.

About half of the children's gross motor and fine motor development was slower in this study. Speech delay was found in 44% children and 32% had cognitive impairment. Results for gross motor development were consistent with those reported by Loeffel (1985)[12] and O'Brien and Smith (1994)[8]. Possible causes of slower development include restriction of physical activity and a more sheltered upbringing by main caregivers, who are generally more protective. Kao (1988) conducted a study with 51 children with CHD between10 and 12 years old who had completed surgical corrections; 54.9% of their parents were overprotective[13]. Caregivers'

methods of childrearing, therefore, should be considered when a delay in gross motor development was evaluated. In Chen, Li & Wang (2004) study percentage of children scoring normally on the language development section of the Denver was significantly lower for children with CHD than for normal children (Fisher's exact test; P =0.003)[11]. The percentage of scores for gross motor development was also significantly lower in children with CHD (P =001). No significant differences were observed in terms of personal and social development. Result of this cross sectional study was limited because speech and cognitive function was depending on parent's education, socioeconomic status. A longitudinal study is necessary to understand changes in growth and development in children with CHD. Furthermore, increasing the size, age range, and residence area of the study population would provide greater understanding of the growth and developmental differences between children with CHD and normal children.

Conclusion:

This cross sectional study shows that the children having congenital heart disease were more prone to developed growth and developmental delay. Severe stunting was more common than wasting in this study. Gross motor and fine motor delay was found the main developmental problem.

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