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Original Article

TO STUDY PATTERN OF GROWTH & HEMATOLOGICAL PROFILE IN CHILDREN WITH CONGENITAL HEART DISEASE AGED 6-60 MONTHS.

Authors:

1. **Dr. Shaveta Sharma**, Senior Resident, Department of Paediatrics, Govt. Medical College, Amritsar , shaveta.attri@gmail.com
2. **Dr. Manmeet Kaur Sodhi**, Professor and Head, Department of Paediatrics, Govt. Medical College, Amritsar,doctor.manmeet@yahoo.com
3. **Dr. Neha Gupta**,Senior Resident, Department of Paediatrics, Govt. Medical College, Amritsar , nehag7095@gmail.com
4. **Dr. Mukhtiar Singh Pannu**, Professor, Department of Paediatrics, Govt. Medical College, Amritsar,mukhtiar.pannu01@gmail.com

Corresponding-Author:
Dr Neeraj Sehgal,
Assistant Professor,
Department of Paediatrics,
Govt. Medical College, Amritsar.
Email ID: sehgalneeraj23@gmail.com
Mobile No: 9876066265

ABSTRACT

Background: Congenital heart defect (CHD) is the most common birth defect, representing a major global health problem. Malnutrition and anemia is widely prevalent among children with CHD with a significant impact on the outcome of intervention.

Aims & objectives: To study pattern of growth & hematological profile in children with congenital heart disease aged 6-60 months.

Methods: This was a case-control study conducted at Department of Pediatrics, Bebe Nanki Mother & Child Care Centre, Guru Nanak Dev Hospital, Amritsar. A total 104 subjects were enrolled in the study which included 52 cases of congenital heart disease & 52 age & sex matched healthy controls. Detailed history, physical examination was recorded & the data was subjected to statistical analysis. Anthropometric measurements were recorded and Z scores for height/length for age, weight for height and have been calculated. Weight for age was interpreted according to Gomez classification, height for age and weight for height were

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interpreted according to Waterlow classification. Hemoglobin levels, red cell indices, RDW, total serum protein and serum albumin levels were evaluated in case and control groups.

Results: There was high prevalence of malnutrition (59.60%) in children with CHD compared to control group (23%). In children with CHD, underweight, stunting and wasting was found to be more prevalent in children with acyanotic CHD as compared to acyanotic CHD. Haemoglobin, red cell indices, total serum protein and S. albumin levels were low in children with CHD compared to control group. Polycythemia was more prevalent in children with cyanotic CHD.

Conclusion: Malnutrition in association with anemia is highly prevalent in children with CHD.

Keywords: Congenital Heart Disease, Malnutrition, Anemia

INTRODUCTION

Congenital heart disease (CHD) is defined as an abnormality in cardiocirculatory structure or function that is present at birth, even it is discovered much later.[1] The incidence of moderate to severe structural congenital heart disease in live born infants is 6 to 8 per 1000 live births.[2] Congenital heart defect (CHD) is the most common defect among all birth defects representing a major global health problem. Adequate health evaluation of children with congenital heart disease (CHD) is critical for the quality of their care.

The cause of growth retardation in CHD is multifactorial.[3] Multiple cardiac and extracardiac factors may contribute to poor growth in infants and children with cardiac malformations. Inadequate caloric intake, and increased energy requirements caused by increased metabolism may all contribute. However, inadequate caloric intake appears to be the most important cause of growth failure in CHD.[3] Structural abnormalities of the gastrointestinal (GI) tract, which occur in 4.2% of children with CHD, gastroesophageal reflux, and food intolerance can also contribute to inadequate nutrient intake and consequent poor growth.[4,5]

The children with CHD are at significant risk for long term consequences of growth failure, including increased susceptibility to infectious diseases, poor school performance, functional impairment in adult life thus affecting economic productivity.[6,7]

The risk factors for malnutrition in children with congenital heart disease comprises of heart failure, cyanosis, multiple heart defects, delayed corrective surgery, anemia and pulmonary

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hypertension.[8] The significant consequences of malnutrition in children with CHD include delayed development, delayed cognitive skills ,impaired immunity, and an increased risk of postoperative pneumonia.

Anemia is an important risk factor for morbidity and mortality in patients with cyanotic and acyanotic congenital heart disease.[9,10] Thromboembolic and cardiovascular events are encountered more commonly in iron deficiency anemia because of reduced permeability of microcytic erythrocytes in comparison to normocytic cells.

Patients with cyanotic congenital heart disease (CCHD) often develop secondary erythrocytosis. Secondary erythrocytosis associated with CCHD is a physiological response to tissue hypoxia with resultant increase in serum erythropoietin level, thereby stimulating the bone marrow erythropoiesis causing an elevated red cell mass, hematocrit, and whole blood viscosity.[11]

MATERIAL AND METHODS

This was a case-control study conducted at Department of pediatrics, Bebe Nanki Mother & Child Care Centre, Guru Nanak Dev Hospital. A total 104 subjects were included in the study, 52 cases with congenital heart disease aged 6-60months and 52 age & sex matched apparently healthy control without CHD.

Children with CHD who had undergone corrective or palliative surgery for CHD, who had chromosomal / genetic anomalies or other congenital disease, Children with chronic medical illness like chronic renal failure, chronic liver disease, malignancy, TB, HIV infection & who were not willing to give consent were excluded from the study.

Informed consent was obtained from parents and other caregivers before enrollment.

Data was collected at time of consultation of cases and controls who fulfilled the inclusion criteria in Paediatric OPD as well as admission in Bebe Nanki Mother & Child Care Centre, Guru Nanak Dev Hospital, Amritsar by direct interview of parent of the child using structured questionnaire along with clinical examination of the child, which includes weight which was measured using electronic weighing scale, Height which was measured using infantometer/stadiometer, MUAC was measured by using non-stretchable, flexible tape.

WHO (0-5yrs) Growth Charts for Weight for Age, Height for Age and Weight for Height was utilized for plotting the measurements, Anaemia (type and degree) assessed by hematological

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parameters (CBC, RBC Indices, RDW and Peripheral smear) from the lab investigations which was sent as a part of the clinical evaluation. Blood sample was collected in EDTA & plain vials for hematological profile and s. albumin levels.

Nutritional status was classified according to Weight for Age (GOMEZ classification of underweight, WHO growth charts), Height for Age (Waterlows Classification of Stunting, WHO growth Charts), Weight for Height (Waterlows Classification of Wasting, WHO growth Charts) and Mid Upper Arm Circumference, (WHO Charts)

Patient with acyanotic CHD were labelled as anaemic as per WHO charts. Patient with cyanotic CHD were labelled as anaemic as per PBF report.

STATISTICAL METHODS

Statistical analysis was done using statistics software SPSS 21, IBM, USA. Pearson's chi-squared test was used to determine whether there is a statistically significant difference between the expected frequencies and the observed frequencies in one or more categories.

TABLE NO. 1: DEMOGRAPHIC PROFILE OF STUDY POPULATION

Variables	Case group (52)	Control group (52)	P value
Age	6-60	6-60	1.00
Sex	1.1:1	1.1:1	1.00
Social class	4.02±0.52	3.81±0.63	0.293
Upper class (I), n(%)	0	0	
Middle class (II andIII), n(%)	7(13.46%)	14(27%)	
Lower class (IV and V), n(%)	45(86.54%)	38(73%)	
Birth order	2.29±0.72	1.71±0.78	0.000
Gestational age	37.16±1.59	37.60±1.3	0.03
Birth weight	2.69±0.50	2.78±0.46	0.274
Exclusive breast feeding till 6 months of age	42(80.77%)	44(84.62%)	0.604
Start of complimentary feeding at end of 6 months	33(63.47%)	43(82.70%)	0.027

TABLE NO. 2: DISTRIBUTION OF CARDIOVASCULAR MALFORMATIONS IN AFFECTED CHILDREN (n=52)

Type of Congenital Heart Disease	No. of cases (52)	Percentage (%)
Acyanotic		
• Ventricular Septal Defect (VSD)	19	36.54
• Atrial Septal Defect (ASD)	9	17.31
• Patent Ductus Arteriosis (PDA)	3	5.77
• Pulmonary Stenosis	2	3.85
• Aortic Stenosis	1	1.92

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• Coarctation of aorta	2	3.84
Total ACHD	36	69.23
Cyanotic		
• Tetrology of Fallot (TOF)	14	26.93
TGA + VSD without PS	2	3.84
Total CCHD	16	30.77

TABLE NO. 3: NUTRITIONAL STATUS IN CASES AND CONTROLS

Nutritional status	Cases (n=52)	Controls(n=52)	P value
Normal	21(40.38%)	40(76.92%)	
Malnutrition	31(59.62%)	12 (23%)	
Pattern of malnutrition			
Underweight(WAZ)	38(73%)	12(23%)	0.000
Stunting(HAZ)	35(67.30%)	8(15.38%)	0.000
Wasting(WHZ)	42(80.76%)	10(23.80%)	0.000
Degree of malnutrition			
Moderate malnutrition	22(42.30%)	12(23%)	0.000
Severe malnutrition	9(17.30%)	0	0.000

TABLE NO. 4: NUTRITIONAL STATUS IN CASES WITH CONGENITAL HEART DEFECTS

Nutritional status	Acyanotic group (n=36)	Cyanotic group (n=16)	P value
Normal	19(52.77%0	2(12.50%)	
Malnutrition	17 (47.23%)	14(87.50%)	
Pattern of malnutrition			
Underweight(WAZ)	24(66.66%)	14(87.50%)	0.039
Stunting(HAZ)	20(55.55%)	15(93.75%)	0.021
Wasting(WHZ)	27(75%)	15(93.75%)	0.023
Degree of malnutrition			
Moderate malnutrition	9(25%)	13(81.25%)	0.023
Severe malnutrition	8(22.23%)	1(6.25%)	0.023

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TABLE NO. 5: HEMATOLOGICAL PARAMETERS IN STUDY POPULATION

Variables	Case group (n=52)	Control group (n=52)	P value
Haemoglobin	11.98±3.22	12.1±1.39	0.009
Anemia	42.30%	23.10%	0.009
Red cell distribution width(increased)	15%	2%	0.000
Peripheral blood smear (microcytic hypochromic)	46.15%	21.15%	0.006
Total serum protein	6.36±0.99	6.46±0.44	0.002
S.albumin	4.28±0.70	4.74±0.44	0.000

RESULTS

Table no. 1 gives baseline, demographic and other characteristics of study population comprising cases and controls. The main study groups (cases and controls) were comparable regarding age, sex, birth weight, birth order and socioeconomic class. The duration of breast feeding was almost similar among cases (80.77%) and controls (84.62%), but delayed establishment of complementary feed was found in cases with CHD (p value-0.027). Overall, 19.24% were aged 6-12 months and 80.67% were aged 13-60 months.

Table no. 2 shows the distribution of cardiovascular malformations in the case group. Ventricular septal defect (VSD) was the leading cardiac lesion among all cases of CHD (36.53%) and accounted for 52.77% of cases in the acyanotic group. Tetralogy of Fallot (TOF) was the most frequent cyanotic lesion among all cases of CHD (15.1%) and among the cyanotic group (87.50%).

The prevalence, distribution and types of malnutrition observed in the main study groups and subgroups are shown in tables 3-4. 31(59.62%) of 52 children with CHD were malnourished compared to 12(23%) children without CHD. In children with CHD, prevalence of underweight (p value -0.000), stunting (p value-0.000) and wasting (p value-0.0000) were significantly higher compared with the control group. Also, the relative proportion of children with moderate malnutrition was significantly higher in patients with CHD (p value-0.000).

Among children with CHD, underweight (p value-0.039), stunting (0.021) and wasting (0.023) was significantly high in children with cyanotic CHD compared to acyanotic CHD.

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Moderate malnutririton was significantly more in cyanotic CHD (p value-0.023) cases whereas severe malnutrition was significantly high in acyanotic CHD cases (p value-0.023).

As shown in Table no. 5, serum proteins and albumin were similar in case and control groups. Overall, 42.30% of the case group, 23.10% of the control group had anaemia (p=0.009). Hypochromic, microcytic red blood cells suggestive of iron deficiency anaemia were found in 46.15% of case group and 21.15% of control group. Red cell distribution was increased in 15% of case group and 2% of control group.

DISCUSSION

Different types of cardiac malformation can affect nutrition and growth to varying degrees. The severity of malnutrition can range from mild under-nutrition to failure to thrive.[12] Progressive decline in nutritional status is linked with active and poorly controlled disease, and deteriorating cardiac function, morbidity and mortality.[13-15] Anemia is an important risk factor for and mortality in patients with cyanotic and acyanotic congenital heart disease.[9,10] Present study was conducted to evaluate growth parameters and haematological profile in children with CHD.

Overall, the prevalence of malnutrition in CHD cases was 59.62%, with 42.30% having moderate and 17.30% of cases having severe malnutrition. Among cases, the relative proportions of underweight, stunting and wasting were 73%, 67.30% and 80.76%, respectively. Vaidyanathan and colleagues reported a higher prevalence of underweight (59.0%) and wasting (55.9%) in children with CHD, with wasting being more prevalent than stunting in children with CHD, as also in our study.[16,17] Okoromah CA et al, reported the prevalence of malnutrition in CHD cases was 90.4% and the relative proportions of underweight, stunting, and wasting, were 20.5, 28.8, and 41.1%, respectively.[18]

Ratanachu S et al, and Pongdara A et al, study found that relative proportions of underweight, stunting, and wasting in children with CHD were 28%, 16% and 22%, respectively.[19]

The high prevalence of malnutrition in present study may be explained by several factors including the distribution of cardiac lesions, the presence of severe complications of CHD, such as CHF, and the absence of surgical CHD correction.

This study was conducted in the tertiary care hospital in our state to which cases with severe CHD and its complications are likely to be referred to for evaluation and management.

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The difference in pattern of malnutrition can be due to lack of pediatrics cardiac surgeries in our area, there are lot of children with unoperated CHD, making them susceptible for chronic malnutrition and stunting.

In present study, among CHD cases Underweight, stunting and wasting was more prevalent in children with CCHD compared to ACHD. Linde and colleagues[20] reported that both wasting and stunting were more common in cyanotic CHD than in acyanotic CHD. Similar results were reported by Okoromah CA et al, where Stunting (68.0%) was significantly high in group of cyanotic CHD.[18]

Anaemia with features suggestive of iron deficiency was highly prevalent in cases with CHD (42.30%) compared to control group (23.10%) p-value (0.009). Olcay L et al reported the prevalence of IDA in cases of CHD was found to be 52.2%.[21] Gaiha M et al, a prevalence of 18.18% was reported, however the subjects of this study were adolescents and young adults.[22]

Limitations of this study were based on the present study is limited by a small sample size. Therefore, it may not be adequately powered to draw major statistical conclusions. In addition, it was carried out at a single tertiary care center, and hence likely to have a referral bias.

CONCLUSION:

To conclude in the present study, it was observed that there is high rate of malnutrition in children with CHD. The relative proportion of underweight, stunting and wasting was higher in children with CHD and amongst the children with CHD, the proportion was higher in children with CCHD compared to ACHD. It was observed that anemia and hypoproteinemia is more prevalent in children with CHD compared to control group. Amongst the children with CHD, it was found to be more prevalent in children with CCHD compared to ACHD.

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