

Oral hygiene and gingival disease among children with structural heart disease at a tertiary hospital in North-Central Nigeria

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Abstract

Background: Poor oral hygiene and gingival disease are factors that increase risk of infective endocarditis in children with structural heart disease. The objectives were to evaluate the oral hygiene status of children with structural heart disease and the prevalence of dental caries/ gingival disease among them.

Methods: Descriptive, cross-sectional study. Subjects were children aged 6 months to 14 years with structural heart disease. Relevant sociodemographic and clinical data were collected. The Decayed, Missing Filled –Teeth (DMF-T) index and Simplified Oral Hygiene index-S (OHI-S) were used to evaluate for dental caries and oral hygiene respectively.

Results: Forty-eight subjects were recruited. Median (IQR) age was 1.88 (0.50 – 6.75) years. Commonest structural heart diseases were ventricular septal defects (19 subjects; 39.6%), rheumatic heart disease (6; 12.5%), and Tetralogy of Fallot (5; 10.4%). Prevalence of dental caries amongst subjects was 11.4% (four of the 35). Six (12.5%) had gingival disease and one (2.9%) had poor oral hygiene. Thirty-two (91.4%) subjects had their mouth cleaned daily, while only four (12.5%) of these had it cleaned at least twice a day.

Conclusion: Dental caries and poor oral hygiene are common amongst children with structural heart disease.

Keywords: Caries; heart disease; hygiene; gingivitis; endocarditis

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Hygiène bucco-dentaire et maladie gingivale chez les enfants atteints de cardiopathie structurelle dans un hôpital tertiaire du centre-nord du Nigéria

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Résumé

Contexte de l'étude : Une mauvaise hygiène bucco-dentaire et une maladie gingivale sont des facteurs qui augmentent le risque d'endocardite infectieuse chez les enfants atteints de cardiopathie structurelle. Les objectifs étaient d'évaluer l'état d'hygiène bucco-dentaire des enfants atteints de cardiopathie structurelle et leur prévalence de caries dentaires/maladies gingivales.

Méthode de l'étude : Étude descriptive et transversale. Les victimes étaient des enfants de 6 mois à 14 ans atteints d'une cardiopathie structurelle. Des données sociodémographiques et cliniques pertinentes ont été recueillies. L'indice Dents obturées manquantes et cariées (IDOMC) et l'indice S simplifié d'hygiène buccale (ISHB) ont été utilisés pour évaluer respectivement les caries dentaires et l'hygiène buccale.

Résultats : Quarante-huit (48) victimes ont été recrutés. L'âge médian (IQR) était de 1,88 (0,50 - 6,75) ans. Les cardiopathies structurelles les plus courantes étaient les malformations septales ventriculaires (19 sujets ; 39,6 %), les cardiopathies rhumatismales (6 ; 12,5 %) et la tétralogie de Fallot (5 ; 10,4 %). La prévalence des caries dentaires chez les sujets était de 11,4 % (quatre sur 35). Six (12,5%) avaient une maladie gingivale et un (2,9%) avait une mauvaise hygiène bucco-dentaire. Trente-deux (91,4 %) sujets avaient leur bouche nettoyée quotidiennement, mais seulement quatre (12,5 %) d'entre eux l'avaient nettoyée au moins deux fois par jour.

Conclusion : Les caries dentaires et une mauvaise hygiène bucco-dentaire sont courantes chez les sujets avec un risque accru de développer une endocardite infectieuse.

Mots-clés : Caries, cardiopathie, hygiène, gingivite, endocardite

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INTRODUCTION

Children with congenital and acquired structural heart disease often face a lifelong risk of cardiac and non-cardiac complications (1). These are particularly more frequent in children who are unable to have correction for their diseases or who have palliative procedures (1). With increasing survival in developing countries, such as Nigeria, complications such as infective endocarditis are becoming increasingly recognized in children and young adults (2-4).

Children with numerous structural heart conditions have increased risk for infective endocarditis (5). These include children with prosthetic valves, surgical systemic to pulmonary shunts and cyanotic congenital heart diseases (5-7). Other high risk lesions for infective endocarditis include patent ductus arteriosus, aortic stenosis, mitral regurgitation with mitral stenosis, aortic regurgitation, ventricular septal defects and coarctation of the aorta (4-6).

As services for surgical correction of structural heart disease are scarce in Africa, there exist a huge number of these patients with uncorrected heart disease that are essentially placed on medical management (8). Thus, infective endocarditis becomes a real risk in these individuals.

Considering the foregoing, it becomes critical that strategies to prevent infective endocarditis be strengthened in these children. Some of the strategies shown to be effective in preventing infective endocarditis in children include good oral hygiene, antibiotic prophylaxis for invasive procedures, regular monitoring/ follow up and early diagnosis and treatment of established cases using effective antibiotics for prolonged periods of time (5, 7).

Of these, oral hygiene is probably the cheapest and easiest to achieve. The viridans Streptococci (*Streptococcus mutans*, *Streptococcus mitis* and *Streptococcus sanguis*), which have been implicated as very common causes of endocarditis, exist as normal flora in the oral cavity and are often dislodged into the blood stream during dental procedures (5, 7). Poor dental hygiene and periodontal or periapical infections from hard or soft tissues may produce bacteremia even in the absence of dental procedures (7). Thus, it is recommended that for children at risk of infective endocarditis, their parents should be taught how to maintain good oral hygiene (7, 9). Designing effective strategies for maintaining good oral hygiene, will require a baseline assessment of oral hygiene and evaluation of knowledge of parents regarding

oral hygiene and its role in preventing infective endocarditis. Thus, the objectives of this study were to evaluate the oral hygiene status of children with structural heart disease, assess practices of parents regarding oral hygiene and determine the prevalence of gingival disease in this group of children.

MATERIALS AND METHODS

The study was a descriptive cross-sectional study in which the subjects were children aged 6 months- 14 years with defined structural heart disease seen at the pediatric cardiology clinic of a tertiary hospital in North-Central Nigeria.

Ethical approval was obtained from the Hospital's Ethical Review Committee. Individual written informed consent was obtained from the parent or caregiver of the child. Children with structural heart disease seen at the paediatric cardiology clinic between the ages of 6 months and 14 years were recruited consecutively over a 3-month period using a purposive sampling method.

The inclusion criteria were age 6 months – 14 years; confirmed structural heart disease and subject must have been seen previously in the clinic to ensure they were patients who had received counselling before. Children were excluded if they had dentures or had infective endocarditis in the past.

A semi-structured study proforma was administered on all subjects recruited. Socio-demographic data comprising age, gender of the child, parental religion and ethnic group(s), as well as age, educational status and occupation of parents was collected. Diagnosis of structural heart disease was based on an evaluation of the clinical and laboratory data, including chest radiographs, echocardiograms and electrocardiograms. Information on current practices regarding oral hygiene in the child was obtained.

A detailed examination of the oral cavity was conducted by a dentist. The same person performed all oral cavity evaluations to ensure consistency of findings. Children that were yet to erupt any tooth were excluded from this analysis. Parameters that were obtained, included number of teeth, number of missing teeth, debris index and calculus index. Oral examination was conducted using a clinical mirror and dental probe for the plaque and calculus indices. The dental caries were scored on the surface of the specified teeth in accordance with the WHO criteria with the Decayed, Missing Filled –Teeth

(DMF-T) index which was recommended by Klein et al (10). The decayed, missing, filled (DMF for secondary dentition and dmf for primary dentition) was calculated for the specified teeth and the mean of all the teeth determined for each child as the mean DMS-T/dmf-t index score (10, 11). The Simplified Oral Hygiene index-S (OHI-S) was used to determine the oral hygiene status scored; determined as good if score was 0–1.2, fair if 1.3–3.0 and poor if 3.1–6.0 as recommended by Greene and Vermillion(12).

Data was analyzed using SPSS®, version 21 software. Frequency distribution tables and cross tabulation of variables were generated. Measures of central tendency and dispersion of quantitative variables, as well as proportion for qualitative variables were determined. Relevant tests for determination of statistical significance were used. A p-value of <0.05 was considered significant.

RESULTS

Forty-eight subjects were recruited over the study period. Sociodemographic characteristics of the subjects are as shown in Table 1. There were 21 females and 27 males, constituting 43.8% and 56.2% of the study population respectively. The median (interquartile range, IQR) age was 1.88 (0.50 – 6.75) years with a range of 6 months to 14 years. A majority (28 subjects; 58.3%) of the subjects had been diagnosed to have structural heart disease in the first year of life.

The structural heart diseases of the subjects are as listed in table 2. Majority (85.4%) of the subjects had congenital heart diseases, while 7 subjects (14.6%) had an acquired heart disease. The commonest congenital heart diseases were ventricular septal defects (19 subjects; 39.6%), Tetralogy of Fallot (5 subjects; 10.4%) and patent ductus arteriosus (4 subjects; 8.3%). Amongst the 19 subjects with VSD; 13 (68.4%) had an isolated VSD; 3 (15.8%) had a VSD and atrial septal defect (ASD); 2 (10.5%) had VSD and pulmonary stenosis (PS) and one (5.3%) had VSD and a patent ductus arteriosus (PDA). Others are as shown in Table 2. Six (12.5%) subjects had rheumatic heart disease. Of these, mitral regurgitation (MR) was present in all (100.0%), two (33.3%) had mitral stenosis (MS) in addition to MR and of these two with MR and MS, aortic regurgitation was also present in one (16.7%) of them.

Dental caries

Thirteen (27.1%) of the subjects were edentulous and were excluded from evaluation for dental caries. The prevalence of dental caries defined by mean dmf index/DFM index >1 was 11.4% (four of the 35 subjects). The prevalence of dental caries was 27.3% (3 of 11 subjects) among subjects aged 5 – 12 years and 20.0% (one of five subjects) among subjects older than 12 years (Table 3). There were no caries in subjects aged less than five years. The difference in prevalence across the age groups was not significant ($p = 0.816$). There was no difference in prevalence between male (three of 18 subjects, 16.7%) and female (one of 17 subjects, 5.9%) subjects ($p = 0.382$) (Table 3).

Gingival disease/Oral hygiene status

Six (12.5%) subjects had gingival disease. Three (8.6%) subjects had poor oral hygiene status using the mean debris score, four (11.4%) had poor oral hygiene status using the mean calculus score and only one (2.9%) had poor oral hygiene status using the simplified oral hygiene index score. (Table 4)

Oral hygiene practices

Regarding oral hygiene practices, 32 (91.4%) of subjects with teeth either cleaned their mouth themselves or had it cleaned by a caregiver regularly. Of the 32 subjects that cleaned their mouth regularly, one (3.1%) cleaned it thrice daily, three (9.4%) cleaned twice daily, 27 (84.4%) cleaned once daily, and one subject (3.1%) cleaned on alternate days. Twenty nine (90.6%) used brush/ foam with paste for cleaning, two (6.3%) used water only, one (3.1%) had the mouth and teeth rubbed by the mother with her fingers.

DISCUSSION

The oral cavity in children with structural heart disease is a common source of bacteria responsible for infective endocarditis. Acyanotic congenital heart diseases predominated amongst the subjects, with ventricular septal defects being the single most common congenital heart disease. This is similar to reports from Nigeria where a systematic review revealed VSDs comprise between 38.9% and 42.4% of all congenital heart diseases (13). Tetralogy of Fallot was the most common cyanotic congenital heart disease seen in 10.4% of subjects. This is similar to reports from other studies in Nigeria (13-15). This condition is known to pose one of the highest risks for

development of infective endocarditis (5, 6).

Oral hygiene practices of tooth brushing/cleaning were generally good amongst the subjects with over 90% of the subjects brushing their teeth daily. Fonseca et al reported only 4.6% of subjects not brushing at all in a population of children with congenital heart disease (16). An older study in a different Nigerian hospital 14 years ago reported only 36.6% of parents of children with congenital heart disease reported brushing or ensuring their children brushed their teeth (17). The finding in the current study probably reflects the effects of deliberate measures in teaching the parents about the importance of oral hygiene. This should be interpreted with caution as respondents may give responses they feel will be favorably perceived by the investigators, considering this is the same clinic where they are taught about these hygiene measures. Nevertheless, it does indicate a high degree of awareness regarding need for regular tooth brushing in children, particularly those with structural heart disease. Despite the awareness, only 12.5% of subjects had their teeth brushed at least twice a day. This is very much inadequate as the World Health Organization based on available evidence recommends at least twice daily brushing with a fluoride containing toothpaste as a strategy for prevention of dental caries and other dental disorders (18-20). The implication of the less frequent tooth brushing may be higher rates of dental caries in this population.

The prevalence of dental caries in this study population of 11.4% is lower than 21.4% reported by Agbelusi et al in Lagos, Nigeria 12 years ago in a population of children with congenital heart disease (21). This is also much lower than the 30% average reported for Nigeria by the World Health Organization in 1998 (22). A more recent study in Nigeria amongst an older population of school children aged 7-15 years reported a similar prevalence of 15.7%, while Adekoya– Sofowora et al in 2006 reported a prevalence of 10.9% amongst nursery school children aged 3 – 6 years in Ile-Ife, Nigeria.(23, 24)Abiola et al in 2009 similarly reported a prevalence of 10.9% amongst children aged 18 months to 5 years in Lagos, Nigeria (25). This suggest dental caries rates amongst Nigerian children with structural heart disease may not be particularly different from that of the general population of children. This is worrisome as the consequences of dental caries in children with structural heart disease is much higher than that

of the general population/ Thus, clinics seeing children with structural heart disease should target reducing the prevalence of dental caries to the barest minimum in collaboration with dental specialists.

The proportion of children with gingival disease (gingivitis) in this study is also alarming for children with congenital and acquired heart disease, which may place them at increased risk for infective endocarditis. While this is lower than 37.8% reported by Agbelusi (21) in Lagos and 78% reported by Hayes and Fasules (26) amongst children for cardiac surgery in the United States of America, it still is quite high for this population, considering the implications. Poor oral health, including gingivitis have been demonstrated to be associated with higher levels of transient bacteremia from everyday events, such as tooth brushing and dental flossing, with associated heightened risks of infective endocarditis (5, 27).

CONCLUSION

Poor oral hygiene is a significant problem amongst subjects in this study with relatively high rates of dental caries and gingival disease. There is a need to improve counselling on good oral hygiene and to provide regular dental consultations for patients with structural heart disease at risk of infective endocarditis.

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Author's contribution: MBA, MFA, BO and AI conceptualized the work. MBA, MFA, BO designed the study. MBA, MFA, BO, AI, HDS, DPO conducted the study and collected the data. MBA, AI, HDS and DPO analyzed the data. MBA, MFA, BO, HDS drafted the manuscript. All authors read and approved the final draft of the manuscript.

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Table 1: Sociodemographic characteristics of subjects

Characteristics	Frequency	Percentage (%)
Gender		
- Male	21	43.8
- Female	27	56.2
Age group		
- 6 – 59 months	32	66.7
- 5 – 12 years	11	22.9
- > 12 years	5	10.4
Age at diagnosis of structural heart disease		
- 0 – 11 months	28	58.3
- 12 – 59 months	10	20.8
- 5 – 12 years	6	12.5
- > 12 years	4	8.3
Religion of father		
- Islam	41	85.4
- Christianity	6	12.5
- Not stated	1	2.1
Highest educational qualification of father		
- None	13	27.1
- Primary	4	8.3
- Secondary	14	29.2
- Post-secondary	17	35.4

Table 2: Types of structural heart disease in subjects

Type	Specific diagnosis	Frequency	Percentage (%)
Congenital	Ventricular septal defects	19	39.6
	Tetralogy of Fallot	5	10.4
	Patent ductus arteriosus	4	8.3
	Atrial septal defect	3	6.3
	Atrioventricular septal defect	3	6.3
	Isolated pulmonary stenosis	3	6.3
	Transposition of the great arteries	1	2.1
	Truncus arteriosus	1	2.1
	Coarctation of the aorta	1	2.1
	Cyanotic congenital heart disease	1	2.1
Acquired	Rheumatic heart disease	6	12.5
	Systemic hypertension with left ventricular hypertrophy	1	2.1

Table 3: Age and gender prevalence of dental caries in subjects*

Age group	Dental caries	No dental caries	Total	P value
<5 years	0(0.0)	19(100.0%)	19	0.816
5 – 12 years	3 (27.3%)	8 (72.7%)	11	
>12 years	1 (20.0%)	4 (80.0%)	5	
Gender				
Male	3 (16.7%)	15 (83.3%)	18	0.382
Female	1 (5.9%)	16 (94.1%)	17	
Total	4 (11.4%)	31 (88.6%)	35 (100.0%)	

*13 edentulous subjects excluded from this analysis

Table 4: Classification of oral hygiene status by mean debris score, mean calculus score and simplified oral hygiene index score

Parameter	Good, N(%)	Fair, N(%)	Poor, N(%)	Total, N(%)
Mean debris index	17 (48.6)	15 (42.8)	3 (8.6)	35 (100.0)
Mean calculus index	21 (60.0)	10 (28.6)	4 (11.4)	35 (100.0)
Simplified oral hygiene index	17 (48.6)	17 (48.6)	1 (2.9)	35 (100.0)