



**INFECTIVE ENDOCARDITIS AND ANTIBIOTIC PROPHYLAXIS
– AN UPDATE FOR DENTAL PRACTITIONERS**

DR. M.P.SANTHOSH KUMAR

Reader, Department of oral and maxillofacial surgery, Saveetha dental college, Saveetha university, Chennai.

ABSTRACT

Infective endocarditis [IE] is an uncommon but life-threatening complication resulting from bacteremia, bacteria in the blood stream. Dental procedures can induce bacteremia, so it is essential to give prophylactic antibiotics for patients with cardiac disease who are at risk of developing infective endocarditis. In this article the current recommendations for dentists regarding antibiotic prophylaxis against infective endocarditis as per American heart association 2007 revised guidelines is presented. In addition to summary of the indications for prophylaxis, information is provided on the conditions for which prophylaxis is not recommended.

KEYWORDS: Infective endocarditis, dental procedures, bacteremia, antibiotic prophylaxis

*Corresponding author



DR. M.P.SANTHOSH KUMAR

Reader, Department of oral and maxillofacial surgery,
Saveetha dental college, Saveetha university, Chennai.

INTRODUCTION

Infective endocarditis [IE] is an uncommon but life-threatening complication resulting from bacteremia, bacteria in the blood stream. Viridans group streptococci, *Staphylococcus aureus*, *enterococcus* are some of the microorganisms implicated with IE. Bacteremia is anticipated following dental procedures,^{1,2} leading to the occurrence of infective endocarditis in patients with compromised cardiac condition. An effective antibiotic regimen directed against the most likely infecting organism, with antibiotics administered shortly before the procedure can prevent this problem. The recommendations made by the American heart association [AHA] is followed for the past 50 years. After 1997 guidelines, AHA published revised guidelines in 2007 for the prevention of IE and reducing the risk of producing resistant strains of bacteria. In this article, latest antibiotic regimen and recommendations for prevention of infective endocarditis as per AHA 2007 guidelines and NICE clinical guidance 64 are presented.

PATHOGENESIS³

It involves a complex sequence or confluence of events. Endothelial damage caused by turbulent blood flow normally seen in congenital or acquired heart disease causes platelets and fibrin deposition leading to formation of nonbacterial thrombotic endocarditis (NBTE). In this environment, an incidence of bacteremia could result in bacterial adherence to NBTE, bacterial proliferation within the NBTE, and formation of vegetations, the typical lesions of IE. This infection usually happens when bacteria or other germs from another part of the body, such as the mouth, spread through the bloodstream and attach to damaged areas in the heart. IE most commonly occurs in conjunction with invasive dental, gastrointestinal (GI), or genitourinary (GU) tract procedures. Mucosal surfaces are populated by a dense endogenous microflora. Trauma to a mucosal surface, particularly the gingival crevice around teeth, oropharynx, GI tract, urethra, and vagina, releases many different microbial species transiently into the

bloodstream. Transient bacteremia caused by viridans group streptococci and other oral microflora [*staphylococcus aureus*] occurs commonly in association with dental extractions or other dental procedures or with routine daily activities. Certain underlying cardiac conditions may predispose an individual to developing endocarditis, such as artificial heart valves. If left untreated, endocarditis can damage or destroy the heart valves and can lead to life-threatening complications. Transient bacteremia is common with manipulation of the teeth and periodontal tissues, and there is a wide variation in reported frequencies of bacteremia in patients resulting from dental procedures: tooth extraction (10% to 100%), periodontal surgery (36% to 88%), scaling and root planing (8% to 80%), teeth cleaning (up to 40%), rubber dam matrix/wedge placement (9% to 32%), and endodontic procedures (up to 20%).^{4,5,6,7,8,9,10} Transient bacteremia also occurs frequently during routine daily activities unrelated to a dental procedure, such as tooth brushing and flossing (20% to 68%), use of wooden toothpicks (20% to 40%), use of water irrigation devices (7% to 50%), and chewing food (7% to 51%).^{11,12,13,14,15,16}

AHA 2007 GUIDELINES¹⁷

In April of 2007, the American Heart Association (AHA) published updated guidelines for infective endocarditis prophylaxis. The AHA guidelines were significantly different from the previous versions, prophylaxis being now recommended for a much lower number of patients. In previous recommendations, congenital heart diseases [CHDs] were classified into high-risk, moderate-risk or mild-risk groups. Recent guidelines resulted in a drastic reduction in the target CHDs for IE prophylaxis and suppression of the CHD classification into at high, moderate or mild-risk for IE, assuming that only patients in the previously-named 'high-risk' group should receive IE prophylaxis. The other CHDs, previously in the moderate-risk or mild-risk groups, are no longer targets for IE prophylaxis.

REASONS FOR REVISION IN GUIDELINES ^{17, 18}

- IE is more likely to occur following transient bacteremia induced by daily activities (frequent exposure such as tooth brushing, chewing food) than from bacteremia caused by a dental, genitourinary or gastrointestinal procedure.
- IE is a rare complication of procedures. A significant number of patients must be treated to prevent one IE.
- For a majority of patients, the first IE is often not linked to a procedure. Prophylaxis protects only a small portion of at-risk patients.
- Prophylaxis prevents only a very small number of IEs, if any, in people who undergo dental, genitourinary or gastrointestinal procedures.
- The risks associated with the adverse effects of antibiotics usually outweigh the benefits of IE prophylaxis.
- A 2008 Cochrane review found that there was no evidence prophylactic antibiotic treatment was either effective or ineffective at preventing IEs in the at-risk population undergoing an invasive dental procedure.
- Maintaining oral hygiene and health can reduce the bacteremia linked to daily activities and is more important than antibiotic treatment prophylaxis associated with dental procedures to reduce the risk of IE.
- The widespread use of antibiotics promotes the emergence of resistance.

Major changes from the 1997 version include:

- “The Committee concluded that only an extremely small number of cases of infective endocarditis might be prevented by antibiotic prophylaxis for dental procedures even if such prophylactic therapy were 100 percent effective.
- Infective endocarditis prophylaxis for dental procedures is reasonable only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from infective endocarditis.
- For patients with these underlying cardiac conditions, prophylaxis is reasonable for all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa.
- Prophylaxis is not recommended based solely on an increased lifetime risk of acquisition of infective endocarditis.”

PROPHYLAXIS AGAINST INFECTIVE ENDOCARDITIS IS INDICATED IN PATIENTS WITH FOLLOWING CONDITIONS: ^{17,18,19}

- Prosthetic cardiac valves
- Previous infective endocarditis
- Unrepaired cyanotic congenital heart disease, including palliative shunts and conduits
- Completely repaired congenital heart defect with prosthetic material or device, during the first six months after the procedure
- Repaired congenital heart disease with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)
- Cardiac transplant recipients with cardiac valvulopathy
- Rheumatic heart disease if prosthetic valves or prosthetic material used in valve repair

PROPHYLAXIS AGAINST INFECTIVE ENDOCARDITIS IS NOT INDICATED IN THE FOLLOWING CONDITIONS

Atrial septic defects, Ventricular septal defects, Patent ductus arteriosus, Mitral valve prolapse, Previous Kawasaki disease, Hypertrophic cardiomyopathy, Previous coronary artery bypass graft surgery, Cardiac pacemakers (intravascular and epicardial) and implanted defibrillators, Bicuspid

aortic valves, Coarctation of the aorta, Calcified aortic stenosis, Pulmonic stenosis, Rheumatic heart disease.

SPECIAL CIRCUMSTANCES

- High-risk patients already receiving long-term antibiotic therapy
AHA recommendations remain the same as in 1997: select an antibiotic from a different class to minimize the risk of encountering resistance.
- High-risk patients who receive anticoagulants
IM injections of antibiotics should be avoided. In these circumstances, the oral route is preferable. IV administration should be reserved for cases where oral intake (capsule or oral suspension) is not possible.
- High-risk patients who undergo cardiac surgery
Preoperative dental evaluation is recommended in order to complete potential dental treatments before cardiac surgery. Such measures may lower the risk for late *Streptococcus viridans* endocarditis in patients with prosthetic cardiac valves.

The risk of mortality from IE due to viridans streptococcal infection of prosthetic valves is at least 20% , while the mortality in the case of native valves is 5% or less . It should be noted that with the exception of the conditions listed above, antibiotic prophylaxis is no longer recommended for any other form of CHD. With respect to prosthetic material, prophylaxis is reasonable for six months because endothelialization of prosthetic material usually occurs within six months after valve placement.

DENTAL PROCEDURES WHICH REQUIRE ANTIBIOTIC PROPHYLAXIS:¹⁷⁻²⁰

Dental procedures that involve manipulation of gingival tissue or the periapical region of the teeth or perforation of the oral mucosa like:

- Scaling and root planing of teeth
- Periodontal procedures
 - a. Curetting tissue
 - b. Periodontal probing
 - c. Periodontal surgery
 - d. Subgingival placement of antibiotic fibers and strips
- Tooth extraction
- Suture removal
- Biopsies
- Prophylactic cleaning of teeth or implants where bleeding is anticipated
- Dental implant placement and replantation of avulsed teeth

- Endodontic instrumentation or surgery only beyond the apex
- Placement of orthodontic bands
- Intraligamentary and intraosseous local anaesthetic injections

DENTAL PROCEDURES WHICH DO NOT REQUIRE ANTIBIOTIC PROPHYLAXIS:¹⁷⁻²⁰

- Routine anaesthetic injection through non-infected tissue
- Taking radiographs
- Placement of removable prosthetic or orthodontic appliances
- Adjustment of orthodontic appliances
- Placement of orthodontic brackets
- Shedding of deciduous teeth
- Bleeding from trauma to the lips or oral mucosa.

ANTIBIOTIC PROPHYLAXIS REGIMEN^{17, 21}

single dose administered 30 min to 60 min before the procedure

	Drug	adults	children
Able to take oral medication	Amoxicillin	2 g	50 mg/kg
Unable to take oral medication	Ampicilin	2 g IM or IV	50 mg/kg IM or IV
	Cefazolin or ceftriaxone	1 g IM or IV	50 mg/kg IM or IV
Allergic to penicillin or ampicillin	Cephalexin	2 g	50 mg/kg
	Clindamycin	600 mg	20 mg/kg
	Azithromycin or Clarithromycin	500 mg	15 mg/kg
Allergic to penicillin or ampicillin and unable to take oral medication	Cefazolin or ceftriaxone	1 g IM or IV	50 mg/kg IM or IV
	Clindamycin	600 mg IM or IV	20 mg/kg IM or IV

IM intramuscular; IV intravenous Amoxycillin is the preferred oral drug. For individuals who are allergic to penicillin or amoxicillin, the use of cephalexin or another first-generation oral cephalosporin, clindamycin, azithromycin or clarithromycin is recommended. Cephalosporins should not be administered to patients with a history of penicillin hypersensitivity reactions that resulted in systemic anaphylaxis, angioedema or urticaria. If antibiotics are not given before the procedure, it may be administered upto 2

hours after the procedure. IM injections should not be administered to patients taking anticoagulants. When procedures involve infected tissues or are performed on a patient with a compromised host response, additional doses or a prescribed postoperative regimen of antibiotics may be necessary.

CONCLUSION

Prophylaxis is not recommended based solely on an increased lifetime risk of acquisition of

infective endocarditis. Infective endocarditis prophylaxis for dental procedures is reasonable only for patients with underlying cardiac conditions associated with the highest risk of adverse outcome from infective endocarditis.²² For patients with these underlying cardiac conditions, prophylaxis is reasonable for all dental procedures that involve manipulation of gingival tissue or the periapical region of teeth or perforation of the oral mucosa. Only an extremely small number of cases of infective endocarditis might be prevented by antibiotic prophylaxis for dental procedures, even if such prophylactic therapy were 100% effective. Bacteremia resulting from daily activities is much more likely to cause IE than bacteremia associated with a dental procedure. The vast majority of cases of IE caused by oral microflora most likely result from random bacteremias caused by routine daily activities, such as chewing food,

tooth brushing, flossing, use of toothpicks, use of water irrigation devices, and other activities. The presence of dental disease may increase the risk of bacteremia associated with these routine activities. There should be a shift in emphasis away from a focus on a dental procedure and antibiotic prophylaxis toward a greater emphasis on improved access to dental care and oral health in patients with underlying cardiac conditions associated with the highest risk of adverse outcome from IE and those conditions that predispose to the acquisition of IE.²³ The 2007 AHA guidelines are significantly different from previous guidelines, with significantly fewer patients being targeted for prophylaxis. Dental practitioners must have adequate knowledge of these guidelines, and implement them when treating patients who are at risk of developing infective endocarditis.

REFERENCES

1. Lockhart PB, Brennan MT, Kent ML, Norton JH, Weinrib DA. Impact of amoxicillin prophylaxis on the incidence, nature, and duration of bacteremia in children after intubation and dental procedures. *Circulation*.109(23):2878-84.[2004]
2. Roberts GJ, Jaffrey EC, Spract DA, Petrie A, Greville C, Wilson M. Duration, prevalence and intensity of bac-teremia after dental extractions in children. *Heart*;92(9):1274-7.[2006]
3. Adam Weiss, Harry Dym, Review of Antibiotics and Indications for Prophylaxis. *Dent Clin N Am* vol [56]. 235–244[2012].
4. Lockhart PB, Durack DT. Oral microflora as a cause of endocarditis and other distant site infections. *Infect Dis Clin North Am*; 13:833–850,[1999]
5. Roberts GJ, Holzel HS, Sury MR, Simmons NA, Gardner P, Longhurst P. Dental bacteremia in children. *Pediatr Cardiol*;18:24 – 27.[1997]
6. Pallasch TJ, Slots J. Antibiotic prophylaxis and the medically compromised patient. *Periodontol* 2000;10:107–138.[1996]
7. Lockhart PB. The risk for endocarditis in dental practice. *Periodontol* 2000;23:127–135.[2000]
8. Cobe HM. Transitory bacteremia. *Oral Surg Oral Med Oral Pathol*;7:609–615.[1954]
9. Sconyers JR, Crawford JJ, Moriarty JD. Relationship of bacteremia to toothbrushing in patients with periodontitis. *J Am Dent Assoc*.87:616–622.[1973]
10. Forner L, Larsen T, Kilian M, Holmstrup P. Incidence of bacteremia after chewing, tooth brushing and scaling in individuals with periodontal inflammation. *J Clin Periodontol* ;33:401– 407.[2006]
11. Rise E, Smith JF, Bell J. Reduction of bacteremia after oral manipulations. *Arch Otolaryngol*.;90:198 –201.[1969].
12. Schlein RA, Kudlick EM, Reindorf CA, Gregory J, Royal GC. Toothbrushing and

- transient bacteremia in patients undergoing orthodontic treatment. *Am J Orthod Dentofacial Orthop.* 99:466–472.[1999]
13. Faden HS. Letter: dental procedures and bacteremia. *Ann Intern Med;* 81:274.[1974].
 14. Round H, Kirkpatrick HJR, Hails CG. Further investigations on bacteriological infections of the mouth. *Proc R Soc Med;*29:1552–1556.[1936].
 15. Felix JE, Rosen S, App GR. Detection of bacteremia after the use of an oral irrigation device in subjects with periodontitis. *J Periodontol;* 42:785–787.[1971].
 16. O’Leary TJ, Shafer WG, Swenson HM, Nesler DC, Van Dorn PR. Possible penetration of crevicular tissue from oral hygiene procedures, I: use of oral irrigating devices. *J Periodontol.* 41:158 –162.[1970]
 17. Wilson W, Taubert KA, Gevitz M, et al. Prevention of in-fective endocarditis: Guidelines from the American Heart Association—A Guideline From the American Heart Associatio Rheumatic Fever, Endocarditis and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia Anes-thesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. *Circulation;*116(15):1736-54.[2007]
 18. Wilson W, Taubert KA, Gevitz M, et al. Prevention of in-fective endocarditis: Guidelines from the American Heart Association—A Guideline From the American Heart Association Rheumatic Fever, Endocarditis and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia Anes-thesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group. *J Am Dent Assoc* 2007;138(6):739-45, 747-60. Erratum in: *J Am Dent Assoc;*139(3):253.[2008]
 19. Nishimura, RA, Carabello, BA, Faxon, DP, et al. ACC/AHA 2008 Guideline Update on Valvular Heart Disease: Focused Update on Infective Endocarditis: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines: Endorsed by the Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. *Circulation;* 118:887-96.[2008]
 20. National Institute for Health and Clinical Excellence (NICE). Prophylaxis against infective endocarditis: Antimicrobial prophylaxis against infective endocarditis in adults and children Undergoing interventional procedures. Clinical guidance, Report no. 64. London, England: NICE; [2008.]
 21. AllenU. Infective endocarditis:Updated guidelines. *Paediatr Child Health;*15(4):205-12[2010]
 22. Bonow RO, Carabello BA, Chatterjee K, et al. 2008 focused update incorporated into the ACC/AHA 2006 guidelines for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to revise the 1998 guidelines for the management of patients \ with valvular heart disease). Endorsed by the Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. *J Am Coll Cardiol;*52(13):e1-142.[2008]
 23. Habib G, Hoen B, Tornos P, et al. Guidelines on the prevention, diagnosis, and treatment of infective endocarditis (new version 2009): the Task Force on the Prevention, Diagnosis, and Treatment of Infective Endocarditis of the European Society of Cardiology (ESC). *Eur Heart J;* 30(19):2369-413.[2009].