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NUTRITIONAL STATUS IN CHILDREN WITH ACYANOTIC CONGENITAL HEART DISEASE – A STUDY

Paediatrics

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ABSTRACT

Objective - To assess the nutritional status in children with Acyanotic CHD (ACHD), and to note the extent of Malnutrition (wasting, stunting, underweight) in them. **Methodology** - A prospective, observational, cross-sectional study was conducted at an urban tertiary care, multispecialty children's hospital in India. A total of 166 children (between age of 6 months-18 years) with ACHD following up in the cardiology clinic or admitted as in- patients were enrolled in the study. A detailed history with thorough general examination was performed (including anthropometry parameters). Every child underwent a clinical cardiac examination, including Pulse- oximetry. The 2D Echocardiogram /CD report of all enrolled patients were studied for noting the anatomical lesion and presence/grade of pulmonary artery hypertension. **Results** – Malnutrition was noted in 50% cases (83/166), of which 44.5% (37/83) belonged to the category of SAM (Severe Acute Malnutrition) and 54.21% (46/83) were MAM (Moderate Acute Malnutrition). 66% of our study subjects (under 5 years) were underweight. In children more than 5 years of age,13.33% (4/30) were observed to be underweight. Isolated severe wasting was noted in 26 patients (26.4%), and moderate wasting was seen in 38 (27.9%) subjects under 5 years of age in the study population. This is significantly higher than the incidence of moderate wasting (19.3%) and severe wasting (7.7%) among normal Indian children as per the NFHS-5 data. Isolated stunting was noted in 42 (25.30%) ACHD cases. **Conclusion**- Isolated underweight is more common than isolated stunting in Indian children with ACHD. The underlying hemodynamics, size, and/or number of lesions have a significant impact on nutritional status and growth. Simple clinical and nutritional assessment will help in early identification of patients with reduced growth potential and offer appropriate nutritional supplementation along with timely intervention for better outcomes.

KEYWORDS

Acyanotic, Malnutrition, Congenital heart disease, Anthropometry

INTRODUCTION

CHD contributes to 1/3rd of all congenital defects with prevalence that ranging from 0.6 to 9 per thousand live births and.(1) Prevalence shows significant variation based on the diagnostic facilities that are available. India reports prevalence of 2.25 - 5.2 per thousand live births. (2) At present in India CHD contributes to 10% of infant mortality rate. No enough data is available on effect of both cyanosis and pulmonary hypertension on growth and nutrition of children. Irrespective of the presence or absence of cyanosis and the nature of the cardiac defect, malnutrition is a common problem in children with CHD.(3) Several reasons like decrease in intake of energy, increased consumption of energy, or both are responsible for malnutrition in these children.(4) This study was done in children between 6 months to 18 years of age with acyanotic congenital heart disease which aimed at determining the burden and determinant of nutritional status. The results will be helpful in improving the nutritional status (by timely clinical assessment and dietary counseling) and early surgical correction/ catheterization procedures to optimize the growth of children with acyanotic congenital heart disease who are found to have undernourishment or malnourishment. In this study correlation of CHD with other factors like clinical rickets, anemia were also be studied. There is no Indian study in literature that correlates the level of nutrition in children with isolated acyanotic CHDs. In this study, we noted the various parameters (stunting, wasting, and underweight) of nutrition and its relation to individual acyanotic cardiac lesion. Presence of micronutrient deficiencies were clinically identified even in children who were asymptomatic and had milder forms of acyanotic CHD. This helps in prevention of complications due to the effect of confounding factors like anemia or Vitamin D deficiency. The entire study was carried out without any pain (prick) to patient or any cost/ expense to the family. Also, free professional dietary advice was given to the needy patients.

Review of Literature

Infants with CHD have several reasons including decreased intake of energy, increased energy requirements, or both thus making them prone to malnutrition. Severity ranges from mild to severe failure to thrive.(5) 64% of CHD patients in developed countries have growth failure.(6) It is thought to be more severe in the developing regions, reaching up to 90% in some reports, where malnutrition is common even in otherwise healthy children.(5,7,8) The degree and type of malnutrition may be related to characteristics of the CHD which includes presence of cyanosis, congestive cardiac failure, or presence or absence of pulmonary hypertension. In Infants with cyanosis both weight and length is equally affected, while, decrease in weight gain as compared to their length for age is seen more in infants with acyanotic lesions.(9) Patients with recurrent admissions in hospital, poor surgical outcomes, severe somatic growth impairment, and increased mortality indicates association of malnutrition with increased morbidity and mortality in these children.(10,11) Appropriate nutritional care of the children with CHD first begins with thorough assessment of nutrition and then accordingly determining their nutritional needs. Most of the time, CHD proves to be a challenge for the physicians due to the complex interplay between, nutritional, medical, surgical and social factors. (12)

According to a study published by Marino et al.(13), The most important goal is to keep their saturation as high as possible in cyanotic lesions. It may also be important to breast feed the baby at expense of needs of energy. On the other hand, it may be perfectly acceptable to bottle feed, in children with acyanotic lesions as this will minimally affect oxygen saturation.(14)

Balu Vaidyanathan, Sreeparvathy B Nair et.al.(15) conducted a study in 2007 at department of paediatric cardiology, Biostatistics* and paediatric cardiology surgery**. Amrita institute of Medical Sciences and Research Centre, India, titled “Malnutrition in children with congenital heart disease: Determinants and Short- term Impact of Corrective Intervention”. Conclusion given was that in children with CHD Malnutrition is common problem. Significant improvement in nutritional status was observed on short term follow up after corrective intervention. A study was conducted by Anthony Batte, Peter Lwabi et.al.(16) named, “Wasting, underweight and stunting among children with congenital heart disease presenting at Mulago hospital, Uganda, Africa.” It was a cross-sectional study in which 194 children had age of 0–15 years, and was conducted between August 2013 and March 2014. They carried out anthropometric measurements and clinical assessments in all children. It concluded that Malnutrition is common

in children with congenital heart disease, and is also associated with heart failure and anaemia.

Nehal El-Koofy, Amira M Mahmoud, Aya M, Fattouh(17) conducted a study at Department of paediatrics, Cairo University, Cairo, Egypt in April 2017 titled, "Nutritional rehabilitation for children with congenital heart disease with left to right shunt." Their aim was to assess the nutritional status in infants with CHD and also evaluate the role of nutritional counselling. It was a cohort study including 50 patients with acyanotic CHD who were having increased pulmonary blood flow (plethora), enrolment of these patients was done from the cardiology clinic in Cairo University Children Hospital. The patients were subjected to, nutritional assessment and clinical evaluation with detailed dietary history, anthropometric measurements and subjective global assessment (SGA) score and blood parameters like complete blood count, serum total protein and albumin assessment. Nutritional counselling was offered to those patients after assessment of degree of failure to thrive (FTT); and were also followed up for 3 months then re-evaluated. Among those with moderate to severe FTT 76.5% were given formula feeding (p 0.002) and had significantly lower rate of optimum weaning among (p 0.037). After nutritional rehabilitation, significant improvement in the anthropometry was found in, the degree of FTT and SGA, level of albumin and also decrease in the percent of anemia among the included patients was noted.

MATERIALAND METHODS

Study Type: Prospective, Observational study

Site Of Study:
Tertiary center multi-specialty referral hospital for children in Mumbai. This center has a specialized pediatric cardiology unit catering to outpatient department, general ward, pediatric ICU, medical cardiac ICU and post-operative cardiac ICU.

Study Participants:
Patients following up in cardiology outpatient department and patients admitted in cardiology as well as general wards with acyanotic congenital heart disease in a Tertiary center multi-specialty referral Hospital for Children.

Study Period: 18 months

Sample Size:
According to pilot study done on patients of acyanotic heart disease at the institute prevalence of malnutrition among patients of acyanotic heart disease was calculated. By using formula $N = (Z\ 2(1-\alpha) \times p \times q) / d2$ sample size was calculated to be 153 and considering 10% attrition we took sample size as 166. (18)

Inclusion Criterion
All children with acyanotic congenital heart disease between the age group of 6 months to 18 years who follow up in cardiac OPD or are admitted as in- patients in general wards, medical cardiac ICU, and/or PICU were included in this study.

Exclusion Criterion
1. Patients with associated co-morbidities such as chromosomal anomalies or any kind of immunodeficiency were excluded from this study.
2. Chronic illness (other than CHD), such as chronic liver diseases, chronic kidney diseases were also excluded from this study.

Methodology
- Detailed history, physical examination with pulse oximetry, 2D echocardiography, and routine blood investigations as per the standard treatment protocol of hospital were recorded
- Anthropometry parameters (WHO growth chart and WHO 2006 and IAP Combined growth charts) were recorded.

Definitions (WHO child growth standards)
- Underweight (weight for age)
- Wasting (weight for height/length) moderate (<-2SD) severe (<-3SD)
- Stunting (height/length for age)
- For children more than 5 years of age BMI was considered
- BMI >= 95th percentile : obesity
- BMI >= 75th and <95th percentile overweight
- BMI < 3rd percentile : underweight

Statistical Analysis Method
After data collection the data entry was done in Excel. Data analysis was done with the help of SPSS Software version 23.

Quantitative data like age of the patients, duration of the disease, hemodynamic parameters, weight at visit is presented with the help of Mean, Standard Deviation, Median and IQR.

Qualitative data like demographics of age groups, gender, type of Acyanotic heart diseases, grade of malnutrition, educational status is presented with the help of Frequency and Percentage table.

Association among two or more groups and status of malnutrition is assessed with the help of Chi-Square test or Fishers Exact Test.

Level of significance is considered at confidence interval of 95%. ($p<0.05$).

RESULTS

In our study, maximum 81 (48.79%) study subjects were from 1-5 years age-group followed by 55(33.13%) study subjects from <1 year of age group. Mean age-group of study subjects was 2.85 ± 3.59. VSD was the most common lesion seen in 75 (45.18%) study subjects, followed by 56 (33.73%) study subjects having ASD and 16 (9.63%) study subjects having PDA. We found, malnutrition in 50% (83/166) (Figure No..1a), of which 44.5% (37/83) were SAM (Severe Acute Malnutrition) and 55% (46/83) were MAM (Moderate Acute Malnutrition) category. (Figure No.1b) 66% of children (under 5 years) and 13.33% more than 5 years were underweight. Isolated severe wasting was noted in 26 patients (26.4%), and moderate wasting was seen in 38 (27.9%) under 5 years of age. (Figure No.2). Isolated stunting was noted in 25.30%. Among the 83 malnourished children, 43 (51.80%) comprised VSD, 21 (25.30%) were ASD and 10 (12.04%) had PDA. 22 patients with VSD had severe wasting and 23 (30.66%) had severe stunting. Of the ASD, 10.6% were severely wasted and 21.42% were severely stunted. There were 2 patients with CoA and both were, severely stunted and wasted. Of 16 patients with solitary PDA, severe stunting was noted in 6 and severe wasting in 4 (Figure No. 3). Association of malnutrition with lesions of CHD in study subjects was statistically significant p=0.02 (Chi square test). Out of the 83 malnourished children, 26.50% had severe PAH, with mild and moderate PAH seen in 3.1% each, p= 0.02 (Chi square test) (Figure No.4). No association was found between the socio economic status p=0.34 (Chi square=4.49), df=4, and calories and protein intake p=0.52, p=0.56 (fisher test) respectively with malnutrition in these study subjects. Also no significant association was found between pallor p=1.36 and clinical rickets p=0.09 (Chi square test) in these study subjects.

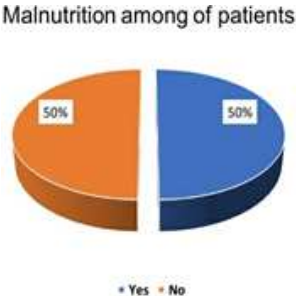

Figure No. 1a Showing Malnutrition Among Total Of 166 Study Subjects. (N=166)

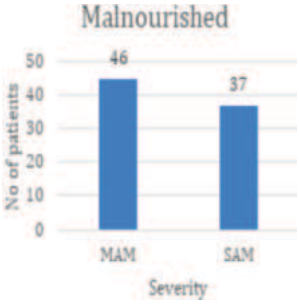

Figure No. 1b showing distribution of malnutrition according to severity. (N=83)

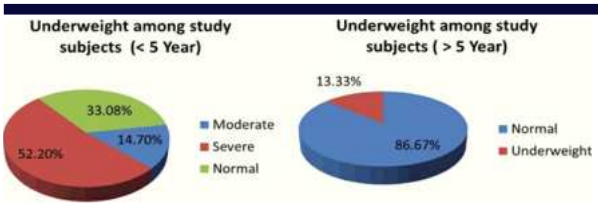

Figure No. 2: (a) showing weight for age (underweight) among study subjects <5 years of age (N=136), (b) showing weight for age (underweight) among study subjects >5 years of age (N=30)

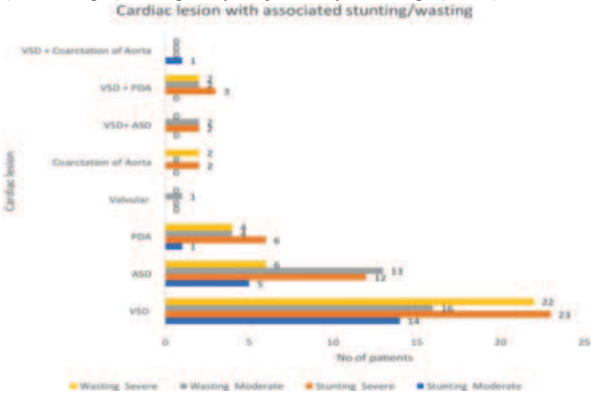

Figure No. 3 Showing association of cardiac lesions with stunting and wasting. (N=166)

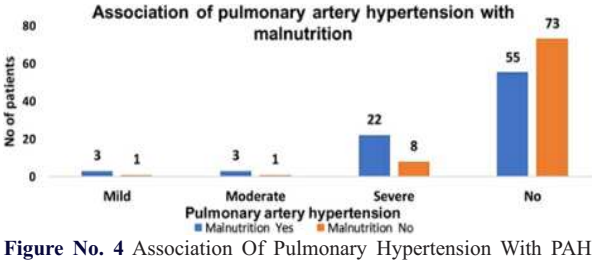

Figure No. 4 Association Of Pulmonary Hypertension With PAH (N=83)

DISCUSSION

Malnutrition is the most important risk factor for the burden of disease among pediatric age group and a major public health problem in developing countries. In children with CHDs, malnutrition is seen irrespective of the type of abnormality or cyanosis.(3) Malnutrition is seen in children with congenital heart disease (CHD) for several reasons like decrease in energy intake, increased consumption of energy, or both.(4) Patients with congestive cardiac failure or an increase in after load (pulmonary hypertension or coarctation of the aorta) often present with increased expenditure of energy. (5) As extra efforts are required to pump an adequate blood for appropriate circulation of body. Decreased in intake of caloric and greater expenditure of energy makes less energy available for deposition of fat. Inefficient processing and utilization of nutrients occurs at cellular level due to anorexia and chronic hypoxemia. (4) Limited studies are available determining the burden of malnutrition among children with acyanotic congenital heart disease. Our study was to assess the nutritional status and to note the presence of wasting, stunting and underweight in children (6 months to 18 years) with acyanotic congenital heart disease. According to the National Family Health Survey -5 (2019-20) (19) data, the incidence of being underweight was 32.3% among under-5 Indian children. In our study, we found, malnutrition in 50% (83/166), of which 44.5% were SAM (Severe Acute Malnutrition) and 54.21% were MAM (Moderate Acute Malnutrition) category. 66% of children (under 5 years) and 13.33% more than 5 years were underweight. Our findings are quite different from the study conducted by Basheir A. Hassan. et. al. (20) , where malnutrition was noted in 84% of patients with acyanotic heart diseases, of which 26% had moderate malnutrition and 57.89% were severely malnourished. Isolated severe wasting was noted in 26 patients (26.4%), and moderate wasting was seen in 38 (27.9%) under 5 years of age.(table no.2) This is significantly higher than the incidence of moderate wasting (19.3%) and severe wasting (7.7%) among normal Indian children (NFHS-5 data) (19). In the study by Basheir A. Hassan et.al, (20) in patients with acyanotic congenital heart disease, 9 (11.84%) out of 76 cases showed wasting. In an Indian study conducted by Balu Vaidyanathan.et.al, (15) 55.9% (weight/height) of patients had z-scores of ≤ –2 at presentation, and 24.2% had z score of < -3SD patients. Thus, implying difference in the prevalence of wasting even amongst children with acyanotic heart disease. Isolated stunting was noted in 42(25.30%). Among the 83 malnourished children, 43 (51.80%) comprised VSD, 21 (25.30%) were ASD and 10 (12.04%) had PDA. 22 patients with VSD had severe wasting and 23 (30.66%) had severe stunting. Of the ASD, 10.6% were severely wasted and 21.42% were severely stunted. There were 2 patients with CoA and both were, severely stunted and wasted. Of 16 patients with solitary PDA, severe stunting was noted in 6 and severe wasting in 4. Out of the 83 malnourished children, 26.50% had severe PAH, with mild and moderate PAH seen in 3.1% each.

CONCLUSION

Children with acyanotic congenital heart disease have significant malnutrition. Isolated underweight (weight for age) is more common than isolated stunting (height/length for age) in these children. Hemodynamics (presence of pulmonary arterial hypertension like in VSD, decreased systemic blood flow as in Coarctation of Aorta); and the size and/or number of lesions have a significant impact on the nutritional status of these patients.

Special importance must be given to anthropometric measurements (stunting, wasting, underweight), with plotting of growth charts to maintain a serial follow- up.

Every pediatric case, especially those with chronic systemic disease like CHD needs a thorough clinical examination for signs of micronutrient as well as macronutrient deficiencies.

These simple clinical observations will help in early identification of patients with reduced growth potential, provide them with appropriate nutritional supplementation and offer timely intervention (catheterization/surgical) for better outcome.

REFERENCES

1. van der Linde D, Konings EE, Slager MA et al. Birth prevalence of congenital heart disease worldwide: a systematic review and meta-analysis. J Am Coll Cardiol 2011;58:2241–7.
2. Anita S.Congenital Heart Disease in India: A Status Report. Indian J Pediatr. 2005; 72: 595-98
3. Gilger M, Jensen C, Kessler B, Nanjundiah P, Klish WJ. Nutrition, growth, and the gastrointestinal system: basic knowledge for the pediatric cardiologist. In: Ganson A, Bricker JT, McNamara PG, eds. The science and practice of pediatric cardiology. Philadelphia: Lea & Febiger, 1990:2354–2370.
4. Schwrmans FM, Pulles-Heintzberger CF, Gerrver WJ, Kester AD, Forget PP. Long-term growth of children with congenital heart disease: a retrospective study. Acta Padeiatr. 1998;87:1250-1255. doi: 10.1111/j.1651-2227.1998. tb00947.
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;81:49-52. doi: 10.1136/adc.81.1.49
6. Cameron JW, Rosenthal A, Olson AD. Malnutrition in hospitalized children with congenital heart disease. Arch Pediatr Adolesc Med 1995; 149: 1098-1102.
7. Thompson-Chagoyan OC, Reyes-Tsubaki N, Rabiela Barrios OL, Buendia- Hernandez A, Miranda Chavez I, Carrasco Quintero R. The nutritional status of the child with congenital cardiopathy. Arch Inst Cardiol Mex 1998; 68: 119-123.
8. Hassan BA, Albanna EA, Morsy SM, et al. Nutritional status in children with un- operated congenital heart disease: An Egyptian center experience. Front Pediatr 2015; 15: 1-5.
9. Norris MK, Hill CS. Nutritional issues in infants and children with congenital heart disease. Crit Care Nurs Clin North Am 1994; 6: 153-163.
10. Forchielli ML, McColl R, Walker WA, Lo C. Children with congenital heart disease: A nutrition challenge. Nutr Rev 1994; 52: 348-353.
11. FreemanL M, Roubenoff R. The nutrition implications of cardiac cachexia. Nutr Rev 1994; 52: 340-347.
12. Roman B. Nourishing little hearts: Nutritional implications for congenital heart defects. Pract Gastroenterol 2011; 35: 11-34.14
13. Marino BL, O'Brien P, LoRe H. Oxygen saturations during breast and bottle feedings in infants with congenital heart disease. J Pediatr Nurs. 1995;10(6):360- 4.
14. Togănel Rodica. **Nutritional Approach of Pediatric Patients Diagnosed with Congenital Heart Disease.** Acta Medica Marisiensis 2013;59(2):121-125
15. BALU VAIDYANATHAN, SREEPARVATHY B NAIR, KR SUNDARAM *, UMA K BABU, K SHIVAPRAKASHA**, SURESH G RAO**, R KRISHNA KUMAR. Malnutrition in Children with Congenital Heart Disease (CHD): Determinants and Short-term Impact of Corrective Intervention. INDIAN PAEDIATRICS. VOLUME 45__JULY 17, 2008
16. Anthony Batte , Peter Lwabi , Sulaiman Lubega , Sarah Kiguli , Kennedy Otwombe , Lucy Chimoyi , Violette Nabatte , Charles Karamagi Wasting, underweight and stunting among children with congenital heart disease presenting at Mulago hospital, Uganda. 2017 Jan 11;17(1):10. doi: 10.1186/s12887-017-0779-y.
17. Nehal El-Koofy, Amira M Mahmoud, Aya M, Fattouh. Nutritional rehabilitation for children with congenital heart disease with left to right shunt. Turk J Pediatr. 2017;59(4):442-451. doi: 10.24953/turkjped.2017.04.011
18. Charan, J., & Biswas, T. (2013). How to Calculate Sample Size for Different Study Designs in Medical Research? Indian Journal of Psychological Medicine, 35(2), 121–126.http://doi.org/10.4103/0253-7176.11623 2.
19. Naional Family Health Survey (NFHS-5), 2019-20
20. Basheir A. Hassan, Ehab A. Albanna, Saed M. Morsy , Ahmed G. Siam, Mona M. Al Shafie, Hosam F. Elsaadany , Hanan S. Sherbiny , Mohamed Shehab and Oswin Grollmuss*. Nutritional status in children with un-operated congenital heart disease: an Egyptian center experience. Frontiers in Paediatrics. June 2015 . Volume 3, Article 53.