



ANTIBIOTIC PROPHYLAXIS: RECOMMENDATIONS, THE STANDARD OF CARE AND CONTROVERSIES

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I. BACTERIAL ENDOCARDITIS

The American Heart Association recommends antibiotic bacterial prophylaxis for the prevention of infective endocarditis. The first set of AHA guidelines was published in 1955 and subsequently modified in 1960, 1965, 1972, 1977, 1984, 1990 and 1997. The current rationale and regimen for prophylactic systemic antibiotics for patients at risk for infective endocarditis is based largely on animal studies. There are no prospective randomized clinical trials demonstrating that antibiotic prophylaxis significantly prevents infective endocarditis in humans. This fact may account for the frequent changes in the prophylactic regimens made by the AHA (i.e., eight including 1955). In fact, there are numerous studies which have shown that the number of cases of infective endocarditis have not been significantly reduced since the introduction of systemic antibiotics. Of particular concern is clinical evidence showing the lack of effectiveness of systemic antibiotics in the prevention of endocarditis. Several of these studies have demonstrated that only three to 20% of infective endocarditis cases could have been prevented by antibiotic prophylaxis. Moreover, the AHA has found 52 cases of failures of endocarditis prophylaxis in the United States from 1979 to 1983. Significantly, four of the six cases that received the recommended prophylactic regimen developed endocarditis with strains of *Streptococcus* sensitive to the antibiotics given for prevention.

The evidence that dental and medical procedures cause endocarditis is circumstantial because, in part, it is impossible to prove that a particular procedure induced the bacteremia that caused an individual case of endocarditis. A causal relation has been assumed on the basis of the temporal association or the incubation period. This has resulted in a widespread belief that the incubation periods have demonstrated that they are commonly from one to two weeks and that an incubation period of one month was notably rare. These studies have further concluded that when incubation periods are longer than two weeks, the suspected procedure was probably not the cause of the endocarditis. A comprehensive review of over 1,100 cases of endocarditis, showed that only 12.4% were related to dental procedures. In many of these cases there was a doubtful causal relation because of the lack of definitive criteria for determining incubation periods.

Examination of the pathogenesis of infective endocarditis provides little support for the long incubation theory. Experiments have demonstrated that the bacteremia following a dental procedure is short-lived. Circulating bacteria are quickly removed from the bloodstream by the reticuloendothelial system within 15 minutes to one hour, thus greatly reducing the likelihood of a delayed infection to the endocardium weeks or months later. Random bacteremias commonly occur physiologically and provide a much more frequent cause of infective endocarditis. Toothbrushing and chewing can be associated with a frequency of bacteremia as high as 40 to 50%, oral irrigation produced bacteremias up to 50% and random testing of individuals with periodontal disease showed the presence of bacteria in the blood in 11% of the cases. Based on this high frequency of physiologic bacteremias and the low percentage of dental procedures preceding endocarditis it has been estimated that the chance of an endocarditis resulting from physiologic "seeding" of oral bacteria was 1,000 times greater than if it occurred following a specific dental procedure. Despite all the caveats it is strongly recommended that the practitioner adhere to the guidelines promulgated by the AHA (Tables 1, 2 and 3).

II. JOINT REPLACEMENTS

Seeding of total joint implants as a result of bacteremias can occur both in the early postoperative period and for many years after the implantation. Similar to the events surrounding bacterial endocarditis daily events cause far more bacteremias than dental procedures. Also, there currently is no scientific evidence demonstrating that antibiotic prophylaxis prevents joint infections in patients undergoing dental treatment. The risk/benefit ratio and the economics do not support the administration of routine antibiotic prophylaxis.

Evidence supports that bacteremias resulting from acute infections in the oral cavity, skin, respiratory, gastrointestinal and urogenital systems can and do cause late implant infection. It is recommended that patients with total joint prostheses with acute oral infections be treated vigorously as any other patient with special attention focused on any unusual signs and symptoms such as fever, swelling, pain and warm joints.

The American Dental Association and the American Academy of Orthopaedic Surgeons have concluded that antibiotic prophylaxis is not indicated for dental patients with pins, plates and screws, nor is it routinely indicated for most dental patients with total joint replacement. There is some limited data, which suggests that some immunocompromised patients with total joint replacements may be at risk following certain dental procedures (Table 4). Antibiotic prophylaxis for these patients undergoing dental procedures should be considered (Tables 5 and 6).

Additionally, it is recommended that antibiotic prophylaxis be considered when the higher-bacteremic-incidence dental procedures are carried out within two years post-implant surgery, on patients who have had previous prosthetic joint infections and on those with other conditions (Table 5).

A potential problem for the dentist is the patient presenting with instructions for prophylaxis from the physician. This can result for two reasons: the physician is unfamiliar with the current guidelines or the physician knows of a special medical condition not known to the dentist. When this situation arises it is mandatory that the dentist consult with the physician in order to determine the reason behind the physician's recommendation. After the consultation the dentist, using appropriate clinical judgement, will decide whether to follow the physician's recommendation or not. The dentist is ultimately responsible for determining which treatment protocol best suits the need of the dental patient. The dentist must always consider the potential benefit versus the risks of the antibiotic prophylaxis. I hope that these guidelines will assist you in treating patients with preexisting cardiac problems and prosthetic joints.

TABLE I. CARDIAC CONDITIONS FOR WHICH PROPHYLAXIS IS OR IS NOT RECOMMENDED

Endocarditis Prophylaxis 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 above and below).
Acquired valvar dysfunction (e.g., rheumatic heart disease).
Hypertrophic cardiomyopathy.
Mitral valve prolapse with valvular regurgitation and/or thickened leaflets.

Endocarditis Prophylaxis 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 residua beyond six mo).
Previous coronary artery bypass graft surgery.
Mitral valve prolapse without valvular regurgitation.
Physiologic, functional, or innocent heart murmurs.
Previous Kawasaki disease without valvular dysfunction.
Previous rheumatic fever without valvular dysfunction
Cardiac pacemakers (intravascular and epicardial) and implanted defibrillators.

TABLE 2. DENTAL PROCEDURES FOR WHICH PROPHYLAXIS IS OR IS NOT RECOMMENDED**Endocarditis Prophylaxis Recommended***

Dental extractions
 Periodontal procedures including surgery, scaling and root planing, probing, recall maintenance.
 Dental implant placement and reimplantation of avulsed teeth.
 Endodontic (root canal) instrumentation or surgery only beyond the apex.
 Subgingival placement of antibiotic fibers/strips.
 Initial placement of orthodontic bands but not brackets.
 Intraligamentary local anesthetic injections.
 Prophylactic cleaning of teeth or implants where bleeding is anticipated.

Endocarditis Prophylaxis Not Recommended

Restorative dentistry (operative and prosthodontic) with/without retraction cord.
 Local anesthetic injections (nonintraaligamentary).
 Intracanal endodontic treatment; post placement and buildup.
 Placement of rubber dams.
 Postoperative suture removal.
 Placement or removable prosthodontic/orthodontic appliances.
 Electrosurgery after postoperative suture removal.
 Taking of oral impressions.
 Fluoride treatments.
 Taking of oral radiographs.
 Orthodontic appliance adjustment.
 Shedding of primary teeth.

*Cephalosporins should not be used in individuals with immediate type hypersensitivity reaction (urticaria, angioedema, or anaphylaxis) to penicillins.

**TABLE 3. PROPHYLACTIC REGIMENS FOR DENTAL, ORAL, RESPIRATORY TRACT,
 OR ESOPHAGEAL PROCEDURES
 (NO FOLLOW-UP DOSE RECOMMENDED)**

<u>Situation</u>	<u>Agent</u>	<u>Regimen#</u>
Standard general prophylaxis	Amoxicillin	Adults: 2.0g; children: + 50 mg/kg PO One hour before procedure
Unable to take medications	Ampicillin	Adults: 2.0g IM or IV; Children: 50 mg/kg IM or IV within 30 minutes before procedure
Penicillin-allergic:	Clindamycin	Adults: 600 mg; Children: 20 mg/kg PO One hour before procedure
	OR	
	Cefazolin*	Adults: 1.0g; Children: 25 mg/kg IM or IV within 30 minutes before procedure.

+Total children's dose should not exceed adult dose.

*Cephalosporins should not be used in individuals with immediate type hypersensitivity reaction (urticaria, angioedema, or anaphylaxis) to penicillins.

TABLE 4. PATIENTS AT POTENTIAL INCREASED RISK OF HEMATOGENOUS TOTAL JOINT INFECTION

IMMUNOCOMPROMISED/IMMUNOSUPPRESSED PATIENTS

- Inflammatory arthropathies: rheumatoid arthritis, systemic lupus erythematosus
- Disease , drug or radiation-induced immunosuppression.

OTHER PATIENTS

- Insulin-dependent (Type 1) diabetes
- First two years following joint placement
- Previous prosthetic joint infecitons
- Malnourishment
- Hemophilia

TABLE 5. INDICENCE STRATIFICATION OF BACTEREMIC DENTAL PROCEDURES⁺

HIGHER INCIDENCE⁺

- Dental extractions
- Periodontal procedures including surgery, subgingival placement of anti-biotic fibers/strips, scaling and root planing, probing, recall maintenance
- Dental implant placement and reimplantation of avulsed teeth.
- Endodontic (root canal) instrumentation or surgery only beyond the apex.
- Initial placement of orthodontic bands but not brackets
- Intraligamentary local anesthetic injections
- Prophylactic cleaning of teeth or implants where bleeding is anticipated.

LOWER INCIDENCE⁺⁺

- Restorative dentistry+++ (operative and prosthodontic) with or without retraction cord**
- Local anesthetic injections (nonintraaligamentary)
- Intracanal endodontic treatment; postplacement and buildup.
- Placement of rubber dam
- Postoperative suture removal.
- Placement of removable prosthodontic/ orthodontic appliances.
- Taking of oral impressions
- Fluoride treatments
- Taking of oral radiographs
- Orthodontic appliance adjustment.

⁺Total children's dose should not exceed adult dose.

⁺⁺Prophylaxis not indicated.

⁺⁺⁺This includes restoration of carious teeth.

^{**}Clinical judgment may indicate antibiotic use in selected circumstances that may create significant bleeding.

TABLE 6. SUGGESTED ANTIBIOTIC PROPHYLAXIS REGIMENS.*

PATIENTS NOT ALLERGIC TO PENICILLIN, CEPHALEXIN, CEPHRADINE OR AMOXICILLIN:

Amoxicillin, 2 grams orally 1 hour prior to dental procedure

PATIENTS NOT ALLERGIC TO PENICILLIN AND UNABLE TO TAKE ORAL MEDICATIONS:
CEFAZOLIN OR AMPICILLIN:

Cefazolin, 1 g or ampicillin, 2 g intramuscularly or intravenously 1 hour prior to the procedure.

PATIENTS ALLERGIC TO PENICILLIN:

Clindamycin, 800 milligrams orally 1 hour prior to the dental procedure

PATIENTS ALLERGIC TO PENICILLIN AND UNABLE TO TAKE ORAL MEDICATIONS:

Clindamycin, 600 mg IV 1 hour prior to the procedure.

*No second doses are recommended for any of these dosing regimens.

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