Review Article

Malnutrition In Congenital Heart Disease

Abstract :

Congenital heart disease accounts for nearly twenty-eight percent of all the major congenital malformations, posing a significant global health problem. Prevalence of both cyanotic and acyanotic varies from 0.7 to 5.3/1000 patients in community-based study while hospital-based study statistics range between 3.9 and 26.4/1000 live births. The increase in birth rate and the requirement of surgical and non-surgical intervention makes it a high and challenging need task for emerging nations like India, where the framework isn't created at the root level. In this population a high prevalence of malnutrition is seen especially in infants. In the era of high survival rates, nutrition provides opportunity for development, growth optimization and a better standard of living. The morbidity & mortality associated malnutrition in infant with congenital heart disease can be reduced by early diagnosis / optimum treatment. Approximately half of the pediatric age population suffering from Congenital Heart Disease (CHD) are found to be malnourished where the most of the affected factor is found to be weight worse than height. The various contributory factors for malnutrition in CHD patients are cyanosis, heart defects, heart failure, pulmonary hypertension, anemia, and delayed corrective surgery. Early and Timely diagnosis is crucial as most congenital heart disorders can be corrected if apt intervention is provided, leading to better prognosis. Decreased caloric requirement , reduction in prevalence of respiratory tract infection, and better absorption will lead to early normalization of their malnourishment. The major studies done in the recent past have focused on the mechanism of failure of growth in patients suffering from congenital heart malformation or on the modalities for improvement of growth of children with congenital heart disease. The severity and frequency of malnutrition associated with congenital heart diseases has not been focused on in the past decades.

Keywords: Congenital Heart Disease, Malnutrition, Cyanosis, Defects.

Introduction:

The most prevalent problem in the pediatric population in India is malnutrition. We may be incorrect in assuming that the majority of cases of malnutrition are a result of improper diet or poor socioeconomic background. It is important to consider that the problem of malnutrition could be secondary to medical disorder. One of the major contributing disorders to malnutrition, as suggested by the studies is congenital heart disease. The most of commonly diagnosed malformation disease in pediatrics is Congenital heart disease (CHD) which contributes to high prevalence, and high incidence of 8 per thousand live births, accounting for 28% of all congenital disorders (1). Advances in recent the field of cardiac surgery and interventional cardiology has substantially enhanced the mean survival rates of the patients suffering from CHD in last few decades (2) based on type of shunt (right to left

shunt or left to right shunt). CHD is classified into cyanotic congenital heart diseases and acyanotic congenital heart diseases respectively (3).Based on the complexity of the defects it is also classified into simple defects (atrial septal defect , pulmonary stenosis, defect in ventricular septum , patent ductus arteriosus), moderately complex defects (stenosis pulmonary , total Anomalous Pulmonary Venous Return (TAPVR) , tetralogy of Fallot, Partial Anomalous Pulmonary Venous Return (PAPVR),aortic stenosis and common atrium) and complex congenital heart diseases (dextro transposition of great arteries(DTGA), tricuspid atresia, pulmonary atresia, Double Outlet Right Ventricle (DORV), congenitally corrected transposition of great arteries, Atrioventricular Septal Defect(AVSD), truncus arteriosus) (4).

The etiology behind numerous CHD stays obscure due to the different inclining factors including the hereditary qualities, ecological danger elements and some partner to chromosomal irregularities, including trisomy 13,21 and 18 and alongside turner disorder. Some of the known contributing conditions mainly comprises the maternal and teratogenic risk factors like gestational diabetes mellitus, congenital rubella syndrome, maternal ingestion of drugs (ethanol, warfarin, lithium, thalidomide etc).The prevalence of malnutrition in children with congenital heart disease is observed to be due to various reasons comprising increase in energy requirements , decreased calorie intake or both. About 40% elevation in the total energy expenditure is seen in suffering from malnutrition as a result of ventricular septal defect (4,5).

Children with CHD in which there is elevation in the after load or heart failure have an increased energy expenditure .Long term hypoxia induced anorexia , thereby affecting growth by inadequate processing of nutrients at the cellular level 4. The factors triggering malnutrition in children with congenital heart malformations include age of children at presentation and pulmonary hypertension. Elevated blood flow and Pulmonary hypertension in the pulmonary system accelerate growth retardation. Hypoxia associated with these conditions along with other contributory factors including frequent infections, inadequate diet , worm infestation etc aggravates the existing problem(5). A study by Vaidyanathan, The issue in Indian pediatrics emphasized the correlation between malnutrition and heart diseases. It proposed that hyperalimentation is not going to correct malnutrition unless the underlying condition is treated. Adverse impact in delayed corrective intervention for growth potential has been demonstrated in the study. The article aims at determining the various aspects of malnutrition in children with congenital heart disorders which will aid in nutrition counseling and other factors contributing to early diagnosis and optimum management of the same for a better prognosis. The emphasis is given on a very important factor of early diagnosis and application of corrective intervention for better long term outcomes. The objective of this narrative review article is to gain an understanding of the existing research and debates associated with anemia in congenital heart disease through various books , patents, search engines and published research and review articles, which is presented in a form of written articles.

Nutrient malabsorption

Congenital heart malformations and it's physiology put a substantial quantity on the right ventricle, reducing cardiac output and elevating risk of low perfusion. These parameters can substantially influence through nutritional management , this brings into light the need for a detailed protocol based on evidences which includes the use of standard growth charts,

parenteral and enteral nutrition, assessment of risks, estimation of calorie requirements. Patient with increased right ventricular pressure resulting in congestive heart failure is predisposed to substantial reduction in the end organ perfusion . This reduces the blood flow to digestive organs , decreasing the nutrient absorption. All things considered there are data on patients with both cyanosis & aspiratory hypertension Feeding fatigue and feeding intolerance may be seen as result of further decrease in the cardiac output. More than 50% of infants with compromised circulation in the splanchnic region suffer from severe malnutrition. Feeble wellbeing isn't an ailment or disarray . All things considered, consider it a sign that a child or youngster is malnourished and can't develop or put on sufficient weight (6).

There's frequently a misconception that unhealthiness implies a kid isn't getting sufficient nourishment. That can unquestionably be one part of the condition. In any case, lack of healthy sustenance happens when a youngster isn't getting the right nourishment to have the option to develop ordinarily. This might be on the grounds that a youngster doesn't get an adequate number of calories. A couple of clarifications behind this include: The formula total (for newborn children) isn't assessed correctly . Calories are restricted to attempt not to cause weight gain Caregivers don't see hunger cues. There's an absence of assets to purchase sufficient nourishment for the family. Can't take in an adequate number of calories. Extended hospital stays, readmissions , high diuretic doses and longer stays in intensive care units are the outcomes of the same(6,7).

Management and Recommendations

The executives and Recommendations Intensive proof based administration is needed for the counteraction of morbidity and late stage mortality associated with malnourished children suffering from congenital heart disease. Because of the advancements in the infrastructure and methodology related to cardiac surgery, neonatal cases of congenital heart disease with poor prognosis are saved and now living into adulthood. the hereditary qualities, ecological danger elements and some partner to chromosomal irregularities etc. Extensive integrated care for growth optimizations, quality of life and developmental outcomes are prerequisites for the same. These parameters can be substantially influenced through nutritional management. This brings into light the need for a detailed protocol based on evidences which includes the use of standard growth charts, parenteral and enteral nutrition, assessment of risks, estimation of calorie requirements, preoperative management and the time of surgical intervention in place at NICU treating patients with congenital heart malformations (8).

The initial two years of life for newborn children and babies is a fundamental time when their bodies and minds are creating. Ordinarily, a child's cerebrum develops as much during their first year as it will for the remainder of their life. Helpless sustenance during this time might make long haul hurt the creating cerebrum. Different issues that might emerge from lack of healthy sustenance in youngsters include:

Not arriving at their ideal size as grown-ups might cause a lower actual limit with respect to exercises and work. Learning issues could prompt lower test scores and more unlucky deficiencies from school. Reduced immunity prompts the danger of contracting more irresistible infections(8,9).

Use of Growth Charts

Practically speaking, most experts uses development graphs as norms against which patient might be estimated for ideal / imperfect development. By and large, American experts have used the Centers for Disease CDC (Control Disease Prevention) improvement blueprints to graph weight for age, length for age, weight for length, and weight list for age. In 2006, in any case, the CDC, National Institutes of Health, and American Academy not set in stone that the 2006 WHO Growth Charts ought to be utilized for kids more youthful than two years and that CDC development diagrams ought to be utilized for kids two years to 20 years of age. The various contributory factors for malnutrition in CHD patients are cyanosis, heart defects, heart failure, pulmonary hypertension, anemia, and delayed corrective surgery. Early and Timely diagnosis is crucial The majority of congenital heart disorders can be corrected if apt intervention is provided, leading to better prognosis. Decreased caloric requirement , reduced respiratory tract prevalence infection, and better absorption will lead to normalization of their malnourishment. The WHO development diagrams contrast the patient and development guidelines and reflect ideal development, though the CDC development outlines contrast the patient and development references.(2) Although babies with CHD don't frequently encounter ideal development, utilization of WHO development graphs gives a chance to distinguish strange development examples and guides the professional to explore the modifiable reasons for these development.

Enteral Feeding

Enterally taking care of the postoperative newborn child with CHD is conceivable. Fast postoperative hemodynamic sufficiency may be undeniably overhauled by enteral sustenance (4), it took care of patients eventually have high certain nitrogen adjusts than those taken care of through enteral nutrition (5). Infants took care of enterally at the caution of every individual expert to accomplish full enteral feeds later than newborn children took care of enterally under the direction of an enteral taking care of calculation. Boston Children's Hospital Cardiovascular Program adjusted an parenteral taking care of calculation distributed by Martin and Cox in 2000 (6) This adjusted calculation gives a 4-venture cycle to distinguish when to start and advance enteral feedings dependent on a progression of hazard factors for gastrointestinal bleakness. Enteral taking care of conventions, for example, the adjusted algorithm of Martin and Cox decrease time dependent on enteral sustenance and permit patients to arrive at the suggested every day stipend of calories all the more rapidly after surgical operation. (7) To accomplish the enteral nourishment objectives set by these conventions, hypercaloric and high protein equations might be required. There are many high protein equations, just as human milk fortifies hypercaloric and might be utilized to streamline, protein, caloric and supplement consumption without liquid equilibrium.

Discharge Planning and Follow-up Care

In a perfect world, the serious dietary administration of the baby with CHD during their hospitalization will set up a nourishing standard for ideal development and improvement all through the life expectancy. Long haul supporting goals should focus in on building a momentary food plan possible for the family to proceed just as setting up a solid wholesome benchmark. Release follow-ups and arranging are important for the patient's achievement in keeping up and acquiring with weight and showing up at developmental accomplishments .

Patients with swallow brokenness who get suitable subsequent consideration with discourse pathologists are 70% bound to show ordinary or improved gobbling on follow-up at a half year of age. Additionally, patients who are firmly followed on release might be all the more speedily evaluated for strange development designs and modifiable causes when their weight-for-length, length-for-age, weight-for-age ,head perimeter for-age, or percentiles underneath 2.4% or drop precipitously (2)

Patients with increased risk of death can benefit from follow ups . Up to 17% of newborn children with left heart condition are diagnosed in stage I and stage II. Patients who get short term home nourishment have preferable results over patients released without observation. Following every day heart rate, oximetry and weight , patients at expanded danger of death can be recognized early enough for proper treatment and reduce mortality.

Discussion :

A far reaching sustenance advancement and ailing health avoidance program can possibly altogether influence endurance, personal satisfaction, and formative results in baby with CHD. Utilizing WHO development graphs is suggested by the CDC for the initial two years of life, and has abundance advantages to the conceivably malnourish populace with CHD they might recognize strange development examples and guide the expert to research modifiable reasons for patients under the 2.4 percentile (3).

Ineffectively sustained youngsters regularly have debilitated invulnerable frameworks, expanding their disease odds. Underweight, malnourished teens , ,, for example, those with a dietary issue , have an expanded danger of osteoporosis and might not have feminine periods. They might have heart and other organ issues with serious hunger. Lack of healthy sustenance, whenever left untreated, can prompt physical or mental incapacity, or even passing.

Youngsters who are overweight have an expanded danger for long haul conditions and infections, including cardiovascular disease, high cholesterol , hypertension, type 2 diabetes, asthma , sleep apnea, and certain tumors. Wellbeing outcomes range from a higher danger of sudden passing to constant conditions that diminish an individual's personal satisfaction.

Lack of healthy sustenance is a significant reason for sickness and demise all through the world. All through the creating scene, lack of healthy sustenance influences very nearly 800 million individuals, or 18% of the populace. Around half of the 10.3 million kids who bite the dust every year are malnourished. It frequently causes illness and incapacity in the kids who get by. Diarrheal illnesses are likewise a significant world medical issue, and might be a reason for hunger. Essentially these passing’s happen in ruined pieces of Africa and Asia, where they frequently result from tainting of the water supply by creature and human defecation (10,11). Around the world, the most widely recognized type of ailing health is iron insufficiency, influencing up to 70 percent of the populace, upwards of four or five billion individuals (11,12).

Interestingly, youngsters in many areas of the planet are turning out to be progressively overweight. What was considered as an issue for industrialized countries just up to this point, is presently influencing youngsters in non-industrial nations. Around 35–40 percent of young youngsters are overweight (12,13).

Tube is regularly used to give supplements to youngsters who have burns , fiery entrail illness, or other long haul conditions that cause persistent ailing health or malabsorption , for

example cystic fibrosis , and meddle with the capacity to take in an adequate number of calories. This strategy includes embedding a slender cylinder through the nose and cautiously directing it along the throat until it arrives at the stomach or small digestive tract. Assuming that the drawn-out tube is important, the cylinder might be put straight forwardly into the stomach / small digestive system through an entry point in the mid section. Tube taking care of can't generally convey satisfactory supplements to youngsters who:

- are seriously malnourished require medical procedure,
- are undergoing chemotherapy or radiation therapies,
- have been truly scorched,
- have diligent the runs or regurgitating,
- have a gastrointestinal lot that isn't useful.

Intravenous taking care of can likewise supply a few or every one of the supplements these youngsters need.

Specialists or enrolled dietitians can assist guardians with canning screen overweight or stout kids. These experts might propose a health improvement plan assuming that the youngster is overweight in excess of 20%. Monitoring weight gain can be refined by changing dietary patterns, bringing down fat admission, and expanding active work.

Acute CHD is more normal than Chronic CHD. Among ACHDs, VSD (ventricular septal imperfection)is the most well-known coronary illness in youngsters and PDA in infants. Larger part, 61.4% in Center An and 18.9% in Center B had Acute CHD. VSD was more normal in Center An and ASD in Center . ASD is typically analyzed in more established youngsters because of the late beginning of indications. TOF was the most widely recognized among Chronic CHD in the two communities, true to form. The distinction in the example of CHDs in both the focuses is owing to the reference predisposition and contrast in the age gathering of the members. Focus A had more your kids, alluded from emergency clinics and Center had more established kids, alluded from camps and school screening programs. Screening under RBSK Scheme is decent drive, particularly for those having place with low financial status. Moreover, these modifiable causes might be anticipated with the assistance of hazard evaluations (11).

Issues with weight: weight reduction, slow weight gain, being under weight or overweight. Not developing taller Not growing out of apparel sizes . Eating not exactly common or caring very little about eating throughout a lengthy time frame. eating less now and again can be ordinary at different ages and formative levels. Not eating great as a result of stomach problems. Being less dynamic and perky or dozing more than expected . Hazard appraisals that are open and simple to utilize should be finished at confirmation, readmission after medical procedure, or on significant status changes (8-11) . Newborn children who are noted to be at increased danger for hunger dependent on a proof based danger appraisal ought to be alluded to an enlisted dietitian, word related specialist, and additionally language instructor(12-15).

CONCLUSION :

Lack of healthy sustenance in hospitalized kids with inherent coronary illness stays normal, featuring the significance of meditation and nourishing screening . Infant kids with inborn coronary heart diseases (CHD) are leaned to awfulness for a significant long time including

reduced energy utilization, extended energy necessities, or both. The reality of yearning can go from delicate undernutrition to powerlessness to prosper—this outstanding influence the after effect of an operation, extending terrible and mortality. Different kinds of heart bends can impact food and advancement to moving degrees. We analyzed the effect of a couple of sorts of cardiovascular reference malformations on food and advancement, and investigated the writing in such manner. The various effects of hypoxia and pneumonic hypertension on food and improvement of youths have been investigated extensively in assessment , yet the thing considered there have deficient data on patient with aspiratory hypertension and cyanosis .

References:

1. Vaidyanathan B, Nair SB, Sundaram KR, Babu UK, Shivaprakaste K, Rao SG, et al. Malnutrition in children with congenital heart disease (CHD): determinants and short-term impact of corrective intervention. Indian Pediatr 2008; 45: 541-546.
2. Grumer-Strawn, LM, Reinold, C, Krebs, NF. Use of World Health Organization and CDC growth charts for children aged 0-59 months in the United States. MMWR Recomm Rep. 2010;59(RR-9):1-14.
3. Ghanayem, NS, Hoffman, GM, Mussatto, KA. Home surveillance program prevents interstage mortality after the Norwood procedure. J Thorac Cardiovasc Surg. 2003;126:1367-1377.
4. Bernstein D. Evaluation of the patient or child with congenital heart disease. In: Behrman R.E, Kliegman R.M, Jenson H.B, editors. *Nelson text book of pediatrics.* 18th ed. Philadelphia, Saunders: The Curtis Center; 2007. p. 1881.
5. Bechard, LJ, Parrott, JS, Mehta, NM. Systematic review 10. Kelleher, DK, Laussen, P, Teixeira-Pinto, A, Duggan, C. Growth and correlates of nutritional status among infants with hypoplastic left heart syndrome (HLHS) after stage 1 Norwood procedure. 2006;22:237-244.of energy and protein intake on protein balance in critically ill children. J Pediatr. 2012;161:333-339.
6. Martin, L, Cox, S. Enteral feeding: practice guidance. Paediatr Nurs. 2000;12:28-33.
7. Braudis, NJ, Curley, MA, Beaupre, K. Enteral feeding algorithm for infants with hypoplastic left heart syndrome poststage I palliation. Pediatr Crit Care Med. 2009;10:460-466.
8. Singh RK, Singhania A, Mishra GV, Patwa PA. Congenital Pulmonary Airway Malformation in One of the Monochorionic Diamniotic Twins--A Rare Encounter. Journal of Evolution of Medical and Dental Sciences. 2020 Nov 30;9(48):3694-7. https://doi.org/10.14260/jemds/2020/810.
9. Joshi G. Gollop-Wolfgang Complex in a New Born with Morton's Toe and Congenital Heart Disease. Journal of Krishna Institute of Medical Sciences (JKIMSU). 2021 Jan 1;10(1).
10. Joshi MP, Taksande AM, Meshram R. Intracranial Brain Abscess in a Child with Cyanotic Congenital Heart Disease. Journal of Evolution of Medical and Dental Sciences. 2020 Dec 7;9(49):3767-70. https://doi.org/10.14260/jemds/2020/826.
11. Devalla AR, Deshpande H, Ninave S, Bhaisare R. Assessment of Malnutrition and Enteral Feeding Practices in Critically Ill in Neurosurgery ICU in Rural Teaching Hospital. Journal of Evolution of Medical and Dental Sciences. 2020 Sep 7;9(36):2610-4. https://doi.org/10.14260/jemds/2020/568.
12. Arodiwe I, Chinawa J, Ujunwa F, Adiele D, Ukoha M, Obidike E. Nutritional status of congenital heart disease (CHD) patients: Burden and determinant of malnutrition at

university of Nigeria teaching hospital Ituku–Ozalla, Enugu. Pakistan journal of medical sciences. 2015 Sep;31(5):1140.
13. Tabib A, Aryafar M, Ghadrdoost B. Prevalence of malnutrition in children with congenital heart disease. Journal of Comprehensive Pediatrics. 2019 Nov 30;10(4).
14. Larson- Nath C, Goday P. Malnutrition in children with chronic disease. Nutrition in Clinical Practice. 2019 Jun;34(3):349-58.
15. Fitria L, Caesa P, Joe J, Marwali EM. Did malnutrition affect post-operative somatic growth in pediatric patients undergoing surgical procedures for congenital heart disease?. Pediatric cardiology. 2019 Feb;40(2):431-6.