

Pattern of antibiotic prophylaxis practice for dental procedures in children with congenital heart disease

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ABSTRACT

Background: Various antibiotic prophylaxis guidelines have been published such as the American Heart Association 2007, British Society for Antimicrobial Chemotherapy 2006, National Institute for Health and Clinical Excellence 2008, European Society of Cardiology 2015, and in Malaysia, the National Antibiotic Guideline 2014 and Clinical Practice Guidelines for the Prevention, Diagnosis and Management of Infective Endocarditis 2017. The aim of the study is to determine the pattern of antibiotic prophylaxis practice for dental procedure in children with congenital heart disease (CHD) at the Department of Paediatric Dentistry, Kuala Lumpur Hospital. **Materials and Methods:** A comparative cross-sectional study of dental records from 2010 to 2015 was done by collecting data on the source and reason of referral, types of heart condition, dental procedure, and antibiotic given. **Results:** There were 210 patients; 69.5% had acyanotic CHD, 21.9% cyanotic CHD, 6.7% repaired CHD with residual defects, and 1.9% with previous infective endocarditis. Slightly more than 58% were referred from government doctors (pediatric cardiologist and National Heart Institute). The common cause for referral was dental assessment (47.6%). Antibiotics were prescribed to 23.3% (49/210) patients, of which, 34.7% was given ampicillin or amoxicillin/clavulanic acid. About 96% of cyanotic heart cases undergoing invasive dental procedures were prescribed antibiotic prophylaxis. Almost 31% were prescribed with antibiotic prophylaxis even though it was not indicated. **Conclusion:** This study shows that there is variability in prescribing antibiotic prophylaxis, and it is important for dental clinicians to standardize the practice of giving antibiotic prophylaxis.

KEYWORDS: Antibiotic prophylaxis, congenital heart disease in children, dental treatment

Introduction

Inappropriate use of antibiotics may result in an increase in the development of drug-resistant bacterial

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infections and potential life-threatening anaphylactic reactions. Antibiotic overprescribing may not only cause an increase in the overall cost of health care^[1] but also the cost of managing the adverse event if it occurs.^[2]

Infective endocarditis (IE) is a disease with high morbidity and mortality.^[3] Thus, antibiotic prophylaxis for heart patients before invasive procedures (all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation

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of the oral mucosa^[4]) has been the primary method advocated for preventing IE.^[4] The rationale for using prophylactic antibiotics is to reduce or eliminate the effect of bacteremia that may result from such invasive procedures.^[5]

There are a number of guidelines on prescribing antibiotic prophylaxis prior to dental treatment such as that of the American Heart Association (AHA, 2007),^[4] European Society of Cardiology (ESC, 2004),^[6] British Society for Antimicrobial Chemotherapy 2006,^[7] and the National Institute for Health and Clinical Excellence (NICE, 2008)^[8] in the United Kingdom and in Malaysia, the National Antibiotic Guideline 2008^[2] and 2014.^[9] These diverse antibiotic guidelines may be a cause of confusion among dental practitioners regarding which guideline to use, the type, dosage and duration of antibiotics, as well as concerns about dental procedures inducing the highest probability of bacteremia and also the type of heart conditions requiring antibiotic prophylaxis. A survey on Canadian dentists revealed that practitioners tended to use antibiotic prophylaxis according to the guideline in place at the time of their graduation from dental school, although this guideline did not meet the current recommendations.^[10]

As guidelines are continuously updated,^[3-8,10] dental practitioners must keep abreast with these current antibiotic prophylaxis guidelines for IE as these guidelines represent standards of care and determine medicolegal standards.^[11] In Malaysia, AHA 2007 recommendations for prescribing antibiotic prophylaxis are practiced. The AHA first published guidelines regarding the prevention of bacterial endocarditis (as it was formerly known) in 1955, and in 2007, the AHA released new guidelines for the prevention of IE. The recent 2007 guidelines restricted the list of cardiac conditions for which antibiotic prophylaxis is required before dental procedures.^[3] The aim of this study is to investigate the pattern of antibiotic prophylaxis practice for dental procedures in children according to current guidelines at the Department of Paediatric Dentistry, Kuala Lumpur Hospital, Malaysia.

Materials and Methods

This study was conducted at the Department of Paediatric Dentistry, Paediatric Institute, Kuala Lumpur Hospital, Malaysia. It is a tertiary referral center for medically compromised children under 16 years old. We receive referrals for dental management of children with congenital heart disease (CHD) from the Paediatric Cardiologist at Paediatric Institute, the National Heart Institute (NHI), and also from government and private general medical and dental practitioners.

This is a comparative cross-sectional study of dental records for all congenital heart patients aged <16 years referred to the department for dental

treatment/assessment. Data were collected from dental records from 2010 to 2015. Data collection includes type of heart condition, type of antibiotic prophylaxis prescribed, and type of dental procedure for which antibiotic prophylaxis was prescribed [Table 1]. Data of patients who refused treatment were excluded from the study. Incomplete dental/medical records, children with CHD referred for trauma, and patients with acquired heart conditions such as chronic rheumatic heart disease and Kawasaki disease were also excluded. If a dental procedure requiring antibiotic prophylaxis was planned, the antibiotic recommended by the patient's physician was recorded. If there is no recommendation by patient's physician, the AHA 2007 antibiotic prophylaxis guidelines were used as standard. Whether the antibiotic prophylaxis is appropriate or not according to AHA guidelines was also recorded. Data collected were entered and analyzed using Microsoft Office Excel 2007. Descriptive statistics were used to measure frequencies.

Results

Over the 6-year period from 2010 to 2015, there were 210 new patients (according to the inclusive criteria) with CHD referred to Department of Paediatric Dentistry, Kuala Lumpur Hospital. Slightly more than 58% ($n = 122$) were referred from government medical doctors, and out of 122 patients 46% ($n = 56$) were referred by the Paediatric Cardiologists at Paediatric Institute, Kuala Lumpur Hospital. Sixty-seven patients (31.9%) were referred from National Heart Institute (NHI). Only about 2.4% ($n = 5$) were referred from general practitioners, and 7.6% ($n = 16$) were referred from dentists [Figure 1].

More than 47% ($n = 100$) of the patients were referred for routine dental assessment and 30.5% ($n = 64$) were referred for dental evaluation before cardiac operation. More than 18% ($n = 39$) were referred for purely dental caries problem, and a small percentage (3.3%; $n = 7$) were for other problems [Figure 2].

Table 1: Variables collected for the study

Variables	Variables
Source of referral	Doctors, dentist, NHI, GP
Reason for referral	Evaluation before cardiac operation; dental assessment; dental caries; others
Type of heart condition	Previous bacterial endocarditis; congenital heart disease (cyanotic or acyanotic); Repaired CHD with residual defect heart valve disease
Type of dental procedure	Extraction; scaling; combination; endodontic; surgical or oral rehabilitation under general anesthesia; others (restoration and preventive)
Type of antibiotic prescribed	Amoxycillin; ampicillin; clindamycin; augmentin; cephalixin

GP=General practitioner; CHD=Congenital heart disease; NHI= National heart institute

Out of 210 patients, 146 were patients with acyanotic CHD (69.5%). The remaining 64 patients were patients with cyanotic CHD ($n = 46; 21.9\%$), patients with repaired CHD but with residual defects ($n = 14; 6.7\%$), and patients with previous IE ($n = 4; 1.9\%$) [Table 2].

There were five types of antibiotics given to the patients prior to dental procedure in 49 out of 210 patients. Ampicillin was prescribed to 34.7% ($n = 17$) of patients and the same percentage was noted to be given amoxicillin/clavulanic acid (augmentin) (34.7%; $n = 17$). Only small percentage of patients were given either cephalixin or clindamycin (4.1%; $n = 2$). Amoxicillin was prescribed to 22.4% of the patients ($n = 10$) [Figure 3].

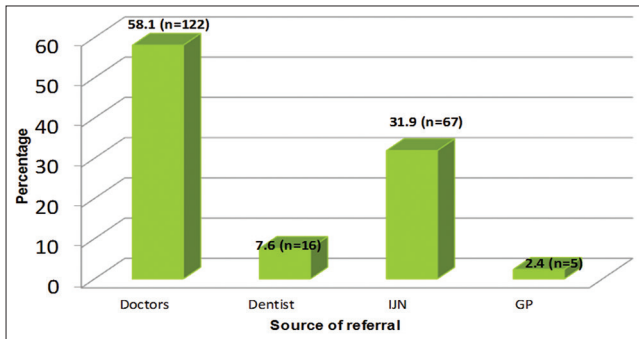


Figure 1: Source of referral for congenital heart disease patients to the department

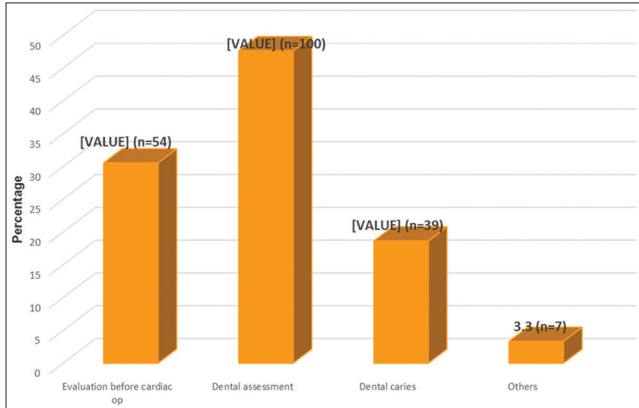


Figure 2: Reason for referral for congenital heart disease to the department

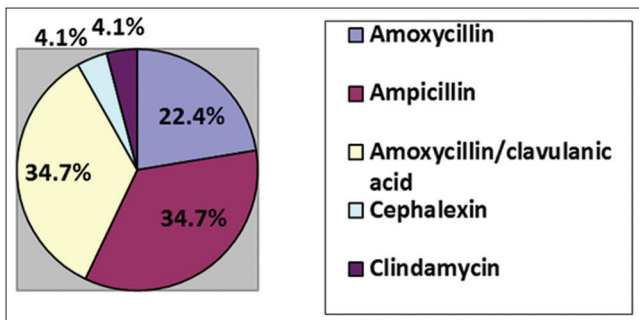


Figure 3: Type of antibiotic prescribed prior to dental procedure (total number of patients = 49 patients)

Tables 3-6 show further analysis of the data, which is the correlation between type of cardiac condition, type of dental procedure, and type of antibiotic prescribed. Treatment involved manipulation of the gingival or periapical region of the teeth or perforation of the oral mucosa are extraction, scaling, combination, and oral rehabilitation under general anesthesia (GA). These treatments are classified under “perforation of oral mucosa.” Treatment classified under restorations and others (preventive measures) does not involve breaching of the oral mucosa and is named as “nonperforation of oral mucosa.”

Table 3 shows that 25 patients with cyanotic CHD underwent procedures that involved perforation of the oral mucosa. Out of the 25 patients, 96% ($n = 24$) were prescribed with antibiotics. Most patients were given either ampicillin (50 mg/kg) or amoxicillin/clavulanic acid. Meanwhile, 60% ($n = 3$) of the patients with repaired CHD with residual defect were not prescribed antibiotics for treatment involved perforation of oral mucosa (oral rehabilitation under GA) [Table 4]. There were 146 patients with acyanotic CHD, 75 had treatment involving perforation of the oral mucosa, and 71 had treatment with nonperforation of oral mucosa (restorations and preventive treatment) [Table 5]. Out of the 75 patients, 30.7% ($n = 23$) were prescribed with antibiotics. As for four patients with previous IE, all patients did not need any antibiotic as only restorations were needed (nonperforation of oral mucosa) [Table 6].

Discussion

This is the first study that investigates the antibiotic prophylaxis pattern among the operators at the Department of Paediatric Dentistry, Kuala Lumpur Hospital. Over the 6-year period, there were 210 new patients with CHD who were referred to the department. Majority of the patients were referred from Paediatric Cardiologists at Paediatric Institute and also from National Heart Institute (NHI).

Upon referral, NHI issued a standardized referral with the diagnosis and the AHA 2007^[4] recommendation. Most of these patients are referred back to their state hospitals. A number of these patients are referred back to our department as the referring hospital does not have the expertise (pediatric anesthetist &

Table 2: Percentage of type of patients with congenital heart disease referred to the department

Type of heart condition	n (%)
Cyanotic CHD	46 (21.9)
Acyanotic CHD	146 (69.5)
Repaired CHD with residual defects	14 (6.7)
Previous IE	4 (1.9)
Total	210 (100.0)

IE=Infective endocarditis; CHD=Congenital heart disease

Table 3: Antibiotic prescribing practice for patients with cyanotic congenital heart disease

Treatment	Cyanotic CHD (n=46)						Total
	Antibiotic						
	No antibiotic	Amoycillin	Ampicillin	Clindamycin	Amoxicillin/clavulanic acid	Cephalexin	
Perforation of oral mucosa	1	4	10	1	9	0	25
Nonperforation of oral mucosa	21	0	0	0	0	0	21
Grand total	22	4	10	1	9	0	46

CHD=Congenital heart disease

Table 4: Antibiotic prescribing practice for patients with repaired congenital heart disease with residual defect

Treatment	Repaired CHD with residual defect (n=14)						Total
	Antibiotic						
	No antibiotic	Amoxicillin	Ampicillin	Clindamycin	Amoxicillin/clavulanic acid	Cephalexin	
Perforation of oral mucosa	3	1	1	0	0	0	5
Nonperforation of oral mucosa	9	0	0	0	0	0	9
Grand total	12	1	1	0	0	0	14

CHD=Congenital heart disease

Table 5: Antibiotic prescribing practice for patients with acyanotic congenital heart disease

Treatment	Acyanotic CHD (n=146)						Total
	Antibiotic						
	No antibiotic	Amoxicillin	Ampicillin	Clindamycin	Amoxicillin/clavulanic acid	Cephalexin	
Perforation of oral mucosa	52	6	6	1	8	2	75
Nonperforation of oral mucosa	71	0	0	0	0	0	71
Grand total	123	6	6	1	8	2	146

CHD=Congenital heart disease

Table 6: Antibiotic prescribing practice for patients with previous infective endocarditis

Treatment	Previous IE (n=4)						Total
	Antibiotic						
	No antibiotic	Amoxicillin	Ampicillin	Clindamycin	Amoxicillin/clavulanic acid	Cephalexin	
Perforation of oral mucosa	0	0	0	0	0	0	0
Nonperforation of oral mucosa	4	0	0	0	0	0	4
Grand total	4	0	0	0	0	0	4

IE=Infective endocarditis

cardiologist) and infrastructure (pediatric intensive care unit back-up) to manage such patients, especially those with cyanotic CHD.

Oral rehabilitation under GA in this group of patients is not without risk. A recent study^[12] of patients with planned dental extractions before cardiac operation, showed that they are at risk for major adverse outcomes, including a 3% risk of death before cardiac operation and an 8% risk of a major adverse outcome. These outcomes should not lead to a neglect of dental infections and their treatment prior to cardiac surgery

but to a careful and individualized treatment protocol by a multidisciplinary team.^[11]

In this study, CHD patients scheduled for oral rehabilitation under GA are managed jointly with the pediatric anesthesiologist and cardiologist prior to intervention taking into consideration the benefit and associated risk of proceeding with the dental procedure.

In AHA 2007,^[4] amoxicillin/clavulanic acid is not recommended. However, in our study, it was

noted that 34.7% of patients were prescribed with amoxicillin/clavulanic acid [Figure 3]. If NICE 2008^[8] guidelines were to be adopted, it would seem that we have appeared to be overprescribing. On the other hand, according to the Malaysia National Antibiotic Guideline 2014,^[9] amoxicillin/clavulanic acid is the preferred antibiotic recommended, albeit no adverse drug events or any cases with IE were noted during the study period. As for the Clinical Practice Guidelines for the Prevention, Diagnosis and Management of IE 2017,^[13] antibiotics recommended are as per ESC 2015^[6] and AHA 2007.^[4]

There appears to be uncertainty of which type of cardiac condition required antibiotic prophylaxis when there was manipulation of the gingival or periapical region of the teeth or perforation of the oral mucosa. Sixty percent (3/5) of the patients with repaired CHD with residual defect and 4% (1/25) with cyanotic CHD were not prescribed antibiotics, but 30.7% (23/75) of the patients with heart valve disease were prescribed with antibiotics. This was appropriate for the AHA 1997^[14] recommendations, but patients with heart and valve disease were not indicated according to AHA 2007.^[4]

Clinicians appeared to concur on the types of dental procedures requiring antibiotic prophylaxis, as all the cardiac conditions listed in Table 4, antibiotics were not prescribed for patients undergoing preventive and restorative treatment.

In an audit^[14] done to determine the level of knowledge and understanding of these multiple antibiotic guidelines among hospital orthodontists in the UK, it was found that compliance with preferred clinical practice is noticeably compromised when complex conflicting guidelines from either different national or international authoritative bodies exist for the IE guidelines. These results have shown that lack of guideline standardization results in sub-optimal clinical practice as a result of generalized confusion, and they recommended guideline convergence.

There are at present many IE guidelines^[2-8,14] by various national and international bodies. Most of these guidelines recommend antibiotic prophylaxis in those categorized as at highest risk of IE and dental procedure involving dento-gingival manipulation. However, when NICE 2008^[8] recommended the cessation of antibiotic prophylaxis for all patients at risk of IE undergoing invasive dental procedures, the uncertainty increased, given the polarization between other guidelines and NICE 2008.^[8] The latest guideline from ESC 2015^[6] differs from AHA 2007^[4] in that it does not recommend prophylaxis in cardiac transplant recipients who develop cardiac valvulopathy.

Conclusion

This study shows that there is variability in prescribing antibiotic prophylaxis for IE in our department among clinicians, which may be due to the various conflicting guidelines from national and international bodies.^[15] However, during the study period, no incidence of IE or adverse reaction to antibiotic was reported. We conclude that it is important for dental clinicians in our department to standardize the practice of antibiotic prophylaxis and recommend clinicians refer and adopt the most current guideline in Malaysia, which is the Clinical Practice Guidelines for the Prevention, Diagnosis and Management of Infective Endocarditis 2017.^[13]

Note:

The study was carried out at the Department of Paediatric Dentistry, Kuala Lumpur Hospital. The department has now moved to Tuanku Azizah Hospital, Kuala Lumpur.

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Conflicts of interest

There are no conflicts of interest.

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