Original Article

موضوع أصيل

MALNUTRITION IN CHILDREN WITH CONGENITAL HEART DISEASES

سوء التغذية لدى الأطفال المصابين بأمراض القلب الخلقية

Zeyad K. Abdullah, MD; Sawsan I. Habeeb, MD

د. زياد عبد الله، د. سوسن حبيب

ملخص البحث

هدف البحث: تمت إجراء دراسة من نمط الحالات والشواهد لتقييم الحالة التغذوية للرضع والأطفال الذين يعانون من أمراض القلب الخلقية، ودراسة العلاقة بين متغيرات العمر، الجنس، نمط الآفة القلبية الخلقية، القصة العائلية مع المتغيرات الغذائية للمرضى المحولين إلى مستشفى البصرة للولادة والأطفال ومستشفى البصرة العام خلال الفترة بين شهر تشرين الثاني 2014 وحتى شهر نيسان 2015.

طرق البحث: تم أخذ القصة المرضية التفصيلية من جميع المرضى بما في ذلك الأعراض المرضية، العمر عند التشخيص، التشخيص ونوع الآفة القلبية، نوع العلاج والتغذية المطبقة، فضلاً عن تقارير التصوير بالأمواج فوق الصوتية (الإيكو). تم إجراء فحوصات جهازية وعامة من ضمنها القياسات البشرية لجميع الأطفال والرضع في الدراسة، كما تم تقييم الحالة التغذوية تبعاً لتوصيات منظمة الصحة العالمية WHO والمركز الدولي للدراسات الإحصائية الصحية، حيث تم اعتماد وجود سوء التغذية عند المريض عندما تكون نقاط Z≥-2 بالنسبة الحالات التالية: الوزن بالنسبة للعمر، الوزن بالنسبة للطول والطول بالنسبة للعمر، كما تم تقييم نسب نقص الوزن، الهزال والتقزم عند المرضى.

النتائج: تمت دراسة 54 مريضاً يعانون من أمراض القلب الخلقية، منهم 33 (بنسبة 61.1%) ذكور و 21 (بنسبة 38.9%) إناث. شملت مجموعة الشاهد 58 من الرضع والأطفال بحيث كان العمر والجنس مطابق لمجموعة المرضى. كان معدل الوزن والطول ومحيط الرأس للمرضى الذين يعانون من أمراض القلب الخلقية (7.1 كغ، 66.8 سم، 41.8 سم على الترتيب) أقل بكثير من مجموعة الشاهد (9.9 كغ، 75.7 سم، 44 سم على الترتيب)، وبفارق هام إحصائياً (p<0.05)، كما كشفت الدراسة أن 44.4% من المرضى الذين يعانون من أمراض القلب الخلقية يعانون من الهزال، و 38.9% يعانون من التقزم بقيمة p=0.000 هامة إحصائياً، كان الهزال أكثر شيوعاً عند الرضع والأطفال الذين يعانون من أمراض القلب الخلقية غير المزرقة (بنسبة 63.3%)، بينما كان التقزم أكثر تواردا في حالات أمراض القلب الخلقية المزرقة (بنسبة 70.8%). كان الهزال والتقزم أكثر شيوعاً عند المرضى المعالجين بأدوية قصور القلب، والمرضى غير الخاضعين لعلاج طبي (بنسبة 37.0% و 29.6% على الترتيب) بقيمة p=0.000. سعى 5.6% من مرضى آفات القلب الخلقية للحصول على المشورة الطبية وذلك نتيجة لعدم زيادة الوزن، إلا أن غالبية المرضى راجعوا بسبب الأعراض المرتبطة بأمراض القلب الخلقية مثل ضيق التنفس، الزرقة (p=0.001).

الاستنتاجات: يعتبر سوء التغذية مشكلة بين الرضع والأطفال الذين يعانون من أمراض القلب الخلقية، لذلك ينبغي توجيه اهتمام خاص بالتشخيص وإجراء التداخل العلاجي والجراحي الباكر، مع ضرورة إجراء استشارة تغذوية لهؤلاء الأطفال بغية استعادة النمو الطبيعي لديهم.

ABSTRACT

Objective: *A case-control study was carried out to assess the nutritional status of infants and children with congenital heart diseases, and study selected variables as age, sex, types of congenital heart diseases, and family history in relation to the nutritional variables of patients who were admitted to Basra Maternity and Children Hospital and Basra General Hospital from October 2014 till April 2015.*

Methods: *Detailed history was taken from all patients including; identity, presenting symptoms, age at diagnosis and type of congenital heart diseases, treatment and feeding history as well as echocardiography reports were*

*Zeyad K. Abdullah, MD, Basrah General Hospital, Basrah, Iraq.

*Sawsan I. Habeeb, MD, Department of Pediatrics, Basrah Medical College, Basrah, Iraq. E-mail:sawsan19612000@yahoo.com.

reviewed. Systemic and general examinations including anthropometric measurements were carried out for all infants and children recruited in the study. Nutritional status was assessed based on WHO/National Center for Health Statistics, and malnutrition was considered when: weight for age, weight for height/length and height for age Z score ≤ -2, as well as proportions of underweight, wasting and stunting were assessed.

Results: *A total of 54 patients with congenital heart diseases were included in this study; 33 (61.1%) were males and 21 (38.9%) were females, and 58 infants and children were aged and sex matched as a control group. The mean weight, height/length and head circumference of patients with congenital heart diseases were (7.1 kg, 66.8 cm, 41.8 cm) respectively; which is significantly lower than control group (9.9 kg, 75.7 cm, 44 cm), p-value<0.05. Current study revealed that; 44.4% of patients with congenital heart diseases had wasting and 38.9% had stunting with significant p-value=0.000. The wasting was more common in infants and children with acyanotic congenital heart diseases (63.3%), while stunting was more in cyanotic congenital heart diseases (70.8%). Wasting and stunting significantly were more common in patients kept on anti-failure therapy (37.0% and 29.6%, respectively) than those without medical treatment, p-value=0.000. Only 5.6% of patients with congenital heart diseases seek medical advice for poor weight gain, and the majority presented with symptoms related to congenital heart diseases like breathlessness and cyanosis with p-value=0.001.*

Conclusions: *Malnutrition remains a problem among symptomatic infants and children with congenital heart diseases, so particular attention is required for early diagnosis, medical and surgical intervention and dietary management of those children to restore normal growth.*

INTRODUCTION

Congenital heart disease (CHD) is a major global health problem. Twenty-eight percent of all major congenital anomalies consist of heart defects.[1] The prevalence of malnutrition in children with congenital heart diseases being as high as 64% in developed countries of the world. The problem is more severe in the developing regions, where malnutrition is common even in otherwise normal children.[2] For infants with congenital heart disease, poor growth is a common co-morbidity that may have multiple factors including hemodynamic abnormalities related to cardiac physiology and disease severity, inadequate nutrient intake, gastrointestinal malabsorption, neurologic insults, and presumed increase in energy expenditure. Inadequate caloric intake appears to be the most important cause of growth failure in CHD. It may be due to anorexia, dyspnea and tachypnea.[3] Acute or chronic malnutrition occurred in 70% or more of patients with cyanotic CHD and those with congestive HF, but only in 30% in patients with neither.[2] Improved dietary intake and consequent catch-up growth have been documented in these patients even with simple nutritional counseling.[4]

METHODS

This case-control study was carried out to assess the nutritional status of infants and children with the diagnosis of congenital heart diseases, who were admitted to Basra Maternity and Children Hospital and Basra General Hospital, or visited pediatric emergency room between October 2014 and first of April 2015. A total of 54 patients, aged 1-36 months; 33 males and 21 females were included in the study, and 58 healthy infants and children, age and sex matched, were selected from infants and children visiting hospital for mild illnesses or those children referred for echocardiography examination with normal reports were enrolled as a control group.

Exclusive criteria:

- History of prematurity, intrauterine growth retardation.
- Known genetic malformations, dysmorphic features, and significant neurologic disability like cerebral palsy.

The echocardiography reports of all infants and children enrolled in this study were reviewed, and a new examination was carried out when required. CHD was classified according to American Heart Association into cyanotic and a cyanotic lesions.[5] As well as physical examination was carried out including systemic, general examination and anthropometric measurements; were assessed and applied to appropriate Z-score charts.

Commonly used anthropometric indices are: weight-for-age (WFA), length-for-age or height-for-age (HFA) and weight-for-length or weight-for-height (WFH), to identify underweight, stunting and wasting, respectively. Each of these nutritional indicators is expressed in standard deviation units from the median of the reference population and further classification accordingly as mild (< -1 to > 2 SD), moderate (<-2 to >-3 SD) or severe (<-3 SD) malnutrition.[6]

Data were analyzed using SPSS program Version 18, expressed by mean and standard deviation, a comparison of proportions was performed using Chi-square test, t-test and fisher exact test. For all tests p-value of <0.05 was considered as statistically significant.

RESULTS

Selected characteristics of studied patients: The mean ages of studied patients and control group was 1.98±1.32 and 1.79±1.16 months respectively, and 81.4% of patients were younger than 18 months. The percentage of patients presented with breathlessness and poor weight gain was 46.3%, and only 5.6% presented with a complaint of poor weight gain. Breast feeding was recorded in 14.8% of patients, and 9.3% of children presented with late diagnosis and positive family history of CHD, Table 1.

Distribution of congenital heart diseases in the studied children: Acyanotic lesions as VSD, ASD, and PDA constitute 55.6%, with VSD account for 33.4% of all lesions, and cyanotic lesions as transposition of great arteries (TGA), Tetralogy of Fallot and Ebstein anomaly account 44.4%, Tetralogy of Fallot was the most common type of cyanotic CHD 20.4% as shown in Table 2.

Growth parameters of patients and control group: Mean weight, length or height, and head circumference of patients with CHD were significantly lower than control group with significant p-value <0.000, Table 3.

Nutritional status of cases and controls: Significantly higher frequency of moderate and severe

Characteristics	Variables	No.	%
Sex	Male	33	61.1
	Female	21	38.9
Age (months)	1-6	31	57.4
	6-18	13	24
	18-36	10	18.6
Clinical presentation	Breathlessness and cyanosis	13	24.1
	Breathlessness and poor weight gain	25	46.3
	Breathlessness	11	20.3
	Cyanosis	2	3.7
	Poor weight gain	3	5.6
Feeding pattern	Breast feeding	8	14.8
	Bottle feeding	19	35.1
	Mixed feeding	4	7.4
	Complimentary feeding	23	42.5
Age of diagnosis (months)	<3	29	53.7
	3-6	20	37
	>6	5	9.3
Family history of CHD	Positive	5	9.3
	Negative	49	90.7

Table 1. Selected characteristics of patients with CHD.

Type of CHD		No.	%
Acyanotic (No. 30, 55.6%)	Ventricular septal defects (VSD)	18	33.4
	Atrial septal defects (ASD)	7	12.9
	Patent ductus arteriosus (PDA)	5	9.2
Cyanotic (No. 24, 44.4%)	Tetralogy of fallot (TOF)	11	20.4
	Transposition of great arteries (TGA)	7	12.9
	Ebstein anomaly (EA)	6	11.1
Total		54	100

Table 2. Types of congenital heart diseases in studied patients.

Indicators		Cases		Controls		*p-value
		No.	%	No.	%	
Wasting	Normal	14	25.9	49	84.5	<0.05
	Mild	16	29.6	9	15.5	
	Moderate	10	18.5	0	0.0	
	Severe	14	25.9	0	0.0	
Underweight	Normal	2	3.7	45	77.6	<0.05
	Mild	28	51.9	13	22.4	
	Moderate	11	20.4	0	0.0	
	Severe	13	24.1	0	0.0	
Stunting	Normal	11	20.4	52	89.7	<0.05
	Mild	22	40.7	6	10.3	
	Moderate	7	13.0	0	0.0	
	Severe	14	25.9	0	0.0	

*Exact fisher test

Table 4. Nutritional indicators among cases and control group.

wasting, underweight and stunting in children with CHD (p-value <0.05), as well as normal weight/length, weight/age, height/age percentage was reported in patients with CHD (25.9%, 3.7%, and 20.4%) and control group (84.5%, 77.6% and 89.7%) respectively, with significant p-value <0.05, Table 4.

Variables	Mean ±SD		p-value
	Cases	Control	
Weight (kg)	7.1 ±3.2	9.9±3.5	0.000
Length or height (cm)	66.8 ±16.9	75.7±12.5	0.000
Head circumference (cm)	41.8 ±4.9	44.0±4.5	0.000

Table 3. Growth parameters of patients and control group.

Nutritional status of patients with CHD in relation to selected patients variables: It was found that higher frequency of studied children were on anti-failure therapy; significantly wasted, underweight and stunted than those children without anti-failure therapy, as well as stunting was more frequent in cyanotic lesions while wasting was more common in acyanotic CHD, with significant p-value of 0.000 and 0.006 respectively, Table 5.

Logistic regression analysis: The selected variables included in the study were subjected to logistic regression analysis. It was found that the presenting symptoms (breathlessness and poor weight gain), type of CHD (VSD), and anti-failure therapy were significantly associated with malnutrition in infants and children with congenital heart disease, Table 6.

Variables			Total	Wasting		Underweight		Stunting		p-value
				No.	%	No.	%	No.	%	
Age (months)	<6		31	14	58.5	11	45.8	10	50.0	0.860
	6-12		13	5	19.4	9	36	9	35.6	
	18-36		10	5	22.1	4	18.5	2	14.3	
Sex	Male		33	13	39.4	18	54.5	16	48.5	0.933
	Female		21	11	52.3	6	28.5	5	23.8	
Types of CHD	Acyanotic		30	19	63.3	16	53.3	4	13.3	0.006
	Cyanotic		24	5	20.3	8	33	17	70.8	
Types of treatment	Anti failure therapy	No	6	2	3.7	4	7.4	2	3.7	0.000
		Yes	42	20	37.0	17	31.4	16	29.6	
	Surgery		6	2	3.7	3	5.5	3	5.5	

Table 5. Nutritional indicators in relation to selected patients variables.

DISCUSSION

Reports shows that congenital heart diseases related malnutrition is common, especially in developing countries, but prevalence varies widely. Significant deficits in weight, length, and head circumference reported in children with CHD compared with matched control group; probably attributed to low energy intake, hypermetabolism and cell hypoxia.

Previous reports showed that congenital heart diseases-related malnutrition is common especially in developing countries, but prevalence varies widely. Current study reveals that the percentage of acute and chronic malnutrition in infants and children with CHD are higher than other reports carried out in outpatients clinic in Baghdad by Hassan et al (29.5% and 21.9%),[7] and in Oman by Venugopalan et al (27%, and 24%),[8] respectively. Because the current study is hospital-based and enrolled studied patients were referred from pediatric ward for echocardiographic examination with severe diseases; their main presenting symptom was breathlessness, similar finding was concluded in other studies carried out in Bangladesh,[9,10] India[11,12] and western countries.[13-15]

Variable	95% Confidence interval		Odd ratio	p-value
	Lower	Upper		
Age	0.648	1.199	0.822	0.864
Sex	0.444	2.105	0.967	0.933
Feeding pattern	0.784	1.173	0.959	0.684
Clinical presentation	0.406	0.667	0.520	0.001
Anti-failure therapy	10.340	123.879	30.412	0.000
VSD	1.146	1.531	1.105	0.006

Table 6. Logistic regression of selected variable with .malnutrition in children with CHD

In South India, Vaidyanathan and colleagues reported a higher prevalence of underweight (59.0%) and wasting (55.9%) in children with CHD compared with the present findings, with wasting being more prevalent than stunting in children with CHD.[13] It is a well known fact that acyanotic CHD was more common than cyanotic congenital heart diseases,[16] and ventricular septal defect and Tetralogy of Fallot are the commonest acyanotic and cyanotic CHD since 1971.[9] Similar results were concluded and the frequencies of individual CHD are consistent with other studies carried out in Basra,[17] Saudi Arabia[18] and Nigeria.[19] But in contrast to a study carried out by Rahman et al, who conclude that atrial septal defect is common acyanotic congenital heart diseases, where they included adult patients with congenital heart diseases in their study.[20]

Children with acyanotic CHD on anti-failure therapy were more likely to be wasted, while those with cyanotic defects were more likely to be stunted, similar results reported by Hassan et al in Baghdad[7] and Salzer et al in Germany.[21] Possible explanations for the poor

growth include; inadequate intake of nutrients as well as increased oxygen consumption, increased mean total daily energy expenditure, impaired absorption secondary to the chronic venous congestion of the bowel, inefficient utilization of nutrients by the tissues, reduced serum Insulin-like growth factor-I (IGF-I) levels, decreased insulin secretion and associated congenital anomalies.[22]

CONCLUSIONS

The mean weight, height/length and head circumference of patients with congenital heart diseases were significantly lower than in control group. Wasting is more obvious in children with acyanotic congenital heart diseases on anti-failure therapy, while stunting is more common in children with cyanotic lesions. The presenting symptoms as; breathlessness with poor weight gain, type of lesion as ventricular septal defects and anti-failure therapy are significantly related to malnutrition in patients with congenital heart diseases. Few patients with congenital heart diseases seek medical advice for poor weight gain and majority were presented with complaints related to congenital heart diseases.

We recommended that; early diagnosis and treatment of children with CHD should be started soon after birth or in early infancy, to improve their growth with proper advice of dietitian for management of nutritional deficiency.

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