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

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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 0.85) 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,1,2 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...
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 be-
tween 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 de-
bris 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 cul-
tures 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 was <0.05. Data analy-
isis 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 rela-
tive 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, patho-
genic 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% respec-
tively. The differences were found to be statistically sig-
nificant 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 re-
sults in children with CHD. In children without CHD
the association of OHI with culture results was insig-
nificant, 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
and inadequate nutrient and caloric intake, hypermetabolic state, acidemia and cation imbalance, tissue hypoxia, recurrent respiratory infections, and endocrine or genetic factors. 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. 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

## 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         |       |
| S. viridans        | 9     | 5         |       |
| M. catarrhalis     | 6     | 13        |       |
| S. mutans          | 2     | 2         |       |
| Mixed              | 6     | 4         |       |
| Others             | 4     | 2         |       |
| Normal anaerobes   |       |           | 0.038*|
| None               | 29    | 35        |       |
| Peptococcus sp.    | 5     | 0         |       |
| Diphtheroids       | 1     | 0         |       |
| Pathogenic aerobes |       |           | 0.07  |
| None               | 22    | 30        |       |
| S. aureus          | 12    | 4         |       |
| S. pyogenes        | 1     | 1         |       |
| Pathogenic anaerobes|      |           | 0.118 |
| None               | 17    | 26        |       |
| B. melaniogenes    | 11    | 6         |       |
| Peptostreptococcus | 5     | 1         |       |
| Actinomyces        | 1     | 0         |       |
| Fusobacterium      | 1     | 2         |       |

* Significant

## Table 3. Mean caries index, mean oral hygiene index, and culture results

| Indices             | CHD Culture + (N=29) | CHD Culture - (N=6) | P     | Non-CHD Culture + (N=28) | Non-CHD Culture - (N=7) | P     |
|---------------------|----------------------|---------------------|-------|--------------------------|-------------------------|-------|
| 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  | 2.87 (1.99)          | 2.16 (0.66)         | 0.399 | 1.53 (0.76)              | 1.13 (0.81)             | 0.236 |

* significant
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. Yuyus et al reported this to be 2.571 for rural and 2.225 for urban area.

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 melanogenes (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 melanogenes (17.1%), Streptococcus viridans (14.3%), and Streptococcus mutans (5.7%). In a previous study, Strom et al found Streptococcus viridans, Streptococcus anaerobe, Haemophylus, Actinobacillus, Cardio bacterium, Eikinela, Kingela, and Neisseria sp. as the types of bacteria frequently found in children with CHD.

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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