Original Article

Nutrition of children with complex congenital heart anomalies

Arlinda Maloku[1,2], Ramush Bejiqi[2], Aferdita Mustafa[2], Naim Zeka[1,2], Rinor Bejiqi[2*]

[1]Department of Cardiology, Faculty of Medicine, University of Prishtina "Hasan Prishtina", Prishtina, Republic of Kosova. [2]University Clinical Centre of Kosovo, Pediatric Clinic, Prishtina, Kosovo.

Correspondence: Rinor Bejiqi, University Clinical Centre of Kosovo, Pediatric Clinic, Prishtina, Kosovo. rinorbejiqi25@gmail.com

ABSTRACT

Nutrition of children with complex congenital heart anomalies, admitted to the clinic, are complicated conditions with a range of symptoms, including faddiness and food refusal, which both result in reduced food intake Our goal was to determine the frequency of feeding issues and the characteristics that predicted them, in children who had open heart surgery during the neonatal and early childhood periods The research was conducted at the Pediatric Clinic, in the Cardiology and Intensive Care Department of the University Clinical Centre of Prishtina. 70 children were included in the study. The children were divided into two groups: the research group which included 40 and the control group with 30 children. The research group included children who underwent one of the forms of the Fontan procedure, while the control group included healthy children. We found that 70% of the children after cardiac surgery intervention had eating issues. At the time of the study, 12 children had subnormal weights and heights, 28 children had refused to eat or lack of appetite and nutrition was a serious issue. In addition, kids with feeding issues typically ate fewer portions than those without eating issues. Individuals who have had repeated heart surgeries and related abnormalities are susceptible to eating problems.

Keywords: Nutrition, Children, Complex congenital heart anomalies, Feeding difficulty, Open heart surgery

Introduction

Feeding disorders in infancy and children are complicated conditions with a range of symptoms, including faddiness and food refusal, which both result in reduced food intake. It frequently comes from aberrant feeding development [1-3]. Also, after surgery for congenital cardiac problems, children must maintain proper nutrition, which can be difficult [4, 5].

There is a global justification for paying attention to lesion-related or specialized feeding issues, supplementing with trace minerals and elements, and adopting an organized feeding pace, timing, and kind strategy [6, 7].

Feeding disorders in infancy and children are complicated conditions with a range of symptoms, including faddiness and food refusal, which both result in reduced food intake [8, 9]. It frequently comes from aberrant feeding development. Also, after surgery for congenital cardiac problems, children must maintain proper nutrition, which can be difficult [10, 11].

There is a global justification for paying attention to lesion-related or specialized feeding issues, supplementing with trace minerals and elements, and adopting an organized feeding pace, timing, and kind strategy [12, 13]. To increase the child's caloric intake and promote a pleasant feeding relationship within the family, nutritional help and preventive measures should be given to these patients [14, 15]. Compared to kids with normal hearts, babies with congenital cardiac abnormalities may require more calories daily, especially if they are experiencing congestive heart failure symptoms [16, 17]. For a variety of reasons, feeding can be difficult, thus parents and other carers frequently collaborate closely with the infant's medical team to make sure the child is eating enough calories to grow and gain weight [18, 19].

Access this article online	
Website: www.japer.in	**E-ISSN:** 2249-3379

How to cite this article: Maloku A, Bejiqi R, Mustafa A, Zeka N, Bejiqi R. Nutrition of children with complex congenital heart anomalies. J Adv Pharm Educ Res. 2024;14(3):90-3. https://doi.org/10.51847/2xFZ3UXu51

Materials and Methods

The research was carried out in the Cardiology Service and the Intensive Care Unit of the Paediatric Clinic of the University Clinical Centre in Prishtina in the period January 2020–December 2023. 70 children were included in the research. The

children were divided into two groups: the research group, which included 40, and the control group, which included 30 children. The research group included children who underwent tertiary intervention, one of the forms of the Fontan procedure, while the control group included healthy children. For each child, general and anamnestic data were obtained from the parents or guardian, including age, gender, place of residence, weight, and height at birth, the age when the congenital heart malformation was diagnosed, the medical reports of cardiosurgical interventions were reviewed, the type of main malformation and follow-up forms, the age when the first, second, and third intervention was made, the Fontan form, and nutrition status.

Results and Discussion

The research included 40 children with congenital heart malformations and 30 healthy children as a control group. In both groups, male children dominated compared to girls; in the group with congenital heart malformations 70% were boys and in the control group 53.3% were boys, with no significant difference between the groups (P=0.239). There is no statistically significant difference in the mean body weight at birth between the group with congenital heart malformations and the control group (P=0.055). We also have no difference in the average body length at birth between the group with congenital heart malformations and the control group (P=0.529). The most frequent primary diagnosis was atresia of the tricuspid valve, in 22 patients or 55.0%, then atresia of the pulmonary artery and single ventricle with 7 cases each or 17.5%, atresia of the mitral valve is present in 3 cases or 7.5% and L- TGA in 1 case or 2.5%. Initially, feeding through the nasogastric tube was in 55 % of children after surgery. As is customary, the remaining patients had a nasogastric tube placed after the administration of anesthesia to initiate early eating during the initial postoperative days [20-22]. There was not one who required a gastroscopic tube. After two years, of the forty youngsters in the research group, 28 had either no appetite or refused to eat, indicating a major problem with nutrition. A significant correlation was observed between the kind of operation, length of mechanical ventilation, age at surgery, length of perioperative tube feeding, and surgical center [23, 24]. Patients with small age at surgery, prolonged breathing, and sophisticated surgical procedures (double outlet right ventricle, univentricular heart palliation) were more common in the group with improper feeding than in the other group. The three factors—type of CHD, age of operation, and reoperation of the univentricular heart—had a very strong correlation with one another, thus the multivariate logistic regression analysis included the variables that were significant in the univariate analysis [25, 26].

A retrospective study of the data from kids who had open heart surgery reveals that feeding issues are a real concern for this group of people. When comparing a population of children who had undergone open heart surgery to a population of healthy children, the prevalence of severe feeding problems is much greater when using the same definition of feeding problems and the age of the children at the time of the study [27-30]. This prevalence is nearly as common and is correlated with the kind and complexity of CHD as well as the patient's age at the time of heart surgery [29, 31-33]. A major constitutional element that leads to the development of problems in other organs and systems, such as secondary feeding difficulties, is cardiac disorders [34, 35].

Our study simultaneously demonstrates that feeding difficulties at the age of two years did not depend on gestational age at birth, hemodynamic status before and following surgery, or any of these factors. Rather, general medical conditions such as the age of children undergoing surgery, the length of time they were on medical ventilation, the type of surgery, and reoperation had the greatest impact on the development of feeding disorders.

Only early feeding difficulties and many operations remained significantly associated with eating problems at the age of two years in the multivariate regression analysis, despite the strong correlation between these three variables. For newborns recovering from heart surgery, enough enteral nutrition may be challenging to obtain early on, yet it is crucial for immune system function, development, and wound healing. Malnutrition and reduced food intake can result from feeding difficulties in infancy and childhood, which are complicated diseases including a variety of symptoms such as food refusal or inadequate intake [17, 36, 37].

A child's environment, learning style, and constitution all influence how they develop when it comes to nutrition [38]. However, since technological advancements are making it possible for more critically sick infants to live, feeding issues tend to become more prevalent. Compared to simplex and at-once fixed abnormalities, we observed that univentricular correction was linked to an increased likelihood of feeding and nutrition issues [39].

This can be explained by the different levels of volume overload, intracardiac mixing, and hypoxemia that children with univentricular hearts experience, as well as the different lengths of time that hypoxemia lasts [40]. In the first few days of life, these kids frequently need palliative surgery, which is followed by at least two additional open-heart procedures [21, 29, 41, 42]. Several of the above-listed risk factors co-occur, which increases the probability of the manifestation and persistence of a feeding disorder in most children with malformation syndromes [20, 31, 32, 43]. For a variety of reasons, feeding can be difficult, so parents and other carers frequently collaborate closely with the infant's medical team to ensure the baby is receiving enough calories to grow and gain weight [44]. In addition, there is a greater chance that a child who has heart surgery during the newborn and early infancy stages may have a feeding difficulty by the time they are three years old [20, 45-48]. This is the outcome of a multifaceted, intricate procedure. The degree of congenital heart disease (CHD), the kid's age during surgery, the kind of operation and follow-up procedures, the length of time the child is on mechanical ventilation, the existence of malformation syndromes, and previously identified neurological abnormalities are independent risk factors [6, 7, 28, 46]. These elements offer

crucial proof of which kids should be sent to interdisciplinary teams.

Conclusion

Compared to children in good health, children with congenital heart disease are more likely to experience stunted growth and undernutrition. Malnutrition is rather common in children with congenital heart disease. To enhance the nutritional status of newborns with congenital heart disease (CHD), a multidisciplinary team is essential as it provides healthcare personnel with specific techniques to combat feeding intolerance and nutritional standardized regimens.

Acknowledgments: The family that participated in this study is acknowledged by the authors for their cooperation.

Conflict of interest: None

Financial support: None

Ethics statement: The Institutional Review Board at our Clinical Centre gave its blessing to this report, and both parents signed written informed permission forms.

References

1. Reilly S, Skuse D, Poblete X. Prevalence of feeding problems and oral motor dysfunction in children with cerebral palsy: A community survey. J Pediatr. 1996;129(6):877-82.
2. Dahl M, Sundelin C. Early feeding problems in affluent society: I. Categories and clinical signs. Acta Pediatr Scand. 1986;75(3):370-9.
3. Maurer I, Latal B, Geissmann H, Knirsch W, Bauersfeld U, Balmer C. Prevalence and predictors of later feeding disorders in children who underwent neonatal cardiac surgery for congenital heart disease. Cardiol Young. 2011;21(3):303-9.
4. Alnofaiey YH, Almuqati HH, Alasmari AA, Alosaimi MH, Alshehri MA, Aljuaid AS, et al. Level of knowledge toward surgical site infections among clinical years medical students in the western region of Saudi Arabia. Pharmacophore. 2022;13(2-2022):74-9.
5. Florina MG, Mariana G, Csaba N, Gratiela VL. The Interdependence between diet, microbiome, and human body health-A systemic review. Pharmacophore. 2022;13(2):1-6.
6. Belaldavar C, Angadi PV. Knowledge and attitudes regarding use of chat GPT in dentistry among dental students and dental professionals. Ann Den Spec. 2024;12(1):14-20.
7. Alrabiah A, Albalawi F, Aljazea SA, Barri RM, Alquraishi SI, Alharthi A, et al. Effect of banana peels on dental bleaching: An in vitro study. Ann Dent Spec. 2024;12(1-2024):21-5.
8. Ojo O. Nutrition and chronic conditions. Nutrients. 2019;11(2):9-14.
9. Pereira-da-Silva L, Virella D, Fusch C. Nutritional assessment in preterm infants: A practical approach in the NICU. Nutrients. 2019;11(9):1999.
10. Nabavi SS, Gholizadeh B. Evaluation of the quality of life of the patients with heart failure in Ahvaz teaching hospitals. Entomol Appl Sci Lett. 2022;9(1-2022):26-30.
11. Canassa VF, Baldin EL. Nymphal performance and fecundity of melanaphis sacchari (Zehntner)(Hemiptera: Aphididae) in different sorghum genotypes. Entomol Appl Sci Lett. 2022;9(2-2022):1-0.
12. Dahl M, Eklund G, Sundelin C. Early feeding problems in an affluent society: II. Determinants. Acta Pediatr Scand. 1986;75(3):380-7.
13. Dahl M. Early feeding problems in an affluent society: III. Follow-up at two years: Natural course, health behavior, and development. Acta Pediatr Scand. 1987;76(6):872-82.
14. Hassan F, Hatah E. A thematic analysis of non-pharmacological intervention strategies in the management of diabetic patients in Malaysia. Arch Pharm Pract. 2022;13(3-2022):62-9.
15. Ahmadinejad M, Moghaddam MA, Shahesmaeili A, Mayel M. Two supportive methods on outcome of patients with chest trauma. Arch Pharm Pract. 2022;13(2-2022):57-61.
16. Mirzaaghayan MR, Ghamari A, Salimi A, Moghadam EA. Nutritional status in non-syndromic cyanotic congenital heart diseases patients: A single tertiary center study in Iran. Iran J Pediatr. 2020;30(1):e98542.
17. McElhinney DB, Hedrick HL, Bush DM, Pereira GR, Stafford PW, Gaynor JW, et al. Necrotizing enterocolitis in neonates with congenital heart disease: Risk factors and outcomes. Pediatrics. 2000;106(5):1080-7.
18. Tume LN, Valla FV, Joosten K, Jotterand Chaparro C, Latten L, Marino LV, et al. Nutritional support for children during critical illness: European Society of Pediatric and Neonatal Intensive Care (ESPNIC) metabolism, endocrine and nutrition section position statement and clinical recommendations. Intensive Care Med. 2020;46:411-25.
19. Day TG, Dionisio D, Zannino D, Brizard C, Cheung MM. Enteral feeding in duct-dependent congenital heart disease. J Neonatal-Perinat Med. 2019;12(1):9-12.
20. Sedrak A. Prevalence and profile of malnutrition in under-five children with congenital heart diseases in Cairo University pediatric hospitals. Egypt Fam Med J. 2019;3(2):19-33.
21. Rahman M, Utamayasa IKA, Hidayat T, Irawan R, Elizabeth R. Anthropometric profile of children with cyanotic and noncyanotic congenital heart disease. MGI. 2020;15(1):1-6.
22. Del Castillo SL, McCulley ME, Khemani RG, Jeffries HE, Thomas DW, Peregrine J, et al. Reducing the incidence of

necrotizing enterocolitis in neonates with hypoplastic left heart syndrome with the introduction of an enteral feed protocol. Pediatr Crit Care Med. 2010;11(3):373-7.
23. Morris CD, Menashe VD. 25-year mortality after surgical repair of congenital heart defect in childhood: A population-based cohort study. JAMA. 1991;266(24):3447-52.
24. Boneva RS, Botto LD, Moore CA, Yang Q, Correa A, Erickson JD. Mortality associated with congenital heart defects in the United States: Trends and racial disparities, 1979–1997. Circulation. 2001;103(19):2376-81.
25. JH M. Cardiovascular health and disease in children: Current status. Circulation. 1994;89:923-30.
26. Perloff JK, Warnes CA. Challenges posed by adults with repaired congenital heart disease. Circulation. 2001;103(21):2637-43.
27. Qin C, Li Y, Wang D, Shi Z, Yao R, Wang D, et al. Maternal factors and preoperative nutrition in children with mild cases of congenital heart disease. Japan J Nurs Sci. 2019;16(1):37-46.
28. Davis JA, Spatz DL. Human milk and infants with congenital heart disease: A summary of current literature supporting the provision of human milk and breastfeeding. Ad Neonatal Care. 2019;19(3):212-8.
29. Zhang M, Wang L, Huang R, Sun C, Bao N, Xu Z. Risk factors of malnutrition in Chinese children with congenital heart defect. BMC Pediatr. 2020;20:1-7.
30. Schwalbe-Terilli CR, Hartman DH, Nagle ML, Gallagher PR, Ittenbach RF, Burnham NB, et al. Enteral feeding and caloric intake in neonates after cardiac surgery. Am J Crit Care. 2009;18(1):52-7.
31. Abdelmoneim HM, Hawary BE, Magdi A, Soliman E. Assessment of nutrition state in children with heart diseases. Egypt J Hosp Med. 2019;77(October):5049-55.
32. Tabib A, Aryafar M, Ghadrdoost B. Heart prevalence of malnutrition in children with congenital heart disease. J Compr Pediatr. 2019;10(4).
33. Bejiqi R, Retkoceri R, Zeka N, Bejiqi H, Vuqiterna A, Maloku A. Treatment of children with protein–losing enteropathy after fontan and other complex congenital heart disease procedures in condition with limited human and technical resources. Mater Socio-Med. 2014;26(1):39.
34. Shaik NB, Lakshmi PK, VV BR. Formulation and evaluation of favipiravir proliposomal powder for pulmonary delivery by nebulization. Int J Pharm Res Allied Sci. 2022;11(2-2022):36-44.
35. Iryna L, Dmytro L, Kseniia M, Olena B, Alina S, Dmytro M. Rational pharmacotherapy of respiratory diseases in the COVID-19 pandemic. Int J Pharm Res Allied Sci. 2022;11(1-2022):55-60.
36. Nordenström K, Lannering K, Mellander M, Elfvin A. Low risk of necrotising enterocolitis in enterally fed neonates with critical heart disease: An observational study. Arch Dis Child-Fetal Neonatal Ed. 2020;105(6):609-14.
37. Maynord PO, Johnson M, Xu M, Slaughter JC, Killen SA. A multi-interventional nutrition program for newborns with congenital heart disease. J Pediatr. 2021;228:66-73.
38. Stein A, Barnes J. Feeding and sleep disorders. In: Rutter M (ed) Child and Adolescent Psychiatry, 4th edn. Blackwell Science, Oxford, 2002:754-75.
39. Dellert SF, Hyams JS, Treem WR, Geertsma MA. Feeding resistance and gastroesophageal reflux in infancy. J Pediatr Gastroenterol Nutr. 1993;17(1):66-71.
40. Limperopoulos C, Majnemer A, Shevell MI, Rosenblatt B, Rohlicek C, Tchervenkov C. Neurodevelopmental status of newborns and infants with congenital heart defects before and after open heart surgery. J Pediatr. 2000;137(5):638-45.
41. Anderson JB, Brown DW, Lihn S, Mangeot C, Bates KE, Van Bergen AH, et al. Power of a learning network in congenital heart disease. World J Pediatr Congenit Heart Surg. 2019;10(1):66-71.
42. Dong S, Wu L, Duan Y, Cui H, Chen K, Chen X, et al. Metabolic profile of heart tissue in cyanotic congenital heart disease. Am J Transl Res. 2021;13(5):4224.
43. Gu Y, Hu Y, Zhang H, Fu W, Yang Y, Latour JM. Implementation of an evidence-based guideline of enteral nutrition for infants with congenital heart disease: A controlled before-and-after study. Pediatr Crit Care Med. 2020;21(6):e369-77.
44. Thommessen M, Heiberg A, Kase BF. Feeding problems in children with congenital heart disease: The impact on energy intake and growth outcome. Eur J Clin Nutr. 1992;46(7):457-64.
45. Joshi RO, Chellappan S, Kukshal P. Exploring the role of maternal nutritional epigenetics in congenital heart disease. Curr Dev Nutr. 2020;4(11):nzaa166.
46. Assefa B, Tadele H. Severe acute malnutrition among Unoperated Ethiopian children with congenital heart disease: A wake-up call to reverse the situation, a retrospective cross-sectional study. Ethiop J Health Sci. 2020;30(5):707-14.
47. Lipsitt LP, Crook C, Booth CA. The transitional infant: Behavioral development and feeding. Am J Clin Nutr. 1985;41(2):485-96.
48. Zhang J, Cui Y, Ma MZ, Luo Y, Chen X, Li J. Energy, and protein requirements in children undergoing cardiopulmonary bypass surgery: Current problems and future direction. J Parenter Enter Nutr. 2019;43(1):54-62.