

Oral-dental hygiene and oral microorganisms in children with and without congenital heart disease

Erniwaty P Panggabean, MD; Lily Irsa, MD; Rosihan Anwar, MD; Munar Lubis, MD; Rusdidjas, MD; Syahril Pasaribu, MD

ABSTRACT

Objective This study was done to compare the dental and oral hygiene status of children with and without congenital heart disease (CHD) by investigating oral microorganisms and dental and oral hygiene indices.

Methods A cross-sectional study was done on children aged 2 to 15 years from April 2002 to December 2003 at the Department of Child Health, Haji Adam Malik Hospital, Medan. There were two subject groups, the first consisting of children with CHD and the second of those without. The dental and oral hygiene status was determined by determining caries index and oral hygiene index. Swabs from the subjects' upper first molars were taken and cultured to determine the types of microorganisms present. Data were analyzed using the chi-square test, Fisher's exact test, and t-test.

Results There was a significant difference in mean oral hygiene index between children with (mean 2.75; SD 1.85) and without (mean 1.45; SD 0.78) CHD ($P < 0.001$). Positive bacterial cultures were more frequent in children with CHD than in those without. The proportion of normal anaerobes was significantly higher in children with CHD ($P = 0.038$). Such a significant difference was not found for normal aerobes, pathogenic aerobes, and pathogenic anaerobes. In children with CHD, there was no significant association between mean caries index and oral hygiene index with culture results. In those without CHD, a significant association was found between the caries index components of decayed tooth index ($P = 0.003$) and DMF-T ($P = 0.022$) with culture results.

Conclusions Oral-dental hygiene in children with CHD is poor relative to that in children without CHD. Microorganism growth appears more likely in children with CHD than in those without [Paediatr Indones 2005;45:127-131].

Keywords: congenital heart disease, dental hygiene, oral hygiene, oral microorganisms, caries index, oral hygiene index

Congenital heart disease (CHD) is defined as an abnormality in cardiocirculatory structure or function that is present at birth.¹ About 0.8% of live births are complicated by cardiovascular malformations.¹⁻³ The cause of most CHD is unknown. Thirteen percent of patients with CHD have an associated chromosomal abnormality.² Impaired growth and physical development and delayed onset of adolescence are common features of many cyanotic and, to a lesser extent, acyanotic forms of CHD. The severity of growth disturbance depends on the anatomical lesion and its functional effect.¹ Most patients with CHD have primary care needs similar to those of patients without CHD, with the additional requirement for endocarditis prophylaxis and a more thorough cardiovascular assessment at routine examinations. Two aspects of routine pediatric care occasionally neglected or delayed in patients with CHD are immunizations and prophylactic dental care.⁴ Infective endocarditis is a serious and often fatal systemic disease that has been associated with dental diseases and treatment.⁵ Previous case series indicate that

From the Department of Child Health, Medical School, University of Sumatera Utara, Medan, Indonesia (EPP, LI, ML, R, SP) and the Department of Microbiology, Islamic University of Sumatera Utara, Medan, Indonesia (RA).

Reprint requests to: Erniwaty Panggabean, MD, Department of Child Health, Medical School, University of Sumatera Utara, Adam Malik Hospital, Jl. Bunga Lau No.17, Medan 20136, Indonesia. Tel./Fax. 62-61-8361721.

approximately 15% of infective endocarditis cases were caused by oral organisms and occurred in patients who had undergone a recent dental procedure.^{6,7}

The objectives of this study were to compare oral-dental hygiene status and oral microorganisms between children with and without congenital heart disease, and to study the association between oral-dental hygiene status to the presence and profile of oral microorganisms in these children.

Methods

A cross-sectional study was undertaken from April 2002 to December 2003 at the Department of Child Health, Medical School, University of Sumatera Utara/Haji Adam Malik Hospital. Study subjects were children who had been diagnosed with CHD by echocardiography done by a pediatric cardiologist. Children were included if they were 2 to 15 years old and had never undergone a surgical heart procedure. They were excluded if they were under dental and oral hygiene care by a dentist, under cytostatic or corticosteroid therapy, or had any other congenital malformation (e.g., Down syndrome, cleft lip and palate), chronic disease (e.g., tuberculosis, malignancy, endocrine and metabolic diseases), or neurological malformation. Parental informed consent was obtained for all subjects. As control group, children without CHD were recruited, age- and gender-matched. Ethical clearance for this study was obtained from the Medical Research Ethics Committee, Medical School, University of Sumatera Utara.

This study examined the subjects' dental and oral hygiene by calculating the caries index and oral hygiene index (OHI). To determine the caries index, the occurrence of dental caries was evaluated by calculating the decayed, extracted, and filled tooth index (DEF-T) for primary teeth and the decayed, missing, and filled tooth index (DMF-T) for permanent teeth. Oral hygiene index was evaluated by calculating the calculus index and debris index.⁸ Dental and oral hygiene were evaluated at the Dentistry School, University of North Sumatera. Microbiological examinations were done on cultures of swabs from the children's first upper molar (M1). The swab cultures were done in the Microbiology Laboratory of the Medical School, Islamic University of North Sumatera. Subjects' nutritional status were determined based on body weight for age (BW/A) and body length for age (BL/A).

The chi-square and Fisher's exact tests were used to compare proportions. Continuous variables were compared using the t-test. Results were considered statistically significant when $P < 0.05$. Data analysis was performed using SPSS 10.5 for Windows.

Results

Thirty-five subjects each were enrolled in the CHD and non-CHD group. The characteristics of subjects are summarized in **Table 1**. Both groups had a mean age of 6.83 (SD 3.07) years. In both groups, subjects consisted of 16 males and 19 females. Both groups appeared to be similar in dental caries and parental education status. However, they were different in nutritional status.

Comparison of caries index in children with and without CHD showed no significant difference ($P > 0.05$). However, there was a significant difference in OHI between the two groups, with mean OHI of 1.45 (SD 0.78) for the CHD group and 2.75 (SD 1.85) for the non-CHD group ($P < 0.001$). This indicated that oral hygiene of children with CHD was poor relative to that of children without CHD.

Positive microbiological cultures were found more frequently in children with CHD than in those without (**Table 2**). Normal aerobes, normal anaerobes, pathogenic aerobes, and pathogenic anaerobes were positive in 77.1%, 17.1%, 37.1%, and 51.4% subjects in the CHD group, respectively, while in the non-CHD group they were positive in 74.3%, 0%, 14.3%, and 25.7% respectively. The differences were found to be statistically significant only for normal anaerobes ($P = 0.038$).

The association between caries index and OHI with culture results among children with and without CHD are shown in **Table 3**. There was no significant association of caries index and OHI with culture results in children with CHD. In children without CHD the association of OHI with culture results was insignificant, but that of the caries index components of decayed tooth index and DMF-T with culture results was significant ($P = 0.003$ and $P = 0.022$, respectively).

Discussion

It is well known that malnutrition accompanies and contributes to morbidity in CHD. Growth interference and malnutrition in CHD can be the result of anorexia

TABLE 1. CHARACTERISTICS OF CHILDREN WITH AND WITHOUT CHD

Variables	CHD N	Non-CHD N
Sex		
Male	16	16
Female	19	19
Mean age (years)	6.83	6.83
Mean body weight (kg)	17.27	20.86
Mean body length (cm)	110.9	117.17
Nutritional status (BW/A)		
Normal	3	15
Mild malnutrition	11	16
Moderate malnutrition	16	3
Severe malnutrition	5	1
Nutritional status (BL/A)		
Normal	7	20
Mild malnutrition	12	10
Moderate malnutrition	8	5
Severe malnutrition	8	0
Type of CHD		
Cyanotic	8	
Acyanotic	27	
Caries		
Positive	34	32
Negative	1	3

BW/A: body weight for age
BL/A: body length for age

TABLE 2. MICROORGANISMS CULTURED FROM UPPER FIRST MOLAR

Variables	CHD N	Non-CHD N	P
Normal aerobes			0.435
None	8	9	
<i>S. viridans</i>	9	5	
<i>M. catarrhalis</i>	6	13	
<i>S. mutans</i>	2	2	
Mixed	6	4	
Others	4	2	
Normal anaerobes			0.038*
None	29	35	
<i>Peptococcus sp.</i>	5	0	
Diphtheroids	1	0	
Pathogenic aerobes			0.07
None	22	30	
<i>S. aureus</i>	12	4	
<i>S. pyogenes</i>	1	1	
Pathogenic anaerobes			0.118
None	17	26	
<i>B. melaniogenes</i>	11	6	
<i>Peptostreptococcus</i>	5	1	
<i>Actinomyces</i>	1	0	
<i>Fusobacterium</i>	1	2	

* Significant

TABLE 3. MEAN CARIES INDEX, MEAN ORAL HYGIENE INDEX, AND CULTURE RESULTS

Indices	CHD		P	Non-CHD		P
	Culture + (N=29)	Culture - (N=6)		Culture + (N=28)	Culture - (N=7)	
Caries index						
Decayed (SD)	7.69 (4.73)	8.17 (4.26)	0.821	7.86 (3.91)	2.86 (2.85)	0.003*
Missing (SD)	2.38 (3.24)	2.50 (3.02)	0.934	3.11 (3.9)	2.29 (4.54)	0.632
Filled (SD)	0	0		0	0	
DMF-T (SD)	10.07 (5.85)	10.67 (6.31)	0.823	11.32 (6.06)	5.14 (6.23)	0.022*
Oral hygiene index (SD)	2.87 (1.99)	2.16 (0.66)	0.399	1.53 (0.76)	1.13 (0.81)	0.236

* significant

and inadequate nutrient and caloric intake, hypermetabolic state, acidemia and cation imbalance, tissue hypoxia, recurrent respiratory infections, and endocrine or genetic factors.¹ In our study, malnutrition appears to be more prevalent and more severe in children with CHD than in those without (Table 1). Varan et al, in their study in children with cyanotic and acyanotic CHD in 1996-1997, reported that 65% of the children were below the 5th percentile for weight, and 41% were below the 5th percentile for both weight and height.⁹

In the early 1930s, an expanding body of literature documented bacteremia after a wide variety of dental procedures, including tooth brushing and chewing, in uninfected mouths.^{10,11} Prophylaxis is particularly important for children because endocarditis is still associated with high morbidity and mortality. Cardiac

conditions have been stratified by the American Heart Association (AHA) into high, moderate, and negligible-risk categories. Prophylaxis is recommended for those in the high and moderate categories.^{12,13} In this study, 8 children fell into the high risk category and the other 27 fell in to the moderate risk category.

The prevalence of dental caries in this study was 97.1% in children with CHD and 91.4% in children without CHD children. These prevalences were higher than those among pre-school children in Jakarta as reported by Suwelo (1992). The latter reported that 88.96% of the children studied had dental caries.¹⁴ Aldy et al (1979) found that the prevalence of dental caries among children <5 years old in Medan was 54%.¹⁵ Yuyus reported that 97.5% of primary school students in Bekasi had dental caries.¹⁶

There were no significant differences in the means of DMF-T index or DEF-T index between children with and without CHD. The result of this study showed that at least there are ten dental problems in each child. This result was higher than SKRT 1995, which found this number to be 6.44 among Indonesian people.¹⁷ Yuyus *et al* reported this to be 2.571 for rural and 2.225 for urban area.¹⁶

This study found significantly more positive cultures in children with CHD than in those without, especially with regard to normal anaerobes, pathogenic aerobes, and pathogenic anaerobes. The two groups differed significantly in the types of normal anaerobic bacteria found in cultures of upper first molar swabs ($P=0.04$). The microorganisms frequently found from the swab culture of children with CHD were *Streptococcus pyogenes* (34.3%), *Bacteroides melaniogenes* (31.4%), *Staphylococcus aureus* 29%, *Streptococcus viridans* (25.7%), and *Streptococcus mutans* (5.7%). Meanwhile, those frequently found in children without CHD were *Moraxella catarrhalis* (37.1%), *Bacteroides melaniogenes* (17.1%), *Streptococcus viridans* (14.3%), and *Streptococcus mutans* (5.7%). In a previous study, Strom *et al* found *Streptococcus viridans*, *Streptococcus anaerobe*, *Haemophilus*, *Actinobacillus*, *Cardiobacterium*, *Eikanela*, *Kingela*, and *Neisseria sp.* as the types of bacteria frequently found in children with CHD.¹⁸

The limitations of this study lie in that culture specimens were taken from upper first molars only. For further study, we recommend that culture specimens are also taken from saliva and/or blood.

In conclusion, children with CHD had poor oral-dental hygiene relative to those without CHD. Microorganism growth appears more likely in children with CHD than in those without. There is no significant association between caries index and OHI with culture results in children with CHD. In children without CHD, the association is significant between caries index components of decayed tooth index and DMF-T with culture results.

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