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RISK STRATIFICATION OF NUTRITIONAL DEFICIENCY IN INFANTS WITH CONGENITAL HEART DEFECTS USING WHO ANTHRO AND STRONGKIDS

Rabbimova Dilfuza Toshtemirovna
MD, Associate Professor, Head of the Department of Propaedeutics of Children's Diseases Samarkand State Medical University Samarkand, Uzbekistan

Khalilova Manizha Abdurashidovna
Master of the Samarkand State Medical University

Abstract
In recent years, nutritional deficiency in children with congenital heart defects (CHD) complicated by chronic heart failure (CHF) has become an increasingly relevant issue in pediatric cardiology. This study clearly demonstrates that 74% of infants (n=50) aged 1 to 12 months had WHO Anthro Z-scores below –2 SD, and 38% were below –3 SD, indicating severe malnutrition. Furthermore, 56% of the sample comprised infants with cyanotic defects, consistent with Mehta et al. (2013), who noted enhanced catabolism under chronic hypoxia. Biochemical markers revealed hypoproteinemia (<60 g/L) in 58% and elevated C-reactive protein (>5 mg/L) in 22%. Risk stratification using the STRONGkids scale identified high risk of nutritional deficiency in 62% of patients, aligning with the findings of Joosten & Hulst (2014) and Sheveleva & Orlova (2021).

Keywords: Congenital heart defect; chronic heart failure; nutritional deficiency; STRONGkids; WHO Anthro; metabolism; infants.

Introduction

Recent international studies (Chourdakis et al., 2020) report malnutrition rates of 65–75% among hospitalized children with CHD, while certain European centers observe rates up to 80% in severe CHF cases (Joosten & Hulst, 2014). Domestic publications (Kiselnnikova & Afanasiev, 2020) show that 70% of patients have Z-scores below –2 SD, closely matching international data. However, comparative analysis indicates that cyanotic defects accounted for no more than 40% in those cohorts, whereas in our study, they represented 56%. According to Mehta et al. (2013), this is due to chronic hypoxia and accelerated protein catabolism. Therefore, faced with a heavier metabolic burden, we anticipated an even higher prevalence of severe malnutrition.

Materials and Methods

This prospective study included 50 infants aged 1 to 12 months admitted to the pediatric cardiac surgery department of the Samarkand Children's Center with echocardiographically confirmed CHD and clinical signs of CHF (Ross functional classes II–IV). Exclusion criteria were

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multisystem anomalies, genetic syndromes, active infections, and terminal conditions. The mean age was 5.8 ± 1.9 months; gender distribution was 52% male and 48% female. Prior to hospitalization, all infants were on mixed or breast feeding, but 68% (n=34) experienced feeding difficulties such as fatigue, vomiting, and reduced appetite. Enteral support with high-protein formulas was provided to only 12% (n=6), and 30% of families faced socio-economic barriers to accessing specialized nutrition.

Anthropometric measurements included weight, length, head circumference, and mid-upper arm circumference; Z-scores were calculated according to WHO Anthro standards. The biochemical panel included total protein, serum albumin, prealbumin, hemoglobin, serum iron, ferritin, and C-reactive protein. Hypoproteinemia (<60 g/L) was observed in 58%, anemia (Hb <110 g/L) in 48%, and elevated CRP (>5 mg/L) in 22%. Nutritional risk stratification was performed using the STRONGkids scale, revealing high risk in 62%, moderate risk in 28%, and low risk in 10% of cases.

Results and Discussion

First, the prevalence of malnutrition (Z < –2 SD) was 74%, matching the 65–75% reported by Chourdakis et al. (2020), while the rate of severe malnutrition (38%) approached the upper range of European data in severe CHD cases (Joosten & Hulst, 2014). Second, comparative analysis showed that infants with cyanotic defects were more prone to severe malnutrition (82% vs. 62% in acyanotic cases, $p<0.05$), in line with Mehta et al. (2013) who described the role of hypoxia in metabolic shifts. Third, the extended biochemical analysis identified signs of systemic inflammation (CRP >5 mg/L) in 22%, which is similar to the 25% reported in the Moscow prospective study by Kovalyova et al. (2021). Fourth, the use of STRONGkids confirmed its high sensitivity (up to 85% according to Joosten & Hulst, 2014), with 62% of high-risk infants requiring immediate nutritional intervention.

Conclusion and Practical Recommendations.

Nutritional deficiency is detected in 74% of infants with CHD and CHF, with 38% exhibiting severe malnutrition (Z < –3 SD).
Cyanotic defects are associated with a higher risk of malnutrition ($p<0.05$).
Comprehensive assessment (WHO Anthro + extended biochemistry + STRONGkids) should be a mandatory standard upon admission and during follow-up.
Individualized nutritional support should include enriched high-protein formulas, dynamic monitoring every 7–10 days, and parenteral supplementation for severe cases.Socio-economic barriers require coordination with social services and parent education programs.

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