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Prophylaxis for Bacterial Endocarditis Prior to Dental Procedures in Children

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OBJECTIVES

After reading this manuscript, the reader should be able to:

1. Review the pathophysiology of bacterial endocarditis (BE) risk in children.
2. Understand the risk categories for BE according to the American Heart Association Guidelines.
3. Discuss the most common pathogens in BE.
4. Summarize antibiotic choices for BE prophylaxis.
5. Discuss the controversy over BE prophylaxis.

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Providing prophylaxis for bacterial endocarditis (BE) prior to dental procedures has long been a topic of controversy because the disease has a low incidence but a relatively high mortality rate. Understanding which patients need prophylaxis and which antibiotics are appropriate is important for health care providers so that high-risk patients are treated appropriately. The incidence of BE in children is quite low, with a broad range of estimates being reported in the literature, all below 0.1%.

In the pediatric population, risks for BE are slightly different than those for adults, with congenital heart disease (CHD) and postsurgical cases being leading risk factors in children. The causes of endocarditis also are changing as the incidence of rheumatic fever declines, the number of immunocompromised patients with long-term central catheters increases, and surgical procedures continue to advance, allowing for more complex and invasive procedures.

Bacterial endocarditis is believed to be due to transient bacteremia, although a direct association has never been proved. In particular, patients with certain types of CHD are at risk for bacterial endocarditis because of the abnormal blood flow through their hearts. Introduction of bacteria into the bloodstream generally causes only a transient bacteremia in patients with normal cardiac flow. Blood flow in patients who have congenital heart disease often can consist of pooling of blood in the ventricles; this pooling allows bacteria time to dwell and the opportunity to colonize the myocardium. Any procedures that can cause a transient bacteremia can be problematic for patients with CHD. In particular, dental procedures can create a temporary bacteremia as small lacerations along the gum line allow oral flora to enter the bloodstream. It also has been shown that relatively routine activities such as brushing teeth or chewing gum can create a portal of entry for bacteria. Once vegetation begins to form, the risk for the patient escalates beyond the damage done to the myocardium, as high blood flow against the vegetation can cause an embolism to break off and travel to other parts of the body.

The offending pathogen in culture-positive cases is most frequently *Streptococcus viridians*, although the incidence of *Staphylococcus aureus* infections is becoming more frequent. Staphylococcal infections are particularly worrisome because they have been shown to have an affinity for certain receptors on the endothelium of cardiac valves. However, the relative infrequency of positive cultures in patients with endocarditis makes treatment difficult and often necessitates the use of broad-spectrum antibiotics.

While some evidence exists that the bacteremia induced by dental, surgical, or other procedures can cause endocarditis, there is a con-

sistent lack of data supporting the efficacy of antibiotic prophylaxis for BE. Whether to treat patients at risk is the topic of much controversy, although the popular opinion tends to lie on the side of prophylaxis because the treatment is so benign and the mortality rate from endocarditis is so great.

The most recent recommendations from the American Heart Association suggest treating patients with prophylactic antibiotics for BE only if they fall in the high-risk or moderate-risk categories (Box 1). Patients who fall in the negligible risk categories have no greater risk than the general population for developing BE, and therefore antibiotic prophylaxis is not recommended (Box 2). Dental practitioners and other health care professionals working with patients in the high- or moderate-risk categories should ensure that prophylaxis is given if any type of procedure that might introduce bacteria is undertaken.

While the main focus of this discussion is on antibiotic prophylaxis against bacteremia, the first step in prevention of bacteremia is the consistent practice of antiseptic measures prior to dental procedures. Antibiotic therapy generally is focused on the likely pathogen, *S. viridians*. Current guidelines recommend giving oral prophylactic doses an hour before the procedure to allow time for the antibiotic to be absorbed and reach a peak level in the blood (Table 1). The most commonly used prophylactic agent is amoxicillin, which is a β -lactam antibiotic whose spectrum is broader than that of penicillin and which is readily available in many dosage forms, many of which are flavored, making the administration of this drug to children easier. Amoxicillin also is available in a generic form, making antibiotic prophylaxis a very affordable measure. The main disadvantage to amoxicillin, to its intravenous equivalent ampicillin, and to the cephalosporins

BOX 1. Categories for which endocarditis prophylaxis is recommended.

High-risk category

- Prosthetic cardiac valves, including bioprosthetic and homograft valves
- Previous bacterial endocarditis
- Complex cyanotic congenital heart disease (e.g., single-ventricle states, transposition of the great arteries, Tetralogy of Fallot)
- Surgically constructed systemic pulmonary shunts or conduits

Moderate-risk category

- Most other congenital cardiac malformations (other than those listed in the high-risk and negligible risk categories)
- Acquired valvar dysfunction (e.g., rheumatic heart disease)
- Hypertrophic cardiomyopathy
- Mitral valve prolapse with valvar regurgitation and/or thickened leaflets

Data from Dajani, Taubert, Wilson, Bolger, Bayer, Ferrier, et al., 1997.

BOX 2. Situations for which endocarditis prophylaxis is not recommended.

Negligible risk category (no greater risk than the general population)

- Isolated secundum atrial septal defect
- Surgical repair of atrial septal defect, ventricular septal defect, or patent ductus arteriosus (without residual beyond 6 months)
- Previous coronary artery bypass graft surgery
- Mitral valve prolapse without valvar regurgitation
- Physiologic, functional, or innocent heart murmurs
- Previous Kawasaki disease without valvar dysfunction
- Previous rheumatic fever without valvar dysfunction
- Cardiac pacemakers (intravascular and epicardial) and implanted defibrillators

Data from Dajani, Taubert, Wilson, Bolger, Bayer, Ferrier, et al., 1997.

TABLE 1. Recommended antibiotic prophylactic regimens for children.

Situation	Agent	Regimen
Standard general prophylaxis	Amoxicillin	50 mg/kg orally 1 hour before procedure
Unable to take oral medications	Ampicillin	50 mg/kg IM or IV within 30 minutes before procedure
Allergic to penicillin	Clindamycin	20 mg/kg orally 1 hour before procedure
	OR	
	Cephalexin or cefadroxil	50 mg/kg orally 1 hour before procedure
	OR	
	Azithromycin or clarithromycin	15 mg/kg orally 1 hour before procedure
Allergic to penicillin and unable to take oral medications	Clindamycin	20 mg/kg IV within 30 minutes before procedure
	OR	
	Cefazolin	25 mg/kg IM or IV within 30 minutes before procedure
	OR	

IM, Intramuscularly; IV, intravenously.

Data from Dajani, Taubert, Wilson, Bolger, Bayer, Ferrier, et al., 1997.

cephalexin, cefadroxil, and cefazolin, is that these drugs are very susceptible to β -lactamase enzymes, which commonly are secreted by gram-negative bacteria. However, the incidence of gram-negative BE is very low, so this should be a negligible concern. As with any antibiotic in the penicillin family, health care professionals should first screen patients for a penicillin allergy and have epinephrine doses available in the event that an anaphylactic reaction were to occur.

The macrolide antibiotics, which may be used for patients who are

allergic to penicillin, are clarithromycin and azithromycin. Macrolides work by binding to the 50 S ribosomal subunit of bacteria, inhibiting protein synthesis. Both of these drugs also are available in both tablet and suspension form, allowing for ease of administration to children. Clindamycin also acts by binding to the 50 S ribosomal subunit, inhibiting bacterial protein synthesis. It too is available in capsule, suspension, and intravenous formulations.

While the controversy over prophylaxis for bacterial endocarditis remains, the completion of a ran-

domized prospective study to analyze the efficacy of prophylaxis cannot be expected, because prophylaxis exists as a guideline for care in most countries. Health care practitioners must make an educated decision regarding whether to provide prophylaxis, taking into account current guidelines and patient-specific factors.

REFERENCE

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