Dental caries and treatment needs in relation to nutritional status among children with congenital heart disease

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ABSTRACT

Background: Congenital heart disease is one of the most common developmental anomalies in children. These patients commonly have poor oral health that increase caries risk. Dental management of children with congenital heart disease requires special attention, because of their heightened susceptibility to infectious endocarditis. The aims of this study were to assess the severity of dental caries of primary and permanent teeth and treatment needs in relation to nutritional indicator (Body Mass Index) among children with congenital heart disease.

Materials and Methods: In this case-control study, case group consisted of 399 patients aged between 6-12 years old with congenital heart disease were examined for dental status in Ibn Al-Bitar specialized center for cardiac surgery in Baghdad/Iraq. A case-matched group (healthy control) of 485 children was also examined from primary schools in Baghdad city. Diagnosis and recording of dental caries and treatment needs were recorded according to the criteria of WHO (1997). The assessment of nutritional status (BMI) was performed following Centers for Disease Control and Prevention growth chart (2000). All data were analyzed using IBMSPSS version 23.

Results: Results recorded the highest mean rank value of (DMFS)and (dmfs) were among CHD cases than control group with statistically high significant difference. Results revealed the mean rank values of (ds, ms, fs and dmfs) were higher at age group 6-7 years among CHD cases, while the mean rank values of (DS, MS, FS and DMFS) were higher at age group 12 years with statistically high significant difference among age group. The mean rank values of all types of treatment needs were recorded to be higher among CHD cases than control group, except for children no treatment needs, these differences were statistically highly significant. Also this study found that the mean rank values of caries experience (ds, ms, fs and dmfs) were higher among wasted than well nourished CHD cases with statistically highly significant for dmfs. Moreover, the mean rank values of all types of treatment need required were higher among wasted CHD cases than well nourished; however, the differences were statistical highly significant.

Conclusion: The study revealed that these children are "at risk" from dental disease and malnourished, the primary focus should be on oral hygiene instructions, the awareness of infective endocarditis and they required a development of preventive programs.

Key words: congenital heart disease, dental caries, treatment need, BMI. **(J Bagh Coll Dentistry 2017; 29(2):108-114)**

INTRODUCTION

Congenital heart disease (CHD) refers to the structural or functional heart defect which is present at birth, it is one of the leading causes of morbidity and mortality in the first years of life [1,2]. There are many types of congenital heart defects, they range from simple defects with no symptoms to complex defects with severe, life-threatening symptoms but the most common anomalies Ventricular Septal Defect (VSD) and Aterial Septal Defect (ASD) [3]. Clinically classified depending on the existence of cyanosis, in acyanotic which are characterized by physiological amount of oxygen in arterial blood and normal skin color; in cyanotic characterized by reduced oxygen in arterial blood and cyanotic skin color [4,5]. Bad oral hygiene that usually associated with these children may be largely attributed to cardiac disease [6,7]. Studies have shown significant findings regarding poor oral health, especially periodontal status, dental caries and dental procedures are risk factors in these patients [6,8].

In addition, several studies showed that dental caries had a higher prevalence and severity among children with congenital heart disease when compared to healthy controls [9,10,11]. The oral microbiological flora plays a very important role in the etiopathogenesis of bacterial endocarditis, given the condition that it is of oral or dental origin [12]. Untreated dental decay in paediatric cardiac patients has a significant implication in the medical care of these patients, as it may develop into pulp infections which are associated with bacteraemia, endocarditis, and even brain abscesses [7,13]. The severity of growth disturbance depend on the anatomical defect of heart and its functional defect, however, most children with mild defect grow normally but gaining weight slower than normal, WHO describe a list of growth problem with z score lines [7, 5, 9, 14]. Panggabean et al observed that malnutrition more prevalent and more severe in children with CHD than healthy [15]. A study of Al-Etbi revealed that 60% of children among VSD groups were in malnourished status [11].Yet, in Iraq, no study was conducted regarding severity of dental caries and treatment need in relation to nutritional status (BMI) among different types of CHD children

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congenital heart disease for this reason, the study was designed.

MATERIALS AND METHODS

The sample involved children with congenital heart disease (Cases) consisted of 399 males and females aged between (6-12) years according to the last birthday [16].This study was carried out during the period between December, 2015 and May, 2016. Collection sample (cases) includes all patients attending the hospital from December 2015 to March 2016, firstly, diagnosed by the specialist as having different type of congenital heart disease attended to Ibn Al-Bitar specialized center for cardiac surgery for diagnosis, treatment and follow up. All children were examined with no medication for at least three months ago from start of examination date. The control group consisted of 485 students selected randomly matching with age and gender from primary schools in Baghdad City; they are healthy without any systemic disease (from personal file). Diagnosis and recording of dental caries (dmfs, DMFS) and treatment need were recorded according to the criteria of WHO 1997 [16] using plane mouth dental mirrors and (CPI) probe. The assessment of nutritional status was performed using BMI following Centers for Disease Control and Prevention growth chart [17]. BMI was calculated by dividing weight of each child in kilogram by his/her length^2 in meter.

Non-normally distributed variables were conveniently presented by median and mean rank. The difference in median between 2 groups was assessed by non-parametric test (Mann-Whitney), while between 3 groups Kruskal-Wallis test was used; and the differences between percentages Chi-square (χ^2) test was used. Data analysis was conducted by application of IBMSPSS program version 23.

RESULTS

Table (1) illustrates the distribution of total sample by age. The high percentage of children was found at age group 6-7 years old among both groups. The median and mean rank of caries experience and its component of primary and permanent teeth (ds, ms, fs and dmfs; DS, MS and FS and DMFS) respectively among CHD cases and control group are seen in Table (2). Results showed that the mean rank values of caries experience and its components of primary and permanent teeth were higher among CHD cases than control group, except for (fs and FS), all these results were statistically high significant (ds: Z=-17.152, Mann-Whitney=33447.0; ms: Z=-7.493, Mann-Whitney=76607.0; fs: Z=-5.984, Mann-Witney=87134.0; dmfs: Z=-16.529, Mann-Whitney=35160.0; Ds: Z=-10.265, Mann-Whitney=71756.5; MS: Z=-4.304, Mann-Whitney=93120.0; FS: Z=-2.547, Mann-Whitney=92905.5; DMFS: Z=-7.875, Mann-Whitney=75617.5), ($p<0.01$). Concerning age, the median and mean rank of caries experience and its component of primary teeth (ds, ms, fs and dmfs) among CHD cases is shown in Table (3). Results showed that the mean rank values of (ds and fs) were higher at age group 6-7 years, with statistically highly significant (ds: Chi=174.182, df=3; fs: Chi=5.319, df=3;), ($p<0.01$).While for permanent teeth, Table (4) illustrates the median and mean rank of caries experience and its component of permanent teeth (DS, MS, FS and DMFS) among CHD cases by age. The mean rank values of caries experience (DS, MS, FS and DMFS) were found to be higher at age group12 years, with statistical highly significant differences (DS: Chi=200.815, df=3; MS: Chi=32.977, df=3; FS: Chi=26.265, df=3; DMFS: Chi=200.295; df=3), ($p<0.01$). Regarding the treatment need, the median and mean rank among both groups seen in Table (5). The mean rank values of all types of treatment need were recorded to be higher among CHD cases than control group, except for TN0 (no treatment need) recorded opposite picture, these differences were statistically highly significant (TN0: Z=-20.225, Mann-Whitney=20570.0; TN1: Z=-22.729, Mann-Whitney=15434.0; TN2: Z=-16.127, Mann-Whitney=37936.0; TN6: Z=-11.156, Mann-Whitney=68739.0; TN7: Z=-7.684, Mann-Whitney=76180.0), ($p<0.01$). Table (6) demonstrates the median and mean rank of treatment need required among CHD cases by age. All the differences among different age for all type of treatment need were statistically significant however a higher mean rank value for TN0- no treatment need was recorded among age group 12 years, while concerning TN1- one surface filling recorded higher mean rank value among age group 6-7 years; for TN2 and TN6 mean rank values were higher among age group 8-9 years than other age groups and mean rank value of TN7- need for other treatment care was higher among age group 10-11 years (TN0: Chi= 206.262, df=3; TN1: Chi=21.736, df=3; TN2: Chi=96.564, df=3; TN6: Chi=15.670, df=3; TN7: Chi=15.361, df=3), ($p<0.01$). Regarding nutritional status, the mean values of (BMI) were lower among CHD cases (-0.6±0.11) than control group (0.8±0.09) with statistically highly significant differences Z=-12.497, Mann-Whitney=49334.0), ($p<0.01$).Also, the distribution of wasting among CHD cases by age

are seen in table (7). The percentage of wasting was higher among age group 10-11years but lower in age group of 12 years with statistically significant difference (Chi=8.373, df=3, p<0.05).Table (8) demonstrates caries experience and its component of primary and permanent teeth (ds, ms, fs and dmfs; DS, MS, FS and DMFS) respectively according to nutritional indicator body mass index for age (BMI) among CHD cases. All mean rank values of caries experience were higher among wasted children than well nourished, while the opposite results for permanent teeth with statistically highly significant for dmfs (Z=-3.096, Mann-Whitney=7257, p<0.01) and significant for ms (Z=-2.297, Mann-Whitney=8215.5, p<0.05).The median and mean rank of treatment need required according to nutritional indicator body mass index for age (BMI) among CHD cases is shown in Table (9). A higher values of mean rank of teeth with TN0-no treatment need and those in need of TN1-one surface filling were observed among well-nourished than wasted, while the opposite was found for other types; however, the differences were statistically highly significant (TN0: Z=-1.346, Mann-Whitney= 8665; TN1: Z=-2.135, Mann-Whitney=8049; TN2: Z=-0.835, Mann-Whitney=9082; TN6: Z=-2.099, Mann-Whitney=8336; TN7: Z=-1.879, Mann-Whitney=8496.5), (p<0.01).

Table 1: The distribution of total sample by age (year).

Age groups	CHD* cases		Control group	
	No.	%	No.	%
6-7	172	43.1	179	36.9
8-9	69	17.3	129	26.6
10-11	81	20.3	81	16.7
12	77	19.3	96	19.8
Total	399	100.0	485	100.0

*Congenital heart disease

Table 2: The median and mean rank of caries experience and its component of primary and permanent teeth (ds, ms, fs and dmfs; DS, MS, FS and DMFS) among CHD* cases and control group.

Caries experience	CHD* cases			Control group		
	No.	Median	Mean rank	No.	Median	Mean rank
ds	399	11	601.2	485	0	312.0
ms		0	493.0		0	401.0
fs		0	418.4		0	462.3
dmfs		12	596.9		2	315.5
DS		0	505.2		0	391.0
MS		0	451.6		0	435.0
FS		0	432.8		0	450.4
DMFS		0	494.5		0	398.9

*Congenital heart disease

Table 3: The median and mean rank of caries experience and its component of primary teeth (ds, ms, fs and dmfs) among CHD* cases by age (year).

Age	Caries experience											
	ds			ms			fs			dmfs		
	No.	Median	Mean rank	No.	Median	Mean rank	No.	Median	Mean rank	No.	Median	Mean rank
6-7	172	13	259.7	172	0	196	172	0	202.6	172	14	247.1
8-9	69	13	254	69	0	233.6	69	0	198	69	17	264.4
10-11	81	6	150	81	0	217.2	81	0	198	81	10	171.1
12	77	0	70.9	77	0	160.8	77	0	198	77	0	67.6

*Congenital heart disease

Table 4: The median and mean rank of caries experience and its component of permanent teeth (DS, MS, FS and DMFS)among CHD*cases by age(year).

Age	Caries experience											
	DS			MS			FS			DMFS		
	No.	Median	Mean rank	No.	Median	Mean rank	No.	Median	Mean rank	No.	Median	Mean rank
6-7	172	0	144.5	172	0	192.5	172	0	194.1	172	0	142.6
8-9	69	0	161.3	69	0	192.5	69	0	198.8	69	0	163.2
10-11	81	1	244.8	81	0	202.5	81	0	195.4	81	1	243.3
12	77	4	311.6	77	0	220.9	77	0	219.0	77	4	312.5

*Congenital heart disease

Table 5: The median and mean rank of treatment need required of teeth among CHD* cases and control group.

Type of treatment need	CHD* Cases			control group		
	No.	Median	Mean rank	No.	Median	Mean rank
TN0-No treatment need	399	16	251.6	485	23	599.6
TN1-One surface filling		3	646.3		0	274.8
TN2- Two or more surface filling		2	589.9		0	321.2
TN6- Extraction		0	512.7		0	384.7
TN7- Need for other care		0	494.1		0	400.1

*Congenital heart disease

Table 6: The median and mean rank of treatment need required among CHD* cases by age (year).

Type of treatment need	Age											
	6-7			8-9			10-11			12		
	No.	Median	Mean rank	No.	Median	Mean rank	No.	Median	Mean rank	No.	Median	Mean rank
TN0-No treatment need	172	13	119.8	69	16	186.4	81	18	256.0	77	22	332.5
TN1-One surface filling		4	229.8		3	168.8		3	175.4		3	187.2
TN2- Two or more surface filling		3	238.2		4	257.1		2	155.2		1	110.7
TN6- Extraction		0	207.0		0	225.8		0	195.4		0	166.0
TN7- Need for other care		0	190.3		0	222.2		0	224.1		0	176.6

*Congenital heart disease

Table 7: The distribution of wasting among CHD* cases by age (year).

Age	CHD* cases		
		Wasting	
	Total	No.	%
6-7	172	27	15.7
8-9	69	9	13.0
10-11	81	17	21.0
12	77	4	5.2

*Congenital heart disease

Table 8: Caries experience and its component of primary and permanent teeth (ds, ms, fs and dmfs; DS, MS, FS and DMFS) according to nutritional indicator among CHD* cases.

Caries experience	nutritional indicator					
	Well nourished			Wasted		
	No.	Median	Mean Rank	No.	Median	Mean Rank
ds	342	11	196.5	57	12	220.7
ms		0	195.5		0	226.9
fs		0	199.7		0	201.5
dmfs		12	192.7		16	243.7
DS		0	202.5		0	185.1
MS		0	200.7		0	196.0
FS		0	200.6		0	196.6
DMFS		0	201.7		0	186.1

*Congenital heart disease

Table 9: The median and mean rank of treatment need required according to nutritional indicator among CHD* cases.

Treatment need	nutritional indicator					
	Well nourished			Wasted		
	No.	Median	Mean rank	No.	Median	Mean rank
TN0-No treatment need	342	16	203.2	57	16	181.0
TN1-One surface filling		4	205.0		2	170.2
TN2- Two or more surface filling		2	198.1		3	211.7
TN6- Extraction		0	195.9		0	224.8
TN7- Need for other care		0	196.3		0	221.9

*Congenital heart disease

DISCUSSION

This study observed that the caries experience and its components of primary and permanent teeth were higher among CHD cases than control group, with statistically high significant differences, these results in line with other studies [9,18-23], however, these finding may be attributed to decrease dental intervention in the cardiac group as compared to the control group may be related to the high complexity of congenital cardiac disease and the greater health demands made by this medical condition [24]. Many parents mentioned that they had experienced a dentist's refusal to treat their child, also inadequate professional and home care [19, 22, 18]. Also, particularly disappointing was that a large number of children brushed their teeth only once or no times per day. Paradoxically, this is because the parents and children may be aware that bleeding gums are potentially harmful and are unaware that if gingiva bleed on brushing [19, 25]. Several studies have shown that socioeconomic conditions may influence oral health status of children with CHD [26- 28]. Or could be attributed to the change in salivary constituents and parameters that related to increase in dental caries experience among CHD group (children with VSD) compared to the control group [11]. another explanation could be due to the digoxine which is cardiac glycoside medication mostly named sugar loaded medicine (sweetened with 30-50% sugar) which related to dental caries[9, 29]. Since dental caries is a chronic disease with accumulative effect, in spite that, CHD group in this study with no medication for just three months ago. The present study recorded that the caries experience in the primary dentition among CHD cases was decreased with age, the same findings were in other studies among healthy children [30-32]. This may be related to decrease in number of primary teeth with advanced age (the natural shedding of primary teeth) [33]. This was confirmed by study of Al-Etbi among CHD children [11]. Also, this may explain that the criteria of one surface filling need (TN1) decrease gradually with increase age among CHD children according to the results of this study. However no Iraqi study was found regarding dental treatment need among CHD cases. Concerning permanent dentition, the mean rank values of caries experience were higher at age group12 years than other age groups this may be related to the accumulative nature of caries lesion that increase with age [34, 35].

This study revealed that the CHD cases need for more dental treatment and oral health care with preventive program than control group, as a high caries experience among CHD cases was noticed, in addition, the majority of studies with heart disease patients of all ages reported that the dental health of these subjects is usually poor [19, 21, 36].

The values of BMI was compared according to CDC growth according to the age and gender because unavailability of Iraqi standard for comparison [19]. Regarding nutritional status, the mean values of (BMI) were lower among CHD cases than control group with statistically highly significant differences. It is a popular view that children with congenital heart disease are often small and undernourished [37,38]. This also found by previous Iraqi study among VSD group [11]. Also, the adverse impact of CHD on growth has been reported by many studies and they attributed to the effects of increased total energy expenditure in these patients [39- 43]. Concerning age, the percentage of wasting was higher among age group 10-11years but lower in age group of 12 years with statistically significant difference. This may attributed to that medical condition of those children with congenital heart disease become better due to spontaneous closure of defect with time because some of cases require no treatment just periodic follow up and prophylaxis or other cases resolved with non-surgical intervention [5, 44], other possible cause, with age, the ability of children to depend on themselves to rely dietary requirement and take meals increase gradually because of normal development, which is reflected on their nutritional status positively with increased nutritional requirements commensurate with the growth of objects. In present study the caries experience (dmfs) were found to be higher among wasted than well-nourished CHD cases, and this may explain that the higher dental treatment was needed among wasted than well-nourished CHD cases. This study is in agreement with Al-Etbi [11]. The increased severity and prevalence of dental caries among malnourished children may be attributed to the nutritional deficiency which increase tooth susceptibility to dental caries by changing in tooth formation or in the quality of the hard tissues of the tooth that can be affected by nutrition [44].

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المستخلص

ألخلفية : مرض القلب الخلقي هو واحد من أكثر العيوب التنموية شيوعا في الأطفال. الأطفال المصابين بمرض القلب الخلقي عادة لديهم الصحة الفموية ضعيفة الأمر الذي يزيد مخاطر الاصابه بتسوس الأسنان. العناية بأسنان الأطفال الذين يعانون من مرض القلب الخلقي تتطلب اهتماما خاصا، بسبب قابليتهم المتزايدة للاصابه بالتهاب شغاف بطانة القلب. إن أهداف هذه الدراسة كانت لتقييم شدة تسوس الأسنان اللبنية والدائميه مع احتياجات العلاج وعلاقتها مع مؤشر التغذية لدى الأطفال المصابين بمرض القلب الخلقي.

المواد والطرق : في هذه الدراسة المقارنة,تم فحص الأسنان لمجموعة الحالة والتي تكونت من 399 مريضا تتراوح أعمارهم 6-12 سنه الذين يعانون من مرض القلب الخلقي في المركز التخصصي ابن البيطار لجراحة القلب في بغداد/العراق. إما ألمجموعه المطابقة (الضابطة) من 485 طفل تم فحصهم من مدارس ابتدائية في مدينة بغداد. تم تشخيص وتسجيل تسوس الإنسان واحتياجات العلاج وفقا لمعايير منظمة الصحة العالمية (1997). تم تقييم الحالة التغذويه (مؤشر كتلة الجسم) وفق خريطة نمو مركز الوقاية والسيطرة على المرض (2000). وتم تحليل جميع البيانات باستخدام IBMSPSS ألنسخه 23.

النتائج : سجلت النتائج أعلى قيمه للرتب الوسطية (DMFS) و(dmfs) بين الأطفال المصابين بمرض القلب الخلقي مقارنه بالمجموعة الضابطة مع اختلافات معنوية عاليه ($p>0.01$).كشفت النتائج إن أعلى قيم للرتب الوسطية (ds, ms, fs, and dmfs) كانت للفئة العمرية (6-7) سنوات لدى حالات مرض القلب الخلقي, بينما أعلى قيم للرتب الوسطية (DS, MS, FS, and DMFS) كانت للفئة العمرية (12) سنه مع وجود اختلافات معنوية عالية. قد سجلت أعلى قيم للرتب الوسطية للأطفال المصابين بمرض القلب الخلقي لكل أنواع الحاجات العلاجيه مقارنة بأطفال ألمجموعه الضابطة,باستثناء الاطفال الذين لايحتاجون إلى علاج, وكانت هذه الاختلافات معنوية عاليه . وأظهرت نتائج الدراسة إن قيم الرتب الوسطية شدة التسوس ومكوناته للأسنان اللبنية (ds, ms,fs and dmfs) أعلى بين الذين يعانون من نقص الوزن والهزال من الأطفال الذين لايعانون من نقص الوزن والهزال في حالات مرض القلب الخلقي مع وجود اختلافات معنوية عاليه. وعلاوة على ذلك, ان قيم متوسط الرتب لجميع متطلبات العلاج أعلى لدى الأطفال الهزل من الأطفال الغير هزال ممن لديهم مرض قلب خلقي ماعدا (TN1,TN0) مع وجود فروق معنوية عاليه.

الاستنتاج : أوضحت نتائج الدراسة إن هؤلاء الأطفال "في خطر" من أمراض الأسنان المختلفة، وينبغي أن يكون التركيز الرئيسي على إرشادات النظافة والعناية الفمويه والوعي حول التهاب شغاف القلب, أضافه إلى الحاجة لتطوير البرامج الوقائية.